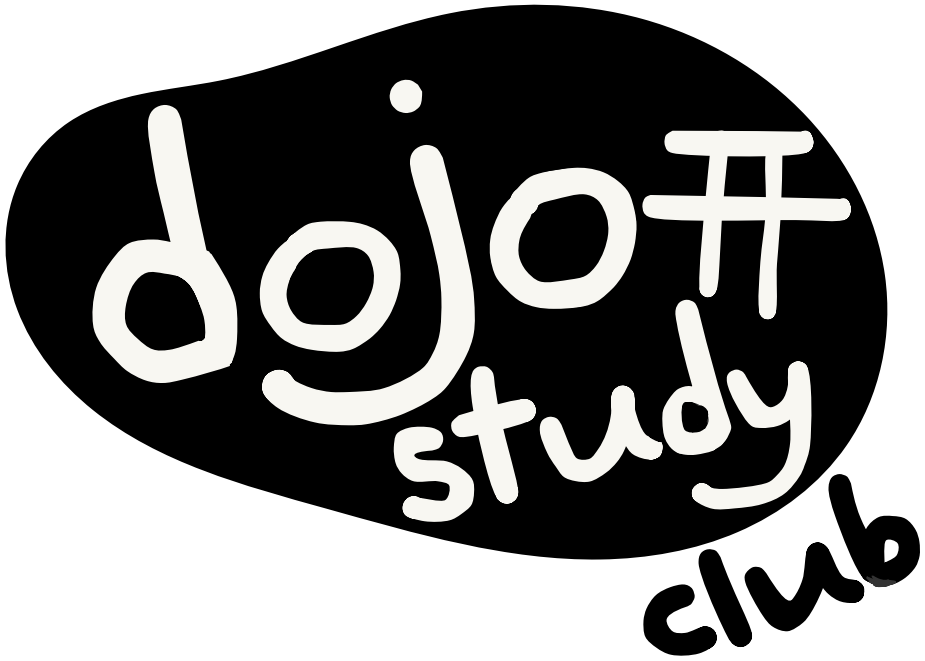


Dojo Study Club

Pure Chemistry
WA2 Revision Guide

Definitions

Exothermic Reaction	A reaction in which heat (energy) is given out to the surroundings.
Endothermic Reaction	A reaction in which heat (energy) is absorbed by the surroundings.
Enthalpy Change	The overall heat change in a reaction.

Rate of Reaction

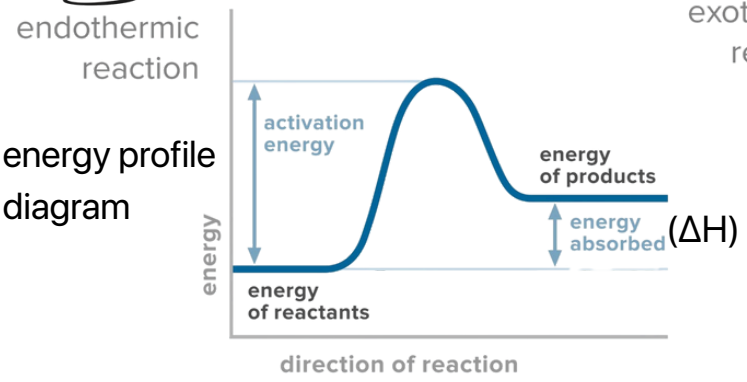
Activation Energy	The minimum energy that reacting particles must possess in order for a chemical reaction to occur.
Catalyst	A substance that will increase the rate of a reaction by lowering the activation energy. Once activation Energy is lowered, more reacting particles have energy greater or equal to the activation Energy.
Haber Process	An industrial application for the production of ammonia.

Electrolysis

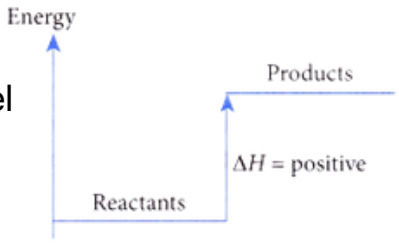
Electrolysis	The process of using electricity to break down or decompose a compound.
Electrolyte	A molten or aqueous compound that conducts an electric current.
Electrode	A metal or carbon rod by which the current leaves or enters the electrolyte.
Inert Electrode	Electrodes that do not react with the products of electrolysis.
Non-Electrolytes	Substances that do not conduct electricity under any conditions.
Electroplating	The deposition of a thin layer of metal on an object, by means of electrolysis.
Simple Cell	A device that converts chemical energy into electrical energy.

