Particles & Purification

Solid ⇄ Liquid ⇄ Gas

Sublimation

Brownian Motion

Kinetic particle

- heat = pressure
- less volume = pressure
- light molecules = faster

$1\ dm^3 = 1000\ cm^3$

Diffusion
= down

Rf = d from bas line to spot / d from solvent front to baseline

Boiling increases
Melting decreases
impure substance

Methods of Purification

- Chromatograph
- filtration
- Decanting
- crystallisation
- Centrifuge
- Solvent extraction
- Simple distillation
- Fractional distillation

Repeat measurments
use apparatus with a small scale
use them carefully

pure → sharp m & b point

2 Atoms, elements, Compounds

mass
electrons → 0·00054

- In the periodic table everything is arranged by proton number (on the top) (atomic number)

mass number → p+n

- An isotope has different number of neutrons. They have the same chemical properties.

* Cancer treatment and checking for gas leaks.

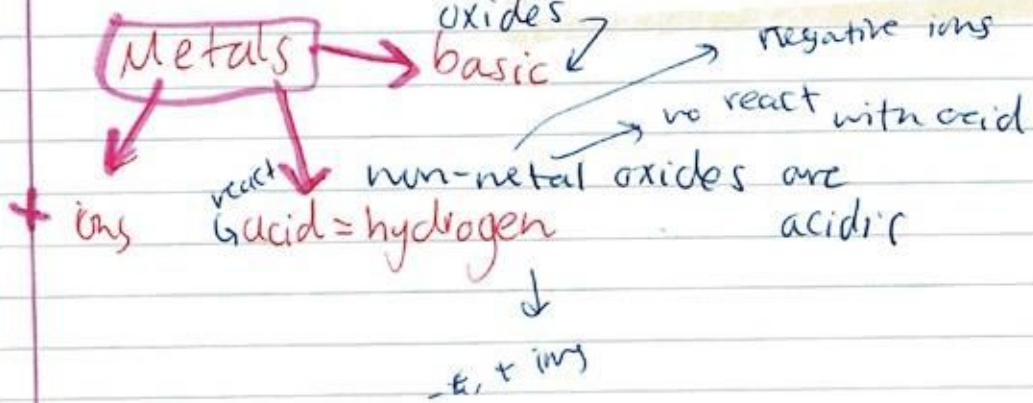
Elements
one type of atom

Compound
2 or more atoms chemically

Mixture
2 or more not chemically can be seperated.

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

graphite conducts
mercury low melting
gallium low density
Cabon high m.p



3 Structure & bonding

- Ionic bonds → metal$^+$ + no-metal$^-$ metal gives non-metal
- Covalent bonds → non metal + non-metal
- Metalic bonds → positive ions, with free moving electrons

Covalent bonds have weak forces between the molecule, giving them lower m.p. and b.p. exception silicon dioxide

Ionic bonds have a + and - force attracting eachother. This makes ~~them have~~ strong between them giving Higher m.p. and b.p.

allotropes → same element diff forms

valency

* of a metal is the numbe of ele-ctrons in their outer shell
* of non-metals is the number of ele-ctrons needed to make a complete outer shell.

giant C.S.

Diamond & Graphite

Conducts electricity because it has layers

how to tell ionic or covalent?

- easy to melt = covalent
- Dissolves in water = ionic
- Conducts = ionic

Metalic bonds are held together by positive ions and lose valency electrons. This is why also pass a voltage throught.

→ they have layers so are ductile & malleble

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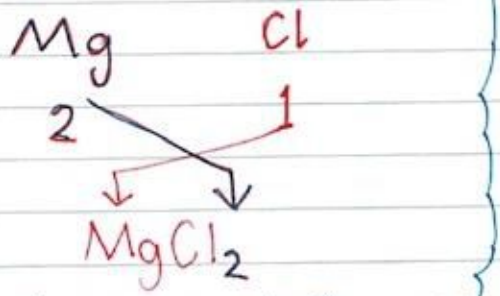
formula & equations

magnesium chloride



Naming elements
- metal then non-metal + ide
* magnesium chloride

- non-metal + non-metal
* nitrogen dioxide
  - nitrogen → V
  - dioxide → VI

OH	hydroxide	-
NO_3	nitrate	-
SO_4	Sulfate	-2
CO_3	Carbonate	-2
HCO_3	hydrogencarbonate	-
NH_4	ammonium	+

