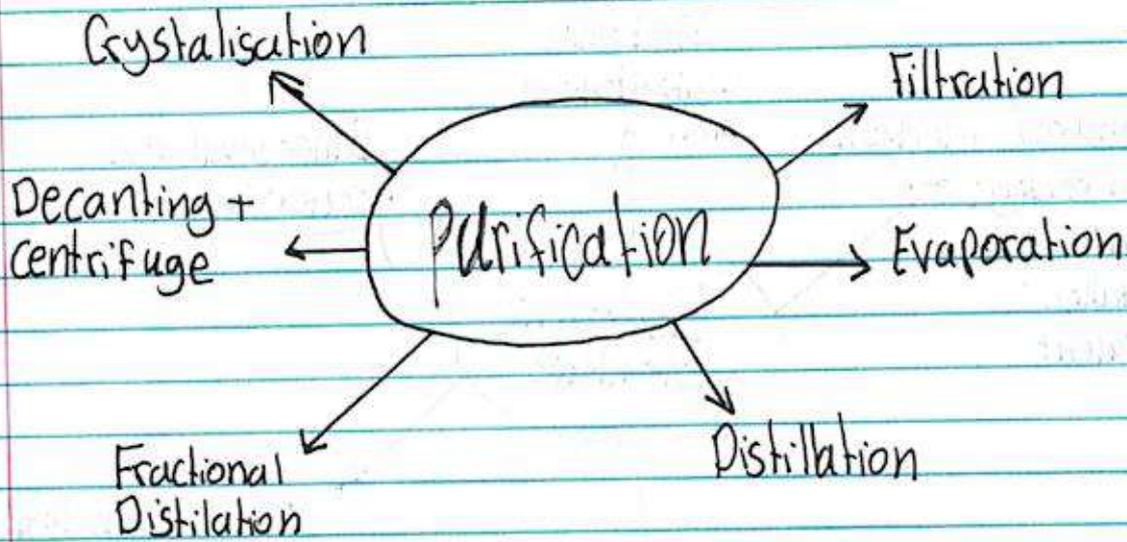
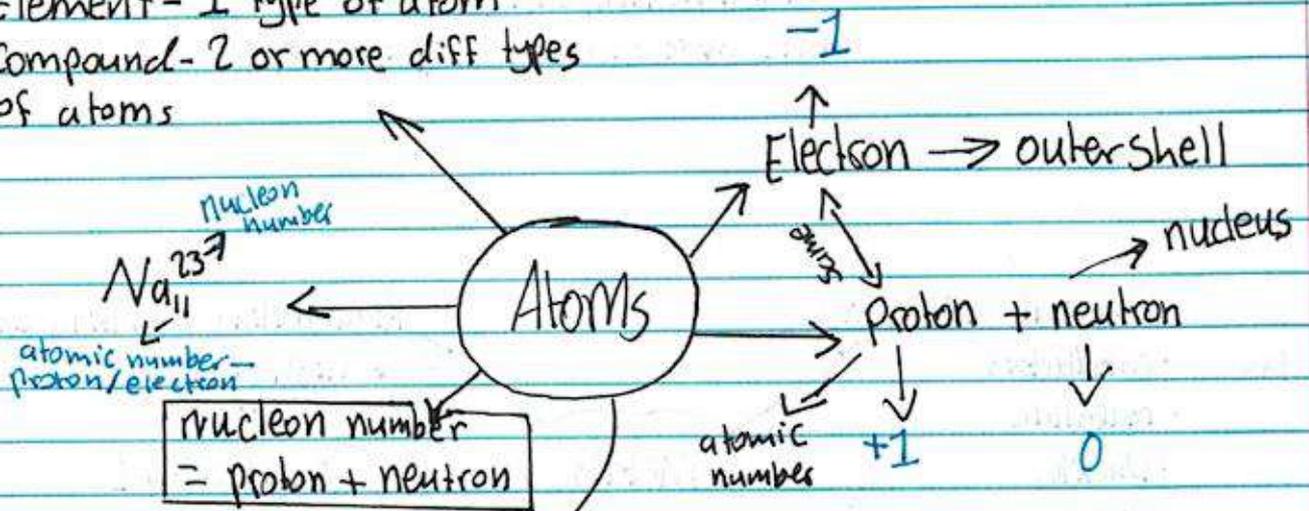


