

Hello! This is my own notes that I made after collating all my errors across all the papers I have done. It touches on content and keywords. I won't guarantee that the notes are 100% accurate and will give you a distinction but I spent a lot of time and effort on them and it helped me a lot so I wanna share them with y'all!

Some wordings might be confusing to understand I'm sorry 😞

Amount of... : moles

% yield not 100 - impurities present in sample, may dissolve back to solution, smt else formed

Catalyst in process - reactant in first stage and pro use in last stage

When saying ph state whether acidic basic or neutral too

Try to explain in terms of mol

When comparing experiments, just say experiment ... and ...

1 mol HCL same mol as 0.5 mol h₂so₄ - collects twice the product for same conc (only conc changes)

Change to g when doing mol ratio

Macromolecule: v large molecule made up of many repeating units of monomers covalently bonded tgt.

Condensation polymerisation: monomers w 2 functional grp react and results in loss of molecules such as water molecules.

Addition polymerisation: chemical reaction where unsaturated monomers alkenes join tgt by breaking cc double bonds, w/o losing any molecules

Silicon dioxide is an acidic oxide but has ph7. Only show that it's acidic oxide when it reacts w base. It's insoluble in water.

Hydrogen peroxide is a bleach so solution turns colourless

✨ conserve!!

Rate of reaction at... -> draw tangent at that point

Pressure only affects gasssss

Stopwatch is just a square

Ammonia formed is condensed and obtained as a liquid

Decomposition of hydrogen peroxide: $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$

Ppt just say insoluble too

Experimental chem

- Styrofoam - reduce heat loss to surroundings (temp change will be more accurate)
- Cannot measure hydrogen gas using balance (and some other gases, see Mr, as they are v light)
- Burette can be used for water displacement but not ideal as it limits how much gas can collect

- See vol of gas going to be produced and which apparatus can measure that vol
- Chromatography doesn't show all substances present in the mixture
- Iodine can be sublimed
- Sodium chloride (most sodium salt) is always evaporation dryness
- For large scale production, evaporation is done via distillation flask
- Solid mixture (have soluble and insoluble solid), add water then heat! To dissolve the soluble solid then filter
- Min number of apparatus qn... just red litmus enough if there's chlorine but need both red and blue for acidic and alkali alone
- Consider solubility
- Gas (lower density) cannot be easily collected back but solid can to be recycled. Transported in liquid state as take up less space for easy handling
- Chlorine, ammonia (very) and oxygen is soluble in water, hydrogen is not.
- Cotton wool plug is used to prevent chemical splash
- Expected results may be more cuz gas dissolve in solution
- Increase decomposition by increasing temp
- How to test if ...smt is catalyst? — conduct exp and see if mass of catalyst remained same
- Metals cleaned w sandpaper first to remove any oxide layer (for better electrical conductivity)

Diffusion

- particles of perfume move from region of higher concentration to region of lower concentration until there is no net movement / no overall change in concentration
- Gain Kinetic energy allows particles to move faster and further

Atomic structure

- Graphite is a lubricant (soft and slippery) - IMFOA between layers
- Alloy conducts electricity but not as well as pure metal. Elements of alloys (mixture) are not chemically combined and there's no mobile electrons.
- Alloys are hard because **LAYERS** of atoms cannot slide over eo easily when force is applied
- When an element burns in excess O_2 , substance formed is always greater in mass than the element ($Mg \rightarrow MgO$)
- Metallic bonding -> strong electrostatic forces of attraction between positive metal ions and sea of delocalised e
- Ethanol add to water - vol decreases cuz ethanol molecules move into empty spaces between water molecules (50cm cube + 50 cm cube not = 100cm cube)
- Hydrogen don't have neutrons omg !
- Gases w same vol have same no of moles as molar volume is 24dm cube. But have diff masses as they have diff Mr
- The element in compound is the one reduced/oxidised
- Superoxide ion has only 7 valence electrons for one oxygen atom

- Don't put Roman numerals in chemical formula
- Hydrogen can gain lose share electrons