Types of formula

- Empirical → Simplest ratio of atoms
- Molecular → num of every atom

Group 1, 2, & 3 are + ← Group 6 & 7 are −

Spectator ions → ionic equations → balanced equation

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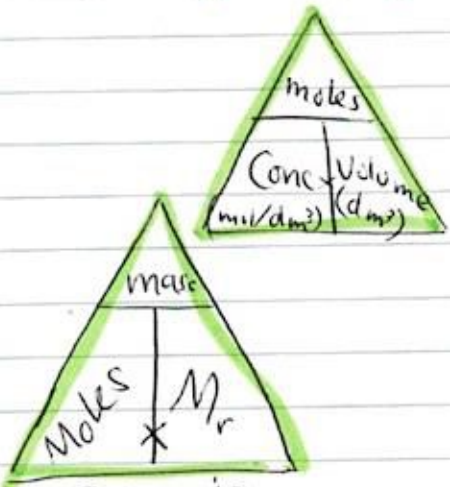
Chemical calculations

A_r = relative atomic mass
M_r = all relative atomic mass together

Example :-

48g MgS → 9.6g Mg ÷8
÷8 6g MgS ← 1.2g Mg



Example :-

Sodium hydroxide mass of 0.5 moles? NaOH 40

mass = moles x M_r
0.5 x 40 = 20g NaOH

Limiting reactant

$$\%\text{ by mass} = \frac{\text{Ar of element in a compound}}{M_r \text{ of compound}} \times 100$$

* Same volume of gas has the same number of moles

equations

$$\text{Volume of gas } (dm^3) = \text{num of moles} \times 24$$

* 1 mole of gas occupies $24 dm^3$ or $24000 cm^3$

$$\%\text{ yield} = \frac{\text{actual yield}}{\text{predicted yield}}$$

* The formula of an ionic compound is empirical.

$$\%\text{ purity} = \frac{\text{mass of pure product}}{\text{mass of impure product}}$$

* Empirical formula
- Divide % by A_r
- divide by lowest
- find ratio
- write formula.

* Molecular fomula
- find emperical formula
- divide M_r by emperical formula
- x empirical by step 2.

Electricity & Chemistry

* Electrolysis is the breaking down of an ionic compound when molten or in an aqueos solution by the passage of electricity.

Cathode → negative → metal
Anode → positive → non-metal

Electrolyte & Electrodes
active → metals

* Hydrogen is formed at the Cathode
* Ionic compounds have metal first in their names

Positive ions → cathode
- cations - reduction
- are metal
- cathode is a negative

Na^+
Mg^{2+}
Al^{3+}
H^+
Cu^{2+}
↓ easier to discharge

Negative ions → anode
- anions - oxidation
- are non-metal
- anode is a positive

SO^{2-}
NO_3^-
OH^-
Cl^-
Br^-
I^-
↓ easir to discharge.

* pure copper is obtained by ~~electrolisis~~ electrolysis.

* If neither are present

Inert electrodes cannot lose elec-trons.
- carbon - graphite
- platinum

* OH^- means that the product is alkaline
* H^+ means the product is acidic

Electrolyte
↓ molten xH_2O
↓ agreous $H_2O \rightleftharpoons H^+ + OH^-$

* a pure strip of copper is placed at the negative end. While an impure on is placed at the Positive end

* Electroplating. The object is placed at the cathode. The plating is placed at the anode. The electrolyte must contain the metal which is used for Plating.

* Aluminium is extracted from an ~~aluminium~~ bauxite ore by crushing it then mixing it with sodium hydroxide. The impurities don't desolve. aluminium is desolved in cryolite to reduce the melting point

* Aluminium is carried out using ~~graphite~~ carbon electrodes. The cathode is carbon lining of the steel cell. Molten aluminum is removed using a siphon tube.

- Conductors → sea of electrons
  - gold
  - copper
  - silver
- Insulators → no mobile electrons
  - glass
  - plastic

* Thicker wires are better because they allow more movement & less friction. This reduces the heat. Aluminium is also used for power lines due to its low density. Steel is placed in the centre to strengthen the cables.