# Unit - 1 -> 2



Element - 1 type of atom  
 Compound - 2 or more diff types of atoms

chemically bonded



Diff neutron number

**Isotopes**

Same chemical properties  
 Diff physical properties

Decays

Radioactive  $\rightarrow$  Geiger counter

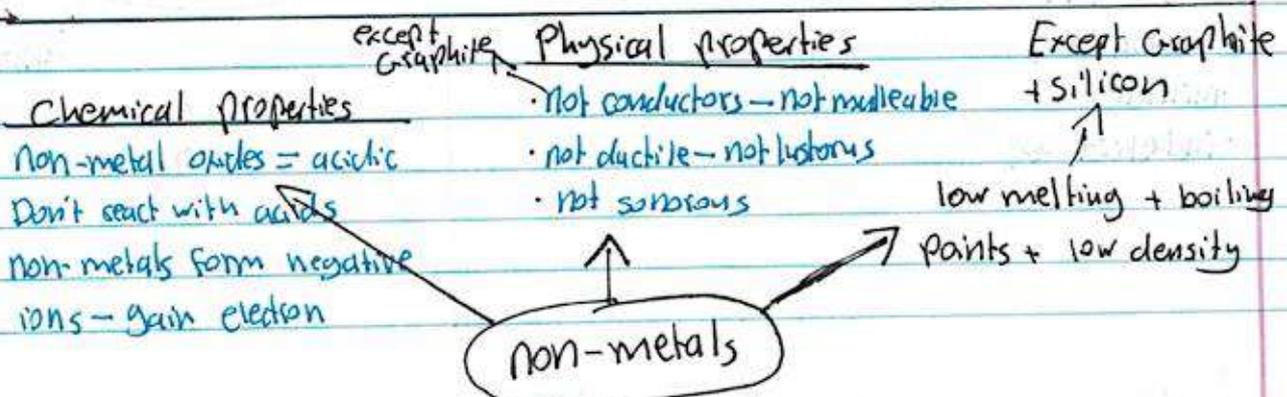
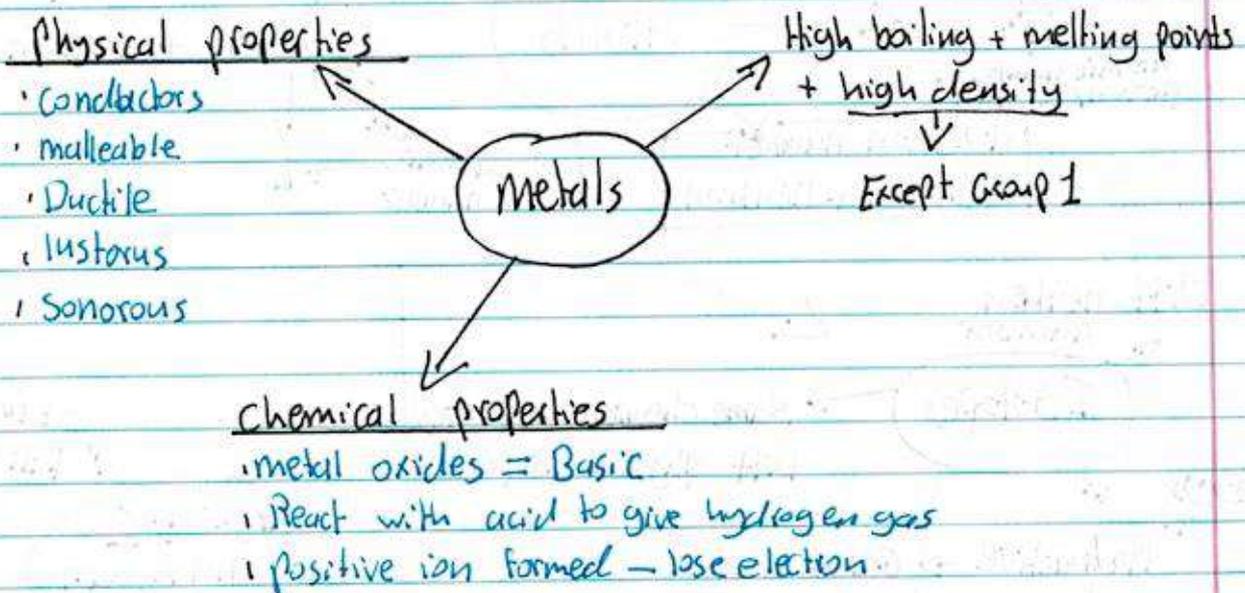
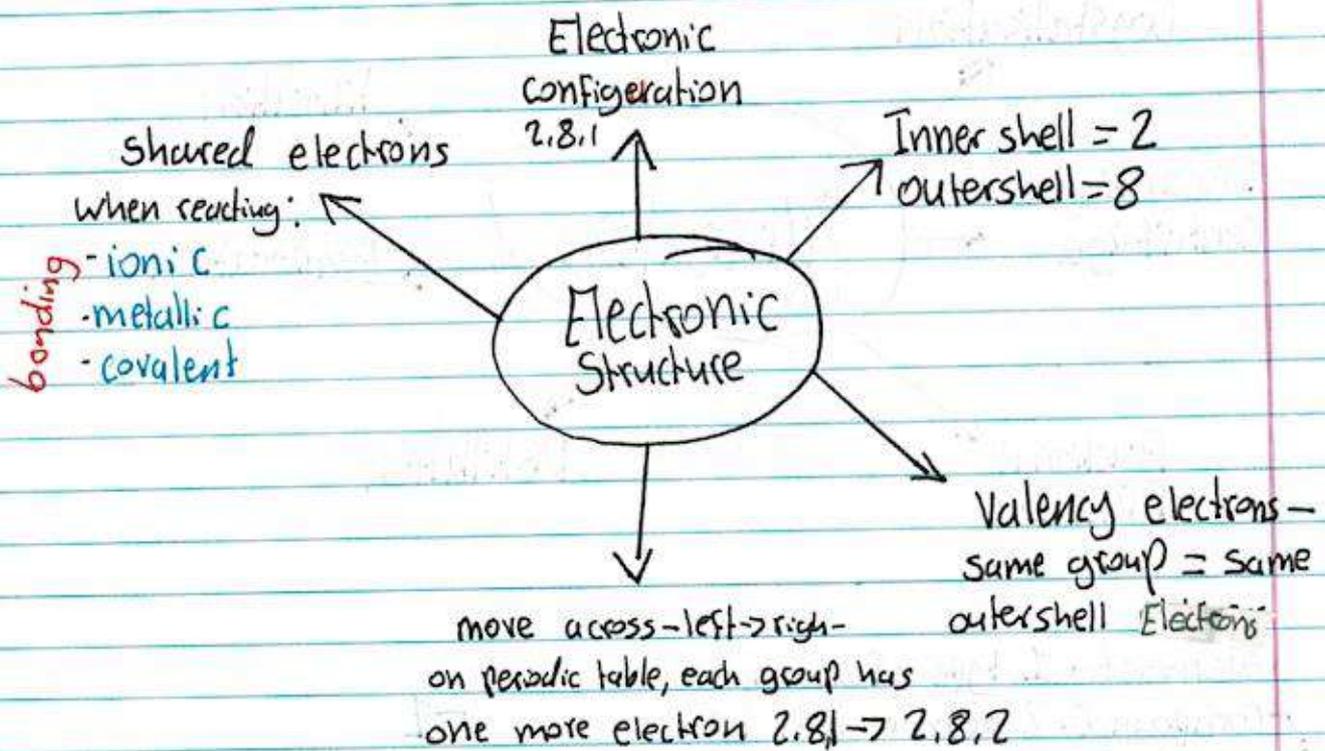
- used in:

- medical uses
- military
- industrial uses

**Group 0**  
**Noble gases**

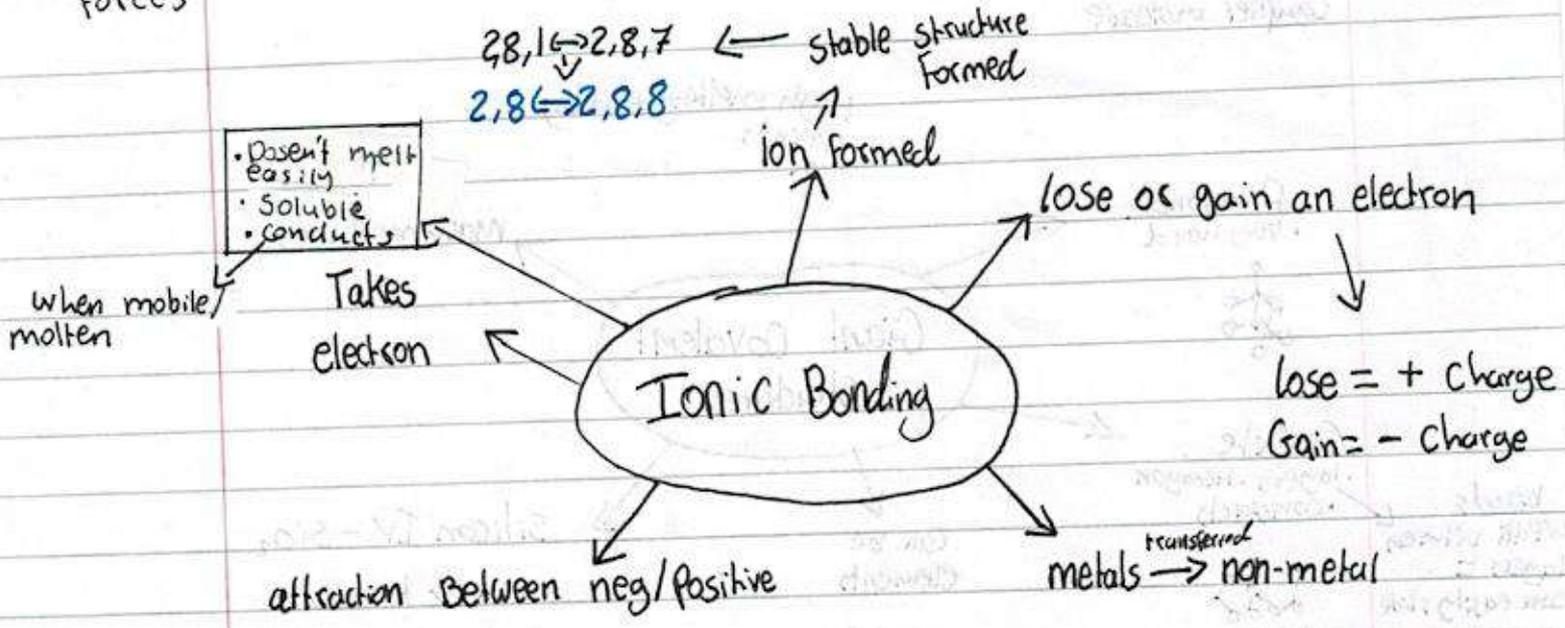
Stable Full outer shell  
 unreactive

$$\text{Density} = \frac{\text{mass (g)}}{\text{Vol (cm}^3\text{)}}$$

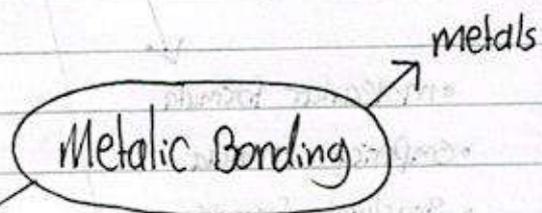
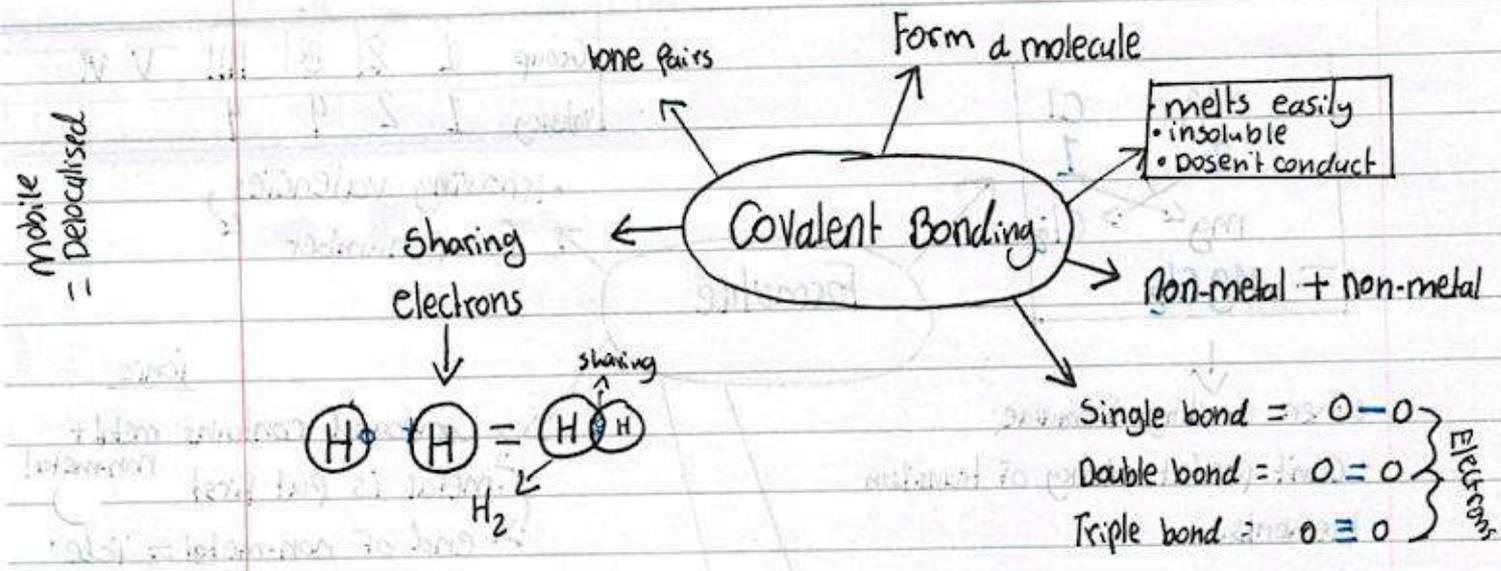