Chemical bonding

- In giant lattice, 1 sodium ion surrounded by 6 chloride ions
- Solutions of ionic compounds (electrolysis of molten) are broken down into constituent elements while there is no change to metals when electricity is passed through.
- NaOH is a white solid w high melting point (ionic compound) that dissolves in water to form an alkaline solution (ionises in water to produce OH⁻ ions)
- Not all ionic compounds are soluble in water (BaSO₄..)
- take electrons from another ELEMENT (not atom)
- Ammonia is a simple molecular substance
- Say what is what diamond is giant covalent structure bonded by strong covalent bond
- Crystalline product- solid
- Water has very few mobile electrons or ions - poor electrical conductors
- When talk abt elements compound mixture, Rmb ratio, chemically combined
- Carbon added to iron to increase its hardness and strength. But when too much added, steel become brittle. Too less, steel become too soft.
- Simple molecular structure: small discrete molecules held tgt by WIMFOA
- Giant covalent structure: atoms held tgt by strong covalent bonds throughout structure.
- Alloy does not conduct electricity as well as pure metal as diff sized atoms in alloy disrupts orderly arrangement of metal lattice. Free moving electrons cannot move along layers easily.
- State what the mobile charge carriers are (ions/electrons)
- When excess ... added, can now conduct electricity as .. unreacted and act as mobile charge carriers
- Molecule present during reaction may be water molecules
- Not all metals have high melting points
- As metal become bigger in atomic size, metallic bonds become weaker
- Oxygen produced can react w graphite to form Co₂
- Oxygen exist as a diatomic molecule always

Acids and bases (try to say alkali)

- Ph give a measure of H⁺ conc in solutions - electrolyte ph decrease cuz of h⁺
- When acids react w metals, hydrogen ions gain e (acid metal reaction is redox)
- Reactive metal displaces hydrogen from acid (metal acid reaction)
- Hydroxide ion acts as a base to remove hydrogen ions from ammonium ion
- End point of titration is the middle of the straight line
- Ammonia plus acid gives ammonium salt (no other products formed)
- No ammonium hydroxide. It's just aq ammonia.
- Ammonium salts don't react with acid
- Ammonium salts + alkali —> salt + ammonia + water
- Ammonia get displaced from its salt in alkaline solution
- Slaked lime and ammonium nitrate —> removes nitrogen

- Limestone (CaCO_3) is insoluble in water, cannot form OH^- to neutralise acidity
- Sulfuric acid is used to manufacture fertilisers or detergent
- Sodium chloride is neutral
- Sodium hydroxide can dissolve silicon dioxide (acidic oxide + base reaction)
- Hydrochloric acid is formed when hydrogen chloride gas dissolves in water
- The acidic/basic oxide formed dissolves in solution to form acidic/alkaline solution
- Same mass of zinc and mg react w acid, Zn has larger Mr so smaller no of mol of H_2 produced, smaller change in mass
- Same rate of reaction if same conc of H^+ (conc of H^+ that matters)
- Lactic acid - weak acid
- Acid can inactivate catalyst, lead to slower reaction rate
- When layer of insoluble salt forms around solid, impure salt formed (so not suitable)
- Describe pH graph: no. of definite step and starting pH

Qualitative analysis

- Unreactive metal does not react with dilute acids as they don't displace hydrogen from acid.
- AgCl (white ppt) ; AgI (yellow ppt)
- Ag , Zn and Sc form colorless compounds (Zn is NOT a transition metal)
- **Warm** don't heat

Redox

- Sulfur dioxide is reducing agent
- Acidified potassium manganate (VII) **solution**
- Non redox: oxidation state of all elements remained same before and after reaction
- Ions can be the reducing/oxidising agent

Chemical energetics

- Activation energy of exo to endo is activation energy plus enthalpy change
- Activation energy of forward and backward reactions always different
- Activation energy of backward reaction (exo) has same value as enthalpy change of reaction of backward reaction but has the opp sign
- Hydrogen oxygen fuel cell- hydrogen reacts w oxygen to produce electricity.
- Oxygen is reduced and hydrogen oxidised
- Neutralisation is exothermic
- Overall enthalpy change have sign
- Produce more energy: more efficient fuel
- Use mol to determine how much energy released for ...g of fuel during combustion
- More energy needed to process raw materials — greater impact on env
- Sustainable energy for electrolysis and fractional distillation - solar energy
- Ammonia burnt - produces nitrogen and water likely (no CO_2 - good)
- Energy absorbed/released need write ...KJ/mol (enthalpy change too)