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Chemical changes

Chemical changes → Physical changes → nothing formed

Chemical change → new substance hard to reverse

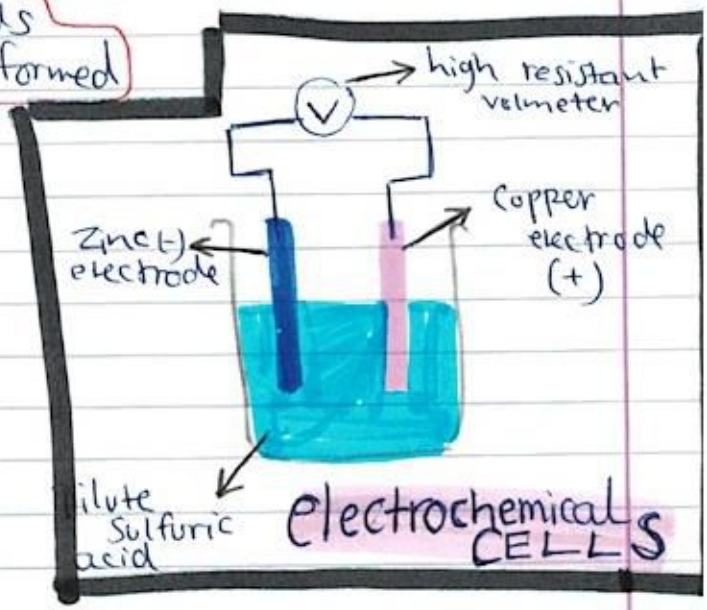
Chemical change → Endothermic → take heat → has more energy ~~before~~ after

Endothermic → is when bonds break → positive energy is ends

Chemical change → Exothermic → release heat

release heat → more energy ~~after~~ before

release heat → bonds are formed → negative energy means exo



Hydrogen - oxygen fuel cells.

- waste H_2O
- platinum electrode
- H = -
- O = +

Advantages

- Water is the only waste product
- More energy per gram
- Light weight
- No need to recharge
- Very efficient

Rate of reaction

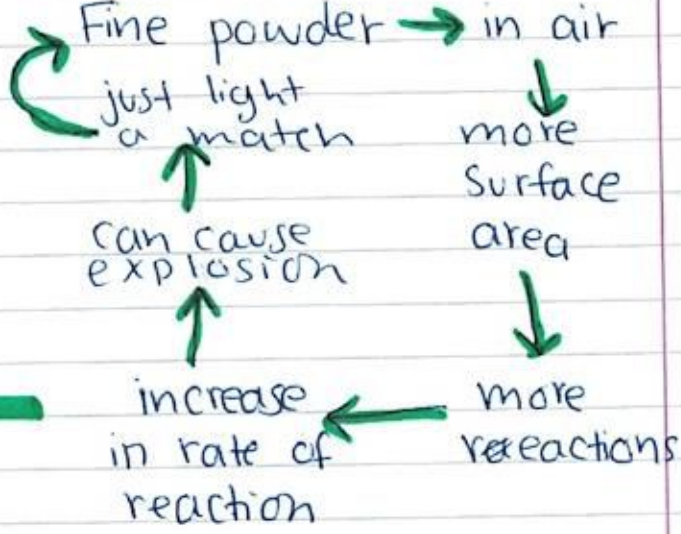
Rate of reaction can be measurred by measuring how fast products are formed or how fast reactants are used up. } The speed of Reaction

Rate of reaction = change in concentration of a reactant or product / time

Limiting reactant is the reactant which is used up first.

Surface area increases the rate of reaction, because there are more particles which can react.

Controlled variables are what is kept the same
Independant variables is what changes.