Stable octet = full outer shell

intermolecular forces



Simple molecule



Diff forms of same element = Allotropes

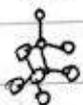
Complex molecule

High melting + boiling points

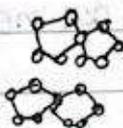
macromolecules

Giant Covalent Structures

Diamond  
• Very hard



Graphite  
• layers - Hexagon  
• conducts



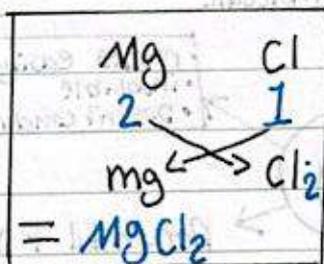
Can be elements

Silicon IV - SiO<sub>2</sub>

- Similar to dia
- No conducts

bonds weak between layers = can easily slide

Group	I	II	III	IV	V	VI	VII	VIII
valency	1	2	3	4	3	2	1	0



Formulae

• knowing valencies, Group number

- when writing formulae:
- Can't predict valency of transition elements.
  - Some non-metals in a compound aren't simplified by cancelling

ionic  
Compound contains metal + non-metal  
• metal is put first  
• end of non-metal = 'ide'  
Ca + O = calcium oxide

Compound contains 2 non-metals  
• if hydrogen present it always comes first  
• non-metal with lower group number first.  
N + O = nitrogen dioxide  
• If both non-metals in same group, further down goes first  
S + O = sulfur dioxide

- molecular formula
- empirical formula
- structural formula

metals charge = + same as group no.  
non-metals charge = - Group no. - 8

(g) (l) (s) (aq)

ionic equation = shows only ions that react

mass → Units

1.2

9.6g → 48g

x1.2 1g → 5g

1.2 → 6g

ratio the calculations  
dumb it down then x

actual yield / Predicted yield x 100 on table

mass of atom  
O = 16

Ar ← Relative atomic mass

Mr ← Relative molecular mass

mass of all atoms in formula  
mg Cl = 24 + 35 = 59

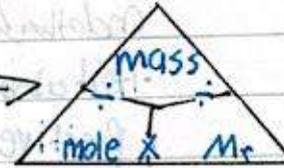
# Chemical calculations

$6 \times 10^{23}$  = Avogadro constant  
1 mole = Relative atomic mass (g)

limiting reactant: used up first.

simple proportion

no. of moles =  $\frac{\text{Mass of sub}}{\text{mass of 1 mole of sub}}$



Titration:



oilry

Electrolysis Cell

## Electrolysis

• Breaks down of ionic compound

↓  
decomposes

electrolyte = mixture that breaks down

electroplating

Redox oilry

# Electricity + Chemistry

• positive electrode

halogens or oxygen → anode → non-metal

→ lose

• negative electrode

metals or hydrogen → Cathode → metal

→ Gain

Positive ion:

cations

Negative ion:

anions

aqueous solution of ionic compound:

Cathode = discharge series

Conductors:

Allows electricity to flow through / mobile electrons

Insulators:

Doesn't allow electricity to flow through

water is only product

Physical change:

• no new substance

Chemical change:

• New substance formed

electrochemical cells

Fuel cells

Chemical changes

Endothermic reaction:

• Heat absorbed

• Positive

• Breaking bonds

Exothermic reaction:

• Heat given out

• Negative

• Creating bonds

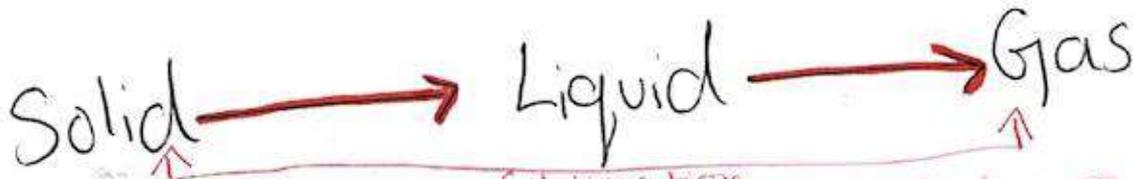
Electrochemical

Cathode = discharge zone

Allows electrons to flow through / mobile electrons

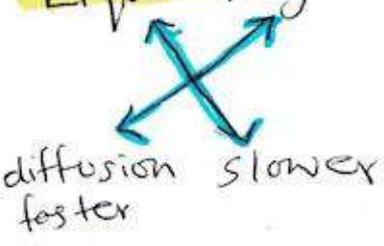
Doesn't allow electricity to flow through