Electrolysis (uses energy) study reactivity of anions

- cathode itself can never be reduced
- At cathode, less reactive is selectively discharged for aq and conc
- mass of electrode is determined by no. of mols x Mr
- current flow is same if use same battery
- **metals —> movement of mobile electrons**
- **covalent substances —> movement of mobile oppositely charged ions**
- **Simple cell also is movement of ions**
- In simple cell, electrons pass from more reactive electrode (-ve electrode) to less reactive electrode (+ve electrode) through external circuit
- Zinc/copper: reddish brown
- Metals: grey
- **Extract** nitrogen and hydrogen
- Don't compare reactivity of ions, just the metal

- why mass doesn't change anymore— reaction completed
- To obtain more accurate mass of smt heat it until reaches a constant mass when cooled
- why theoretical ratio is..(Half eqns, overall eqn, ... moles of ... decompose to form ... moles of this and this)
- how ...affects ratio- Explain, cause greater ratio difference between ...
- why ratio difference becomes smaller after some time - Solution becomes saturated w
- What happens to concentration ... after electrolysis - concentration increases as vol. of water decreases as H⁺ and OH⁻ are selectively discharged
- Inert electrodes (e.g. carbon, platinum, graphite, silver) do not take part in electrolysis as it is a good electrical conductor - state both points!
- copper does not react with acid (reactivity series),copper acts as catalyst transition metal
- different combination of metals produce different voltages in simple cell - talk about reactivity difference, more reactive metal has higher tendency to lose valence electrons to form positive ions and flow through the circuit/wire to less reactive metal
- Their current depends on conc of mobile ions
- hydroxide ions **give up electrons more readily** (to be oxidised) than sulfate ions
- Bubbles of gas lift metal up
- Ionic solution decomposed as ions are being selectively discharged
- Solid deposited may be washed off so less increase in mass than expected
- Over time, ... conc decrease so other one gets selectively discharged to form...
- Impurity added (molten cryolite) decrease boiling point so less energy needed to keep electrolyte molten
- Linked to effect when electricity passes through ionic compounds. Ionic compounds broken down into constituent elements
- Why electroplating is considered endothermic: energy taken in at anode for oxidation so electrons can be gained at cathode for reduction
- Gas dissolves in WATER don't say electrolyte

- Why colour of copper two surface remains blue during experiment (in moles)

- 1 mol of Cu from anode will oxidise to form 1 mol of Cu^{2+} ions. 1 mol of Cu^{2+} ions will be reduced at cathode to form 1 mole of Cu. Cu^{2+} ions concentration in solution remains same, remains blue colour. Replenishes

REACTIVITY SERIES

- Copper carbonate (green $\rightarrow$ black upon heating)
- Metal oxide (white?)
- Black copper (II) oxide turns reddish brown after react w h (copper + water formed)
- Metal powder + metal oxide $\rightarrow$ white smoke and displaced oxide (reduction too)
- Iron oxide does not corrode in dry air (no water present to rust it)
- Magnesium reacts v slowly w cold water but vigorously with steam
- Magnesium in alloy is reactive, react and form salt. (Like other reactive metals)
- Al form aluminium oxide layer which protects metal from further reaction, remains undissolved
- Gold is mined commercially in its elemental state rather than as a compound as it doesn't easily form compounds with other elements (unreactive)
- Unreactive metals likely found as elements in soils or rock
- When using hydrogen, lower temp. are needed to reduce lower reactivity oxide
- Hydrogen keeps flowing in tube until tube is cold to **prevent metal from reacting with oxygen in air to form back ...**
- Heat metal carbonate - produces Carbon dioxide
- Acts as barrier/protective layer to prevent iron from coming into contact with oxygen and iron in air
- Poly(ethene) good for food cans as it does not corrode
- Sacrificial protection - **corrodes in place of iron (lose e more easily to form +ve ion)**
- Not suitable: coating is not permanent and may be easily damaged, then can rust
- Displacement can be when more reactive metal displace... from its ions
- Displacement only occur in solution. Solid is reduction.
- Store metal under layer of oil
- Coating on catalyst reduces rate of reaction as there is **lesser surface area** exposed for catalyst to react w reactant.
- Mercury is less reactive than copper
- When metal added to solution, the fixing is cause metal react with water in solution to produce hydrogen gas
- Aluminium is used to make food containers because of its resistance to corrosion. It forms a layer when reacted with air or water.
- Ensure no air in harber process: oxygen in air would react w iron and iron loses its function as a catalyst (like acid, it can block active site of catalyst)

Periodic table

- Moving across period, no of valence electrons increases. Metals have higher tendency to lose their valence e to form positive ions. Non metals have higher tendency to gain or share electrons to form negative ions or molecules. Noble gas don't form compounds as

they have full valence e shell (chemically unreactive), no need to gain lose or share electrons.