Reversible Reactions

* Reversible reactions are reaction which can go both ways

Key words
- water of crystallisation

Equilibrium → pressure → gas
Equilibrium → temperature
Equilibrium → concentration

- Closed system
- reactants to products
  products to reactants
  Dynamic equilibrium
- Concentration is the same
- equilbrium side

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Acids & Bases

* Lab acids ⟶ H^+ in water
- hydrochloric acid → HCl
- Sulfuric acid ⟶ H_2SO
- nitric acid ⟶ HNO_3

* Lab Alkalis ⟶ OH^- in water
- Sodium hydroxide → NaOH
- calcium hydroxide → $Ca(OH)_2$
- ammonia ⟶ NH_3

Litmus blue
acidic → red

neutralisation reaction
crushed lime stone
neutralises acidic soil

- Amphoteric oxides
a + b properties
salt → acid
complex salt → alkalis

→ Acids

* metal oxides and hydroxides react to form a salt & water.

* Metal carbonates react to form a salt, water & carbon.(dioxide)

* metals react with acids to form salt & hydrogen

* Acid with a base ⟶ salt & water

* Acids react with ammonia you get a salt.

→ Bases/Alkalis

* bases are not soluble in water. but Alkalise are

* Red Litmus paper to blue. Alkalis

* Oxides

- Basic oxide → most metal
metal + O_2
no reaction with alkalis
| | with water metal hydroxide

- Acid oxides → most non-metals
non + O_2
Acidic oxides + alkalis → salt + water
A.O + base (metal oxides) + heat
A.O + H_2O → A Solution

- Neutral Oxide
no acid or base
Lower oxiden non-metals

Making and Identifying Salts

Salts

* reacting a metal + acid
* reacting insoluble base + acid
* neutralising an alkali with an acid by titration
* By precipitation

- Above hydrogen in the reactivity seris

✗ Sodium potassium

✗ Copper Lead silver

$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

Zinc — Sulfuric acid → Zinc sulfate + Hydrogen

heat

flask

filter excess metal

evaporating basin

rest of steps

- Same as previous good for low in reactivity seris

- Soluble salt ← Soluble base and acid

Group 1 & ammonium Salts → weak

Strong + Strong any indicator

end point titre (v-u)

methyl or-red

Strong acid

excess acid

Vise versa → Phenolphalein indicator

Pink → ∅ excess acids

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The Periodic Table

* The groups tell the number of valency electrons in the outer -shell.

* The groups have similar chemical properties.

- metaloids have propertise similar to metals & non-metals. (they r on the right).

* Group 1 metal are soft. Their melting & boiling decreases down the group. While density increases

Helium → weather balloons
Neon → advertising signs
Argon → extraction of titanium. electric light-bu
Krypton → lasers eye surgen
xenon → in lamps.

* Nobel gases are unreactive due to their complete outershell (monatomic)(inert)
* Colourless non-metal

* Transition metal malliable, hard shiny & ductile

* Group VII elements (non-metal) are called halogens. They are written as → Cl_2

* Group 7 can react 1 elements.
* Down Group 7 element reactivity with Group 1 elements decrease

* Not a proper trend for transition metals for density & melting point

* when Group 7 reacts it gives away its an atom.

* ~~Halides~~
Cl_2 → Halogin
2 Cl → Hialide
2 KCl → Pottasium Chloride

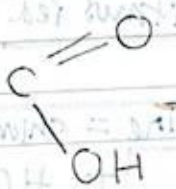
* The more reactive replaces a the less reactive

* Down Group 1 melting point decreases & (till Pb) density increases

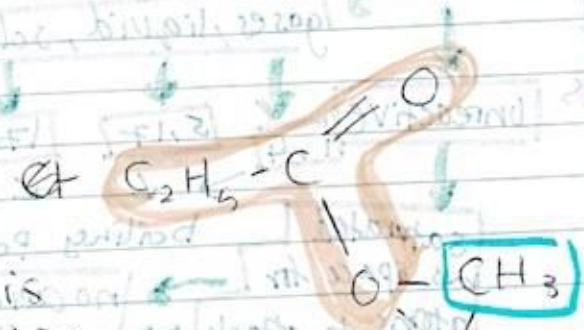
* They form coloured compounds (transition elements)
* Ionic structures & ions are complex
* They are good catalysts → Iron vanadium
* Less reactive
* reacts sometimes with steam
* has more than 1 oxidation state.
* manganese → +1 to +7

Alkyl → Alkane → C_nH_{2n+1}

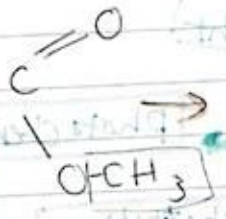
C_nH_{2n+2}



→ Carboxylic



→ product is water



→ ester

Methyl propanoate

3 carbon

C_2H_5COO

3

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- Zinc ore is blasted with hot air. The waste settles at the bottom. Carbon monoxide froms ~~from~~ the oxygen in Zinc oxide & coke.