H E A T = E N E R G Y

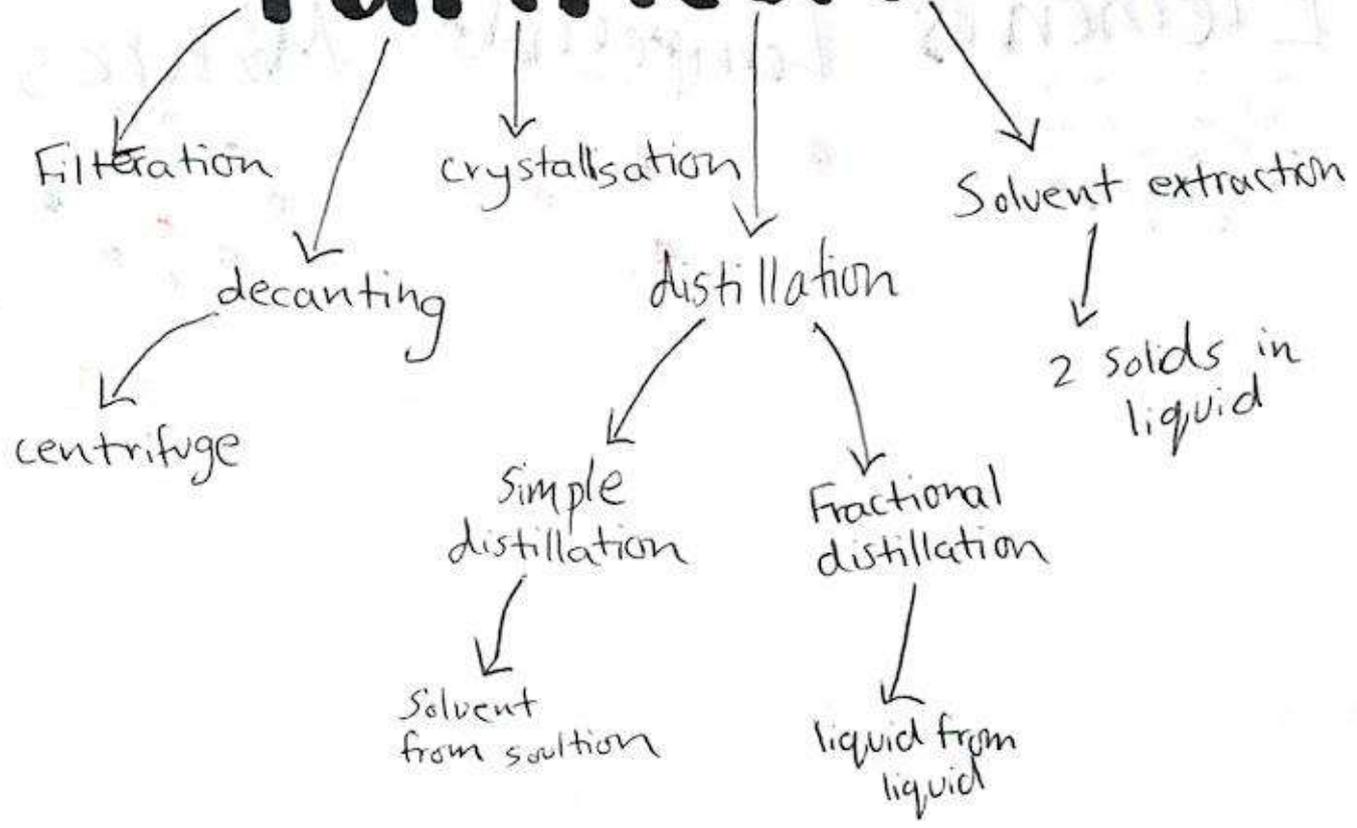


energy = pressure

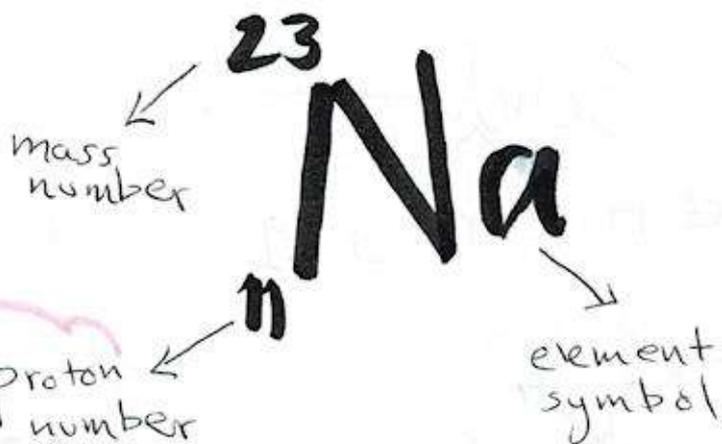
Liquid & gas are always in motion



# methods of purification



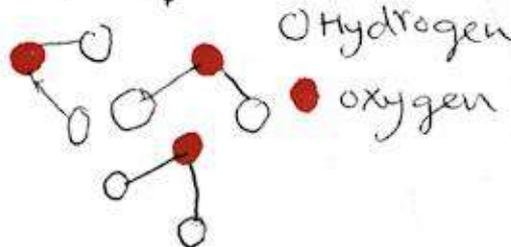
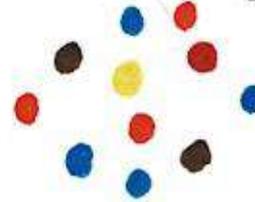
mass number = protons + neutrons  
elements arranged accordingly.



Isotopes

medical use: kill cancer  
industrial use: check for oil leaks

graphite → conducts electricity

Elements	Compounds	Mixtures
		

$$\text{density} = \frac{\text{mass (g)}}{\text{volume (cm}^3\text{)}}$$

# Structure & Bonding

Ionic formula's

write flip then

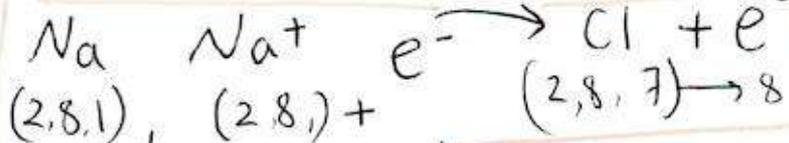
Simplify

GCS have 3D covalent bonds.