Cheat Sheet

Endothermic

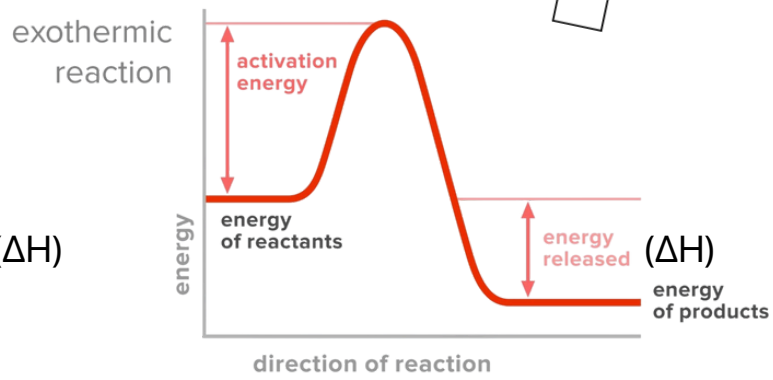


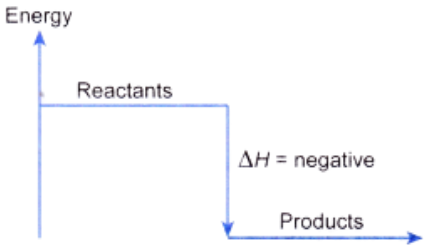
energy profile diagram



energy level diagram

Exothermic





ΔH = BB - BF

enthalpy change = bonds breaking - bonds forming

ΔH = BB - BF

enthalpy change = energy absorbed to break bonds - energy released to form bonds

Endothermic

Exothermic

Rate Of Reaction

The speed at which reactants are converted into products, per unit time

Concentration (aqueous solutions)	Higher concentration, more particles per unit volume, higher frequency of efficient collisions.
Temperature (all)	Higher temperature, particles move faster with more energy, higher frequency of efficient collisions
Pressure (gases)	Higher pressure, particles closer to one another, higher frequency of efficient collisions
Surface Area (solids)	Smaller particles, larger surface area, higher frequency of efficient collisions

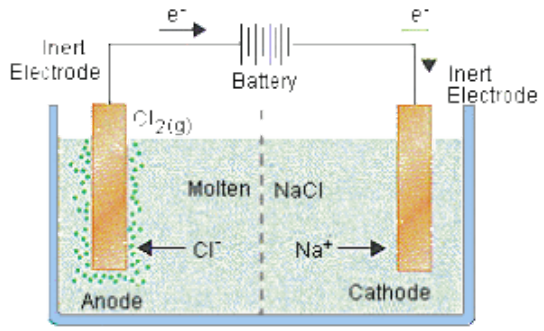
Electrochemistry

electric energy > chemical energy

Electrolysis — **does it have a battery?** — **Chemical Cell**

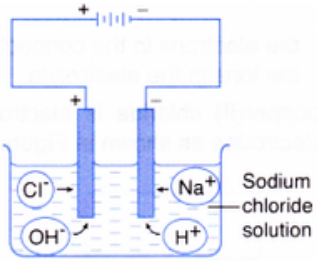
chemical energy > electric energy

Molten



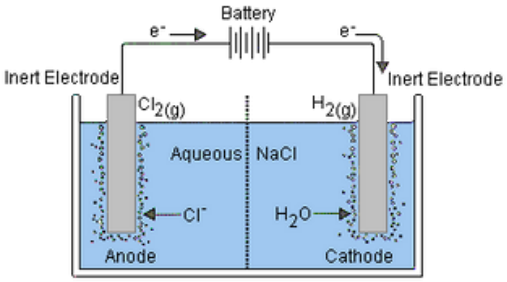
- most simple, only 2 ions present
- in this case, NaCl is the electrolyte.
- Na+ and Cl- are the ions
- Anode: Cl- discharged
- Cathode: Na+ discharged