- Hematite contains 60% iron. We use coke to seperate it in a blast furnace.
- Carbon monioxide seperates the minerals.
- Slag has less weight allowing it to leave above the iron keeping them seperated
- The Hopper crushes the iron so it reacts easily

- Steel is an alloy of iron. Contains a carbon &....

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* An Alloy is a combination of 2 or more metals to form a compound.

* Due to the different sizes of metal ~~atoms~~ particles in an Alloy, it causes it to be stronger than a pure metal

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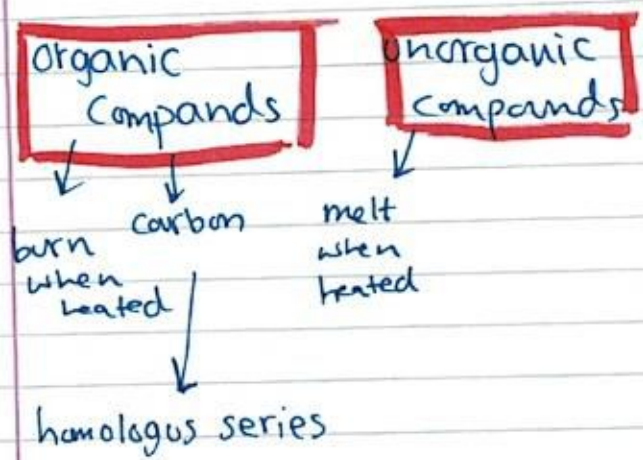
Organic chemistery and petrochemicals



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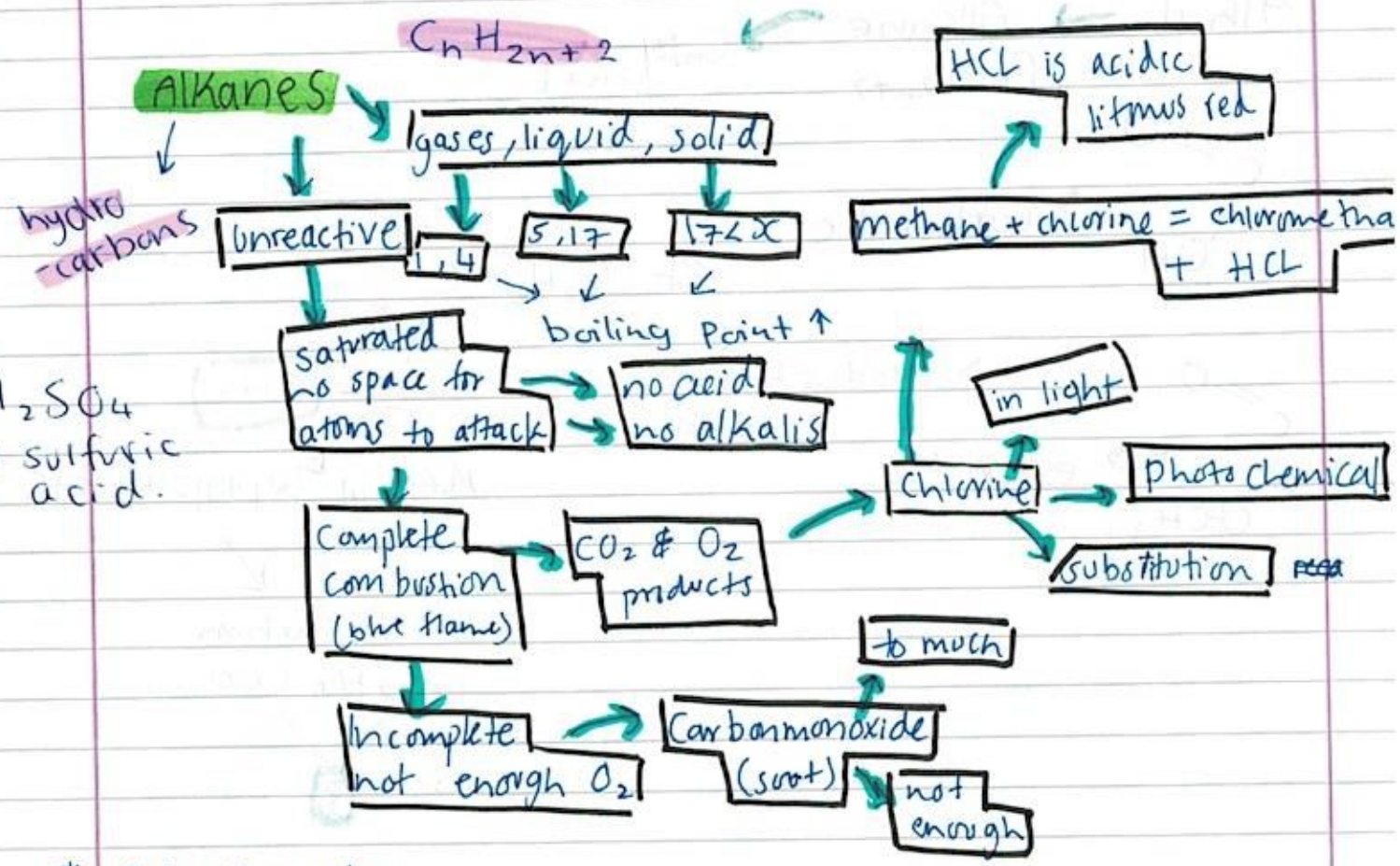
The variety