Diamond  
Graphite → allotropes

ionic bonds → lattice → high m & B

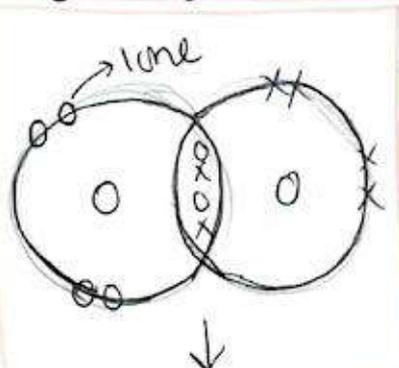
→ non-metal



metal

electrostatic bonding

## Covalent bonding



→ This is strong but 5 atoms of these together

→ O<sub>2</sub>

Carbon has 4 bonds so it forms double bonds

have weak intermolecular forces

↓ m.B

## Metallic bonding

→ delocalised  
→ + ions -

Non + non-metal  
→ share to get full

## Group 1

low m & B, p + density → decrease as you go down

oxidation

easy to cut

good conductors

oxidizes quickly

ionic soluble in H<sub>2</sub>O → alkaline solutions

easy as you go down

basic oxides

## Transition metals

high m & B, p, d → good conductor of heat & electricity

shiny

magnetic

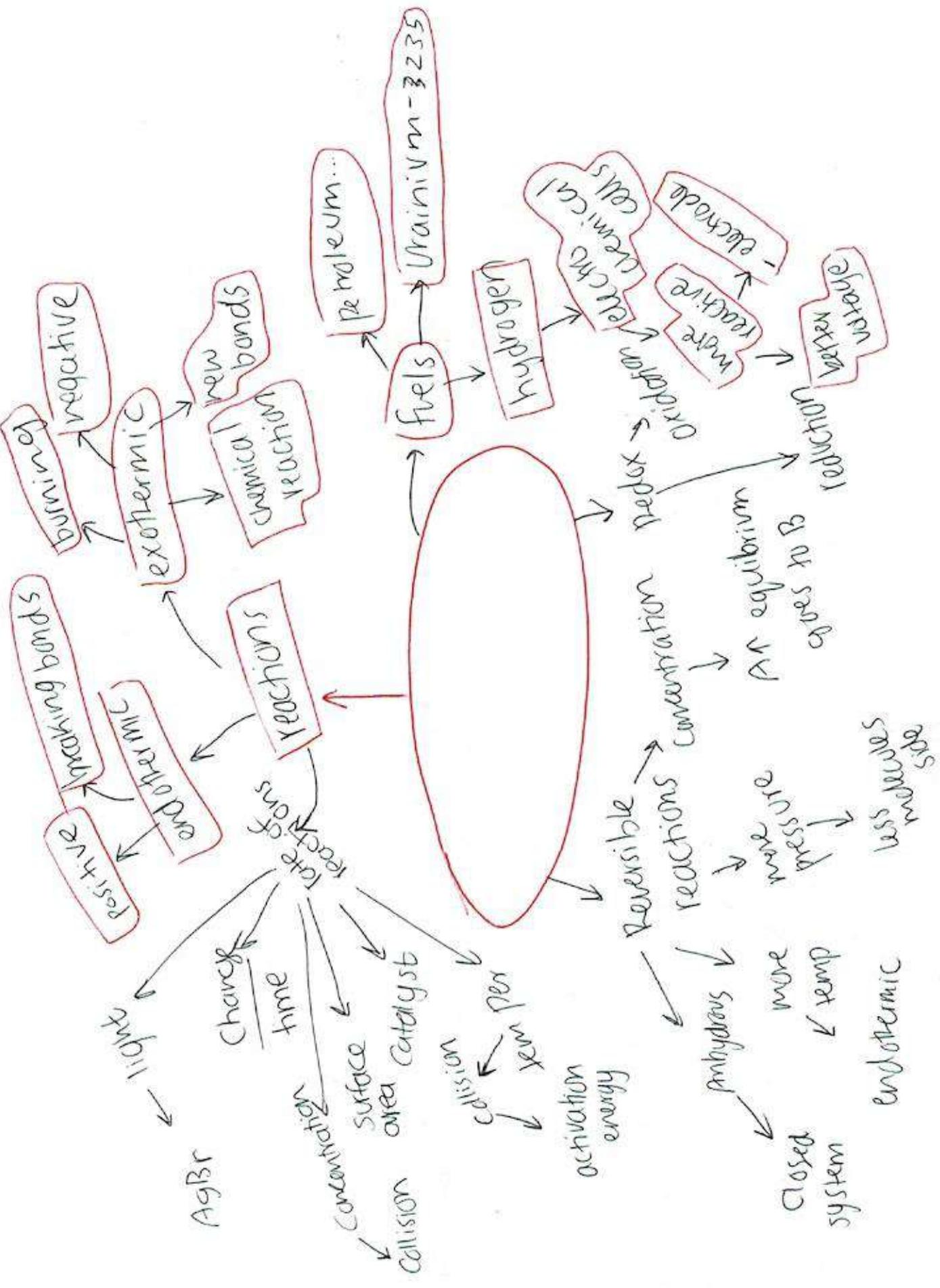
precipitation

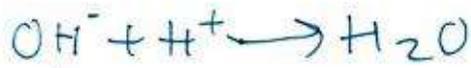
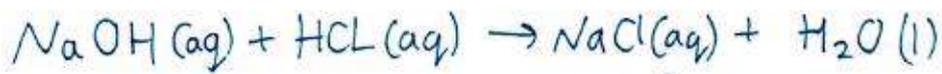
thermal decomposition

ss + ss  
↓  
solid



S.A.





Combine to  
make water



proton donor + proton acceptor

Strong acid + conductivity  
lower pH — than a weak acid  
reacts faster —

Weak base  
lower conductivity  
less alkaline  
slower rate of reaction — from a strong base

Rat

## Limiting reactants

2 magnesium reacts with 2.74g of hydrochloric acid. Limiting reactant?