Dilute



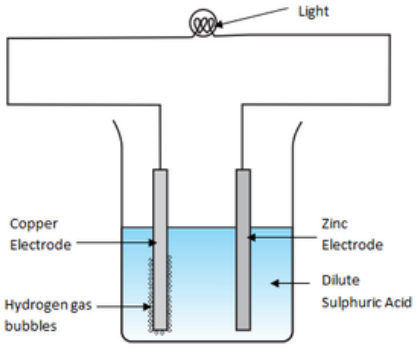
- 4 ions present
- Na+, Cl-, H+, OH-
- Ions chosen based on ease of discharge
- Anode: OH- discharged
- Cathode: H+ discharged

Concentrated



- 4 ions present
- Na+, Cl-, H+, OH-
- Ions chosen based on ease of discharge (concentrated)
- Anode: Cl- discharged
- Cathode: H+ discharged

Simple Electric Cell



- a more reactive metal is preferientially oxidised.
- Anode: More Reactive Metal (Zinc)
- Cathode: Less Reactive Metal (Copper)

The more reactive metal's electrons would flow to the less reactive metal, creating a potential difference.

The further apart the 2 metals are on the reactivity series, the greater the voltage.

Electrolyte must always be aqueous.

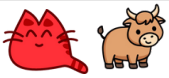
Generally,

Cations: less reactive = easier discharge
Anions: OH- > Halogens > Others

Concentrated

in concentrated electrolytes, the ease of discharge of anions change.
Halogens > OH-

Red Cat And Ox



- **Red**uction at **Cat**hode
- **Ox**idation at **An**ode

(for all electrochemistry)

Cation Table

Cation	Sodium hydroxide solution, NaOH(aq)		Aqueous ammonia, NH_3(aq)	
	On adding a few drops	On adding excess	On adding a few drops	On adding excess
Zn^{2+}	White precipitate	Precipitate dissolves in excess to form a colourless solution	White precipitate	Precipitate dissolves in excess to form a colourless solution
☆ $A\beta^{3+}$	White precipitate	Precipitate dissolves in excess to form a colourless solution	White precipitate	Precipitate is insoluble in excess
☆ Pb^{2+}	White precipitate	Precipitate dissolves in excess to form a colourless solution	White precipitate	Precipitate is insoluble in excess
Ca^{2+}	White precipitate	Precipitate is insoluble in excess	No precipitate	No precipitate
Cu^{2+}	Light blue precipitate	Precipitate is insoluble in excess	Light blue precipitate	Precipitate dissolves in excess to form a deep blue solution
Fe^{2+}	Green precipitate	Precipitate is insoluble in excess	Green precipitate	Precipitate is insoluble in excess
Fe^{3+}	Reddish-brown precipitate	Precipitate is insoluble in excess	Reddish-brown precipitate	Precipitate is insoluble in excess
NH_4^+	No precipitate. On heating, ammonia gas is given off and the gas turns moist red litmus paper blue.	No change is observed		