- Strongest non metal *oxidising agent* is at top of a group (17)
- Noble gases are monoatomic
- Why helium cannot be recovered if released into atmosphere — density very low compared to other gases which could be easily recovered
- Both transition metals and compounds w transition metals are good Catalyst
- ONLY transition metals form coloured compounds
- Oxidation state between (7 to -7)
- Iodine is black solid at room temp

Organic compounds (simple molecular structure - follow the rules)

- vegetable oil (polyunsaturated) has longer carbon chain than Alkene
- Factors that affect solubility of organic compounds : presence of oxygen in compound , molecular size
- Methyl group (CH₃)
- Flammability of hydrocarbons decrease down the group as bigger molecular size
- Longer chain - more energy needed to overcome WIMFOA
- Organic solvent don't mix with salts
- produce smt only, the ends on both sides same
- as we move down the homologous series, each member differ by an additional -CH₂- group of atom, which more energy is released to form bonds than absorbed to break
- Isomers have different enthalpy change as they are structurally different. Thus, the bonds that are broken will be different though bonds formed same (link to bond forming and bond breaking)
- Same homologous series —> same functional group and same general formula (state), differ by -CH₂- unit
- Cracking importance - breaks down less useful long chain hydrocarbons to form shorter fractions which are more useful to meet higher industrial demands
- During fermentation, ethanol in presence of bacteria reacts with atmospheric oxygen to form ethanoic acid: oxidation (impurities formed)
- Fermentation produces dilute ethanol solution which undergo fractional distillation to purify ethanol
- **Heat** needed to oxidise ethanol to ethanoic acid

Air

- Why chlorine atoms like catalyst: still present even after reaction and can be regenerated
- **21% oxygen**, 78% nitrogen
- Methane is the main substance present in natural gas: (degrading of dead organisms), and has greater global warming effects than CO₂
- Calcium carbonate does not remove CO
- How NO is formed: high temperature, large amt energy absorbed to break the N-N triple bonds in N₂ - so lean burn energy good as lower temperature

- CO is poisonous gas - cause headaches, breathing difficulties and even death
- Sulfur dioxide and acid can corrode machinery parts
- SO₂ react with oxygen to form SO₃ and dissolve in water to form acid rain (sulfuric acid) same as Nitrogen oxides
- To dispose off polymer that cannot be recycled: incineration produces poisonous gas which pollute air. Burying in ground pollutes lands as non biodegradable.
- How photosynthesis and respiration help regulate CO₂ in atmosphere? - during respiration 1 mol of glucose produce 6 mol of CO₂, taken in by plants for photosynthesis. (Rmb the eqnss)
- Why planting more trees not a long term solution to reduce CO₂? - trees respire and produce CO₂, add back to atmosphere. Rate of production of CO₂ from burning of fossil fuels is faster than rate at which CO₂ removed from atmosphere through photosynthesis
- **Biodegradable:** able to decompose naturally by bacteria or other living organisms
- Non biodegradable: +ve— allows material to be reused again, save cost
- Ve: difficult to dispose off, leading to pollution problems when burnt, air pollutants formed —> air pollution
- Zero emission: no greenhouse gas or air pollutant produced
- Global warming: increase in earth average temp and cause extreme weather events
- Plastic can cause water pollution when not treated properly before discharge, also form microplastics

Carbon neutral? - CO₂ emitted during combustion is offset when photosynthesis.

- renewable - sugarcane plants can be grown and replaced/replenished in our lifetime
- non renewable - ethanol can also be made from catalytic addition of steam to ethene. Ethene is formed from cracking of petroleum obtained from fossil fuels which take millions of years to form