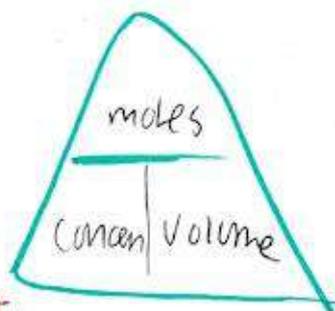
$$\text{Mg} = 24 \quad \text{Cl} = 35.5 \quad \text{H} = 1$$

$$\text{HCl} = 36.5$$

$$\text{Mg} \rightarrow \frac{1.2\text{g}}{24} = 0.05\text{mol}$$

$$\text{HCl} \rightarrow \frac{2.7\text{g}}{36.5} = 0.075\text{mol}$$

should be double the Mg thus it is limiting reactant.



Percentage by mass

$$\frac{\text{Mass of element}}{\text{mass of compound}} \times 100 = \% \text{ mass}$$

Actual yield

$$\frac{\text{predicted yield}}{\text{predicted yield}} \times 100 = \% \text{ yield}$$

pure product

$$\frac{\text{pure product}}{\text{impure product}} \times 100 = \% \text{ purity}$$

Concentration mol/dm<sup>3</sup>

$$= \frac{\text{moles of solute}}{\text{Volume of solution dm}^3}$$

\* g → mol

\* cm → dm

\* formula.

$$\boxed{1\text{cm}^3 \rightarrow 0.001\text{dm}^3}$$

$$\div 1000$$

same volume of gas has the same number of moles

## Empirical formula

- 1) percentage to grams
- 2) grams to moles



- 3) divide by smaller number
- 4) multiply to get a whole number

# Writing formula

	Mg	Cl	→ not for transition
valen	2	1	
	1	2	→ MgCl <sub>2</sub>

OH → hydroxide → -

NO<sub>3</sub> → nitrate → -

SO<sub>4</sub> → sulfate → 2-

CO<sub>3</sub> → carbonate → 2-

NH<sub>4</sub> → ammonium → +

HCO<sub>3</sub> → hydrogencarbonate → -

## Molecular formula

% to grams → mols of each  
divide all by the smallest  
write empirical formula out  
multiply all by each molar mass  
add together:

Ar → mass number or  
atomic mass

Relative molecular mass  
formula

→ All the Ar's together

$$\frac{\text{molecular formula molar mass}}{\text{empirical formula molar mass}} = x$$

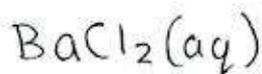
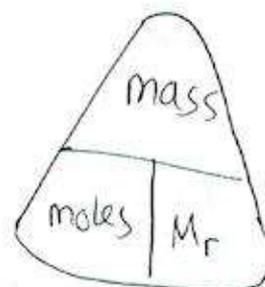
x empirical

Diatomic molecules → H<sub>2</sub> N<sub>2</sub> O<sub>2</sub> F<sub>2</sub> Cl<sub>2</sub> Br<sub>2</sub> I<sub>2</sub>

A substance forms an ions if :-

- \* metal & non-metal
- \* HCl H<sub>2</sub>SO<sub>4</sub> HNO<sub>3</sub>
- \* ammonia compounds (NH<sub>4</sub>)

spectator  
ions

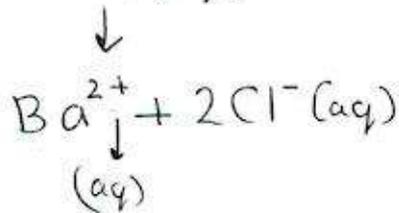


1) balance BICR → ionic equations

2) ions

3) cross out spectator ions

4) rewrite



1 mole of hydrogen → 1g Ar = 1 } molar mass  
1 mole of sodium ions → 23g Mr = 23 }

# Acids & Bases

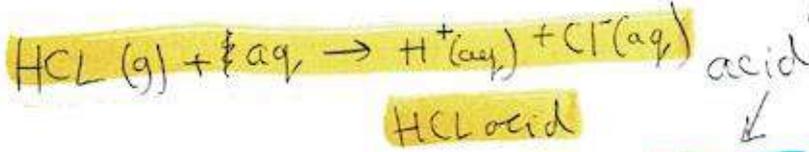
In water  
Acids → hydrogen ions

Alkalines → hydroxide ions

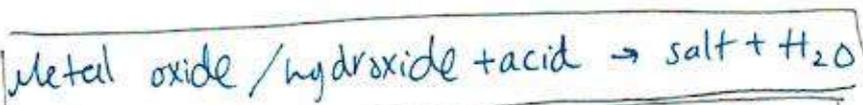
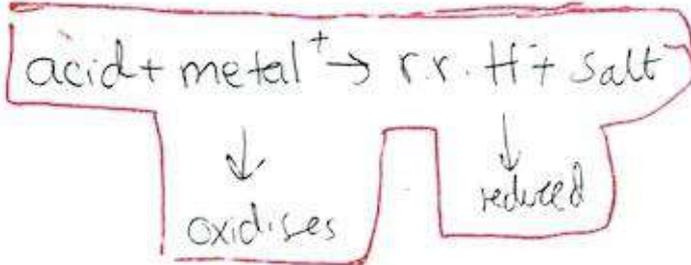
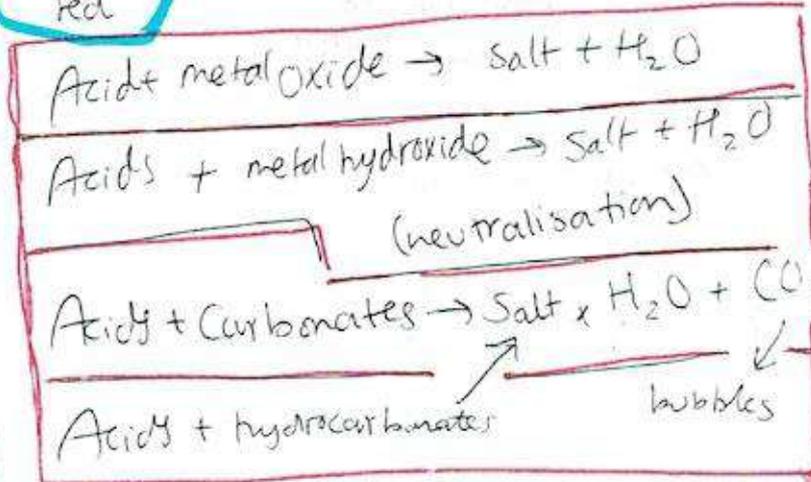
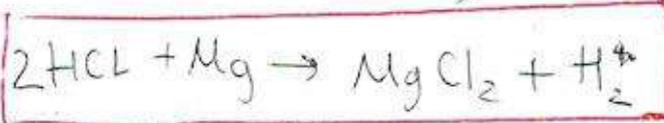
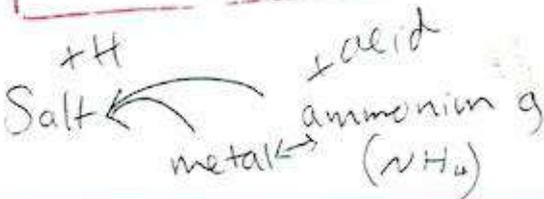
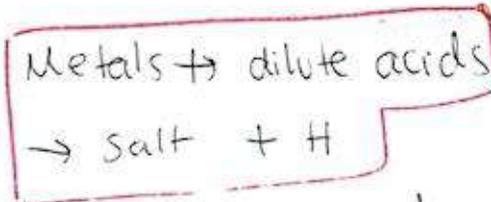
Universal indicator