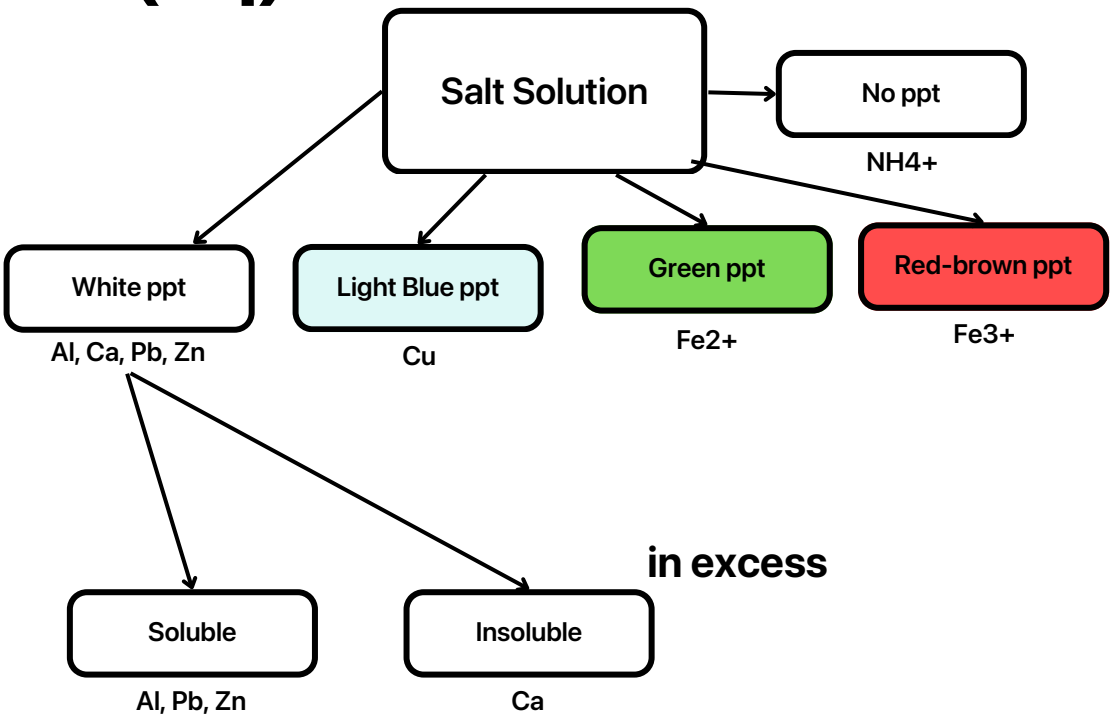
How to differentiate between Al and Pb

The observations with NaOH(aq) and NH3 (aq) are the same for Al3+ and Pb2+ ions

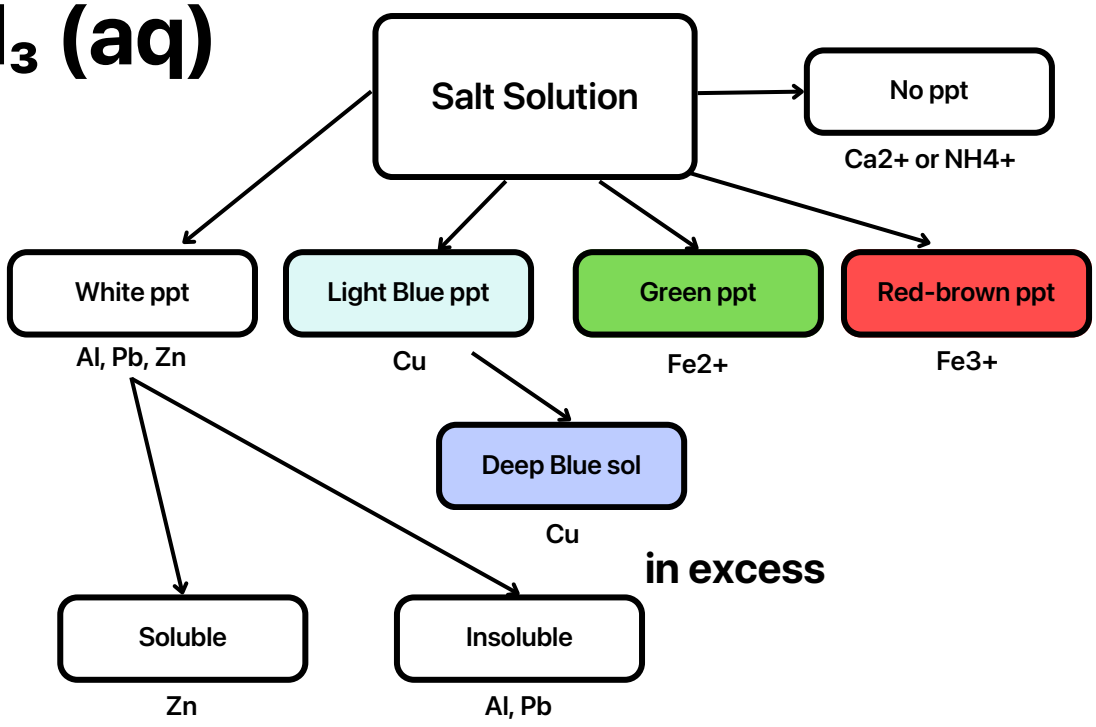
- Add Potassium Iodide (KI) to both solutions.
- A yellow precipitate (PbI2) is formed for Pb, while no precipitate formed for Al

Cation Table

NaOH (aq)



NH_3 (aq)