* A hydrocarbon contains hydrogen & carbon

C_nH_{2n} Alkenes → hydrocarbons

unsaturated hydrocarbons

bromine water reacts to test it

* ethanol
→ solvent → alcohol to drink
→ fuel
→ make ester

Cracking → Catalyst

silicon oxide
aluminum oxide
↓
powder form in catalytic craker

Alcohols

ethanol → steam + ethene + pressure + phosperic acid

missible

boils 78°C

glucose fermentation process

$C_nH_{2n+1}OH$

carboxylic acids → alcohol → esters + water

- oate

Polymers

monomers → macromolecule → polymers

↓

polymerisation

addition polmerisation

↓

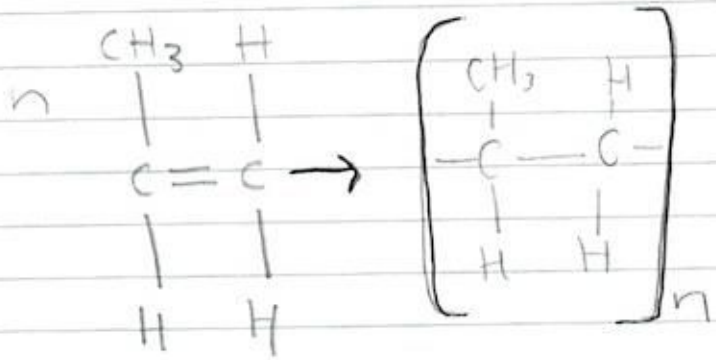
formation of polymer from monomer

double bond between carbon breaks and attachs to the next

non-biodegradable

- Landfills
- Burn them

traflaroethene



polyamide → NH_2

n = repeated structure

~~Carboxlic~~

Carboxlyc acid + amine → polyamide

condensation polymerisation → polymer + another

monomer + monomer

a + b

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Biological Molecules

Macromolecules

proteins → carboxylic acid → amide linkage
amide group NH_2

HCL → enzymes
↓
protein + H_2O
heat + HCL → amino acid

↓
Combines and returns OH H into water

mono
di
~~tetra~~
tri
tetra
penta
hexa
hepta

in presense of water is called hydrolysis

Carbohydrates → $C_x(H_2O)_y$

monosachride → glucose (simple) $(C_6H_{10}O_5)_n$ + water
- glycosidic linkage

polysaccride
starch + water $\xrightarrow[+\text{heat}]{HCl}$ glucose
hydrolysed

Starch → pasta, potatoes
↓
glucose

Cellulose → polymer of glucose
↓
cows and sheep

Enzymes ar biological catalysts. Produced by → 30 - 40 °C microganisms.