• Litmus as an indicator

Bromothymol



acid  
blue → red



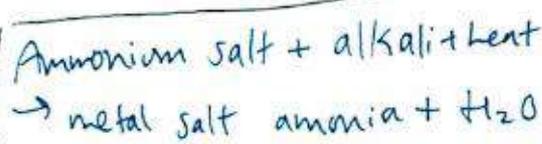
Base reacts with an Acid

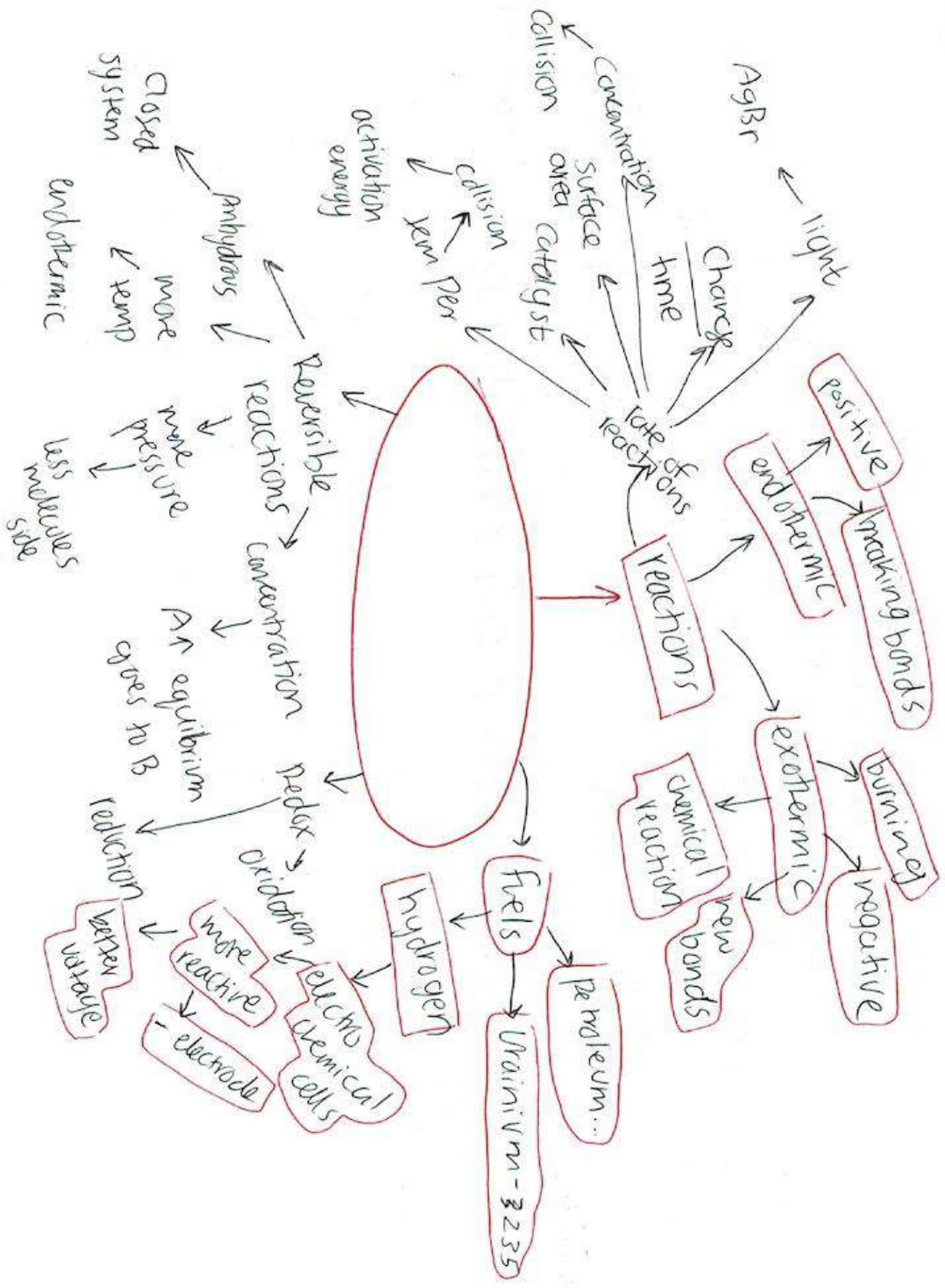
↓ Ammonia is a base

if it is soluble in water Alkali

red → blue  
methyl orange / yellow

acid + base = salt  
neutralisation reaction





# Reactions + Definitions

- o Metals always lose electrons
- o Non-metals always gain electrons
- o Metals react with acid to form hydrogen gas
- o Hydrogen chloride reacts with water to form hydrochloric acid
- o Some non-metals form oxides with different formulae