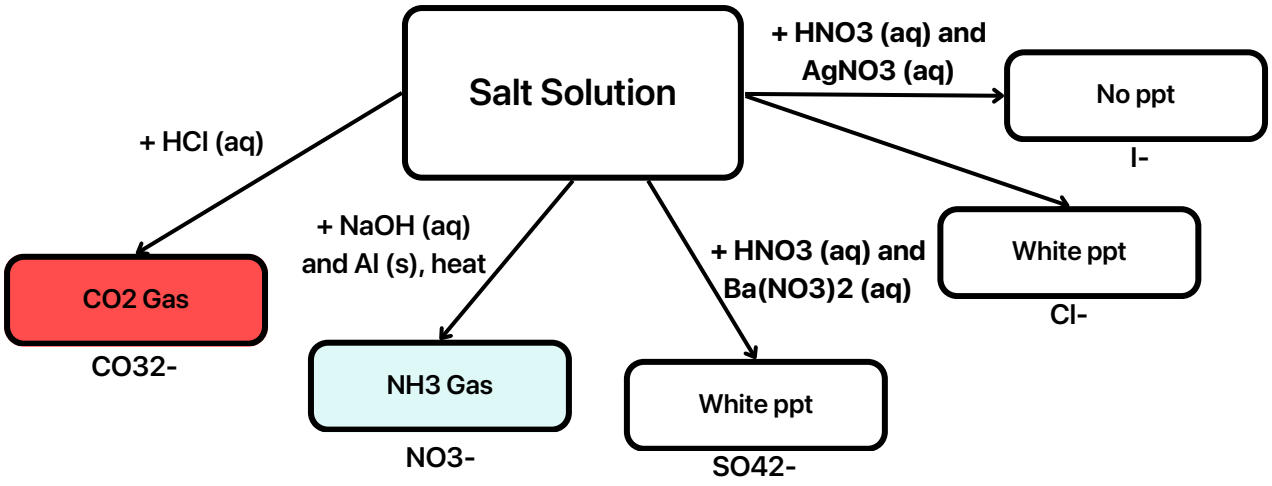
Anion Table

Anion	Test	Observations for positive test and inference
CO_3^{2-}	Add dilute hydrochloric acid. Pass the gas that is given off into limewater.	Effervescence is observed. Gas given off forms a white precipitate with limewater. Carbon dioxide gas is given off.
NO_3^-	Add sodium hydroxide solution, then add a piece of aluminium foil. Warm the mixture. Test the gas given off with moist red litmus paper.	Effervescence is observed. The moist red litmus paper turns blue. Ammonia gas is given off.
SO_4^{2-}	Add dilute nitric acid, then add barium nitrate solution.	A white precipitate of barium sulfate is formed.
Cl^-	Add dilute nitric acid, then add silver nitrate solution.	A white precipitate of silver chloride is formed.
I^-	Add dilute nitric acid, then add silver nitrate solution.	A yellow precipitate of silver iodide is formed.

Sulfates, Chlorides and Iodides require Dilute Nitric Acids - Why?

- To remove carbonates and hydroxide ions!
- If dilute nitric acid is not added, precipitates of BaCO3 , Ag2CO3 and AgOH will form when barium nitrate / silver nitrate is added, which will interfere with the results.

Anion Table


Salt Solution
+ HCl (aq)
CO2 Gas
CO32-
+ NaOH (aq)
and Al (s), heat
NH3 Gas
NO3-
+ HNO3 (aq) and
Ba(NO3)2 (aq)
White ppt
SO42-
+ HNO3 (aq) and
AgNO3 (aq)
No ppt
I-
White ppt
Cl-

Gas Table

	Gas	Test	Observations
Odourless	Oxygen	Insert a glowing splint into the test tube.	The glowing splint is rekindled.
	Hydrogen	Place a lighted splint at the mouth of the test tube.	The lighted splint is extinguished with a 'pop sound'.
	Carbon dioxide	Bubble gas through limewater.	White precipitate is formed in the limewater. The precipitate dissolves upon further bubbling.
Pungent	Chlorine (Greenish yellow)	Place a piece of moist blue litmus paper at the mouth of the test tube.	The moist blue litmus paper turns red, and is then bleached.
	Sulfur dioxide	Place a piece of filter paper soaked with acidified potassium manganate (VII) at the mouth of the test tube.	The purple acidified potassium manganate (VII) turns colourless.
	Ammonia	Place a piece of moist red litmus paper at the mouth of the test tube.	The moist red litmus paper turns blue.