

Redox Reactions & Electrolysis.

Q-1) What is oxidation?

[OIL-RIG]

- gain of oxygen
- removal of hydrogen
- loss of electrons
- increase in oxidation no.

Q-2) What is reduction?

- > - gain of hydrogen
- removal of oxygen
- gain of electrons
- decrease in oxidation no.

Q-3) What is oxidation number / state?

> It is a number given to an atom in a compound which describes how oxidised or reduced it is.

(numerical charge value : eg: Al^{3+}).

Q-4) Rules for oxidation no. / state.

① The oxidation no. of any uncombined element is zero

eg: Cl_2 , O_2 , Fe , C ...

② The sum of oxidation no. of all atoms in a neutral compound is zero.

eg: H_2SO_4 , MgO , $NaCl$...

③ The sum of oxidation no. of all atoms in an ion, is equal to the charge on that ion.

eg: SO_4^{2-}

$$S + 4(O) = -2$$

$$S + 4(-2) = -2$$

$$-8 = -2.$$

$$-2 + 8 = 6 \therefore S = +6$$

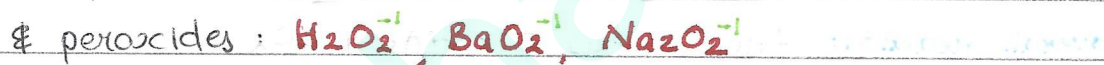
④ The more electronegative element in a substance is given a negative oxidation state.



⑤ Group I elements have oxidation no. +1

Group II elements have oxidation no. +2.

⑥ Oxygen ~~had~~ has oxidation no. -2.



⑦ Hydrogen has oxidation no. +1

except hydrides (-1)



⑧ Fluorine has oxidation no. -1

↳ it's the most electronegative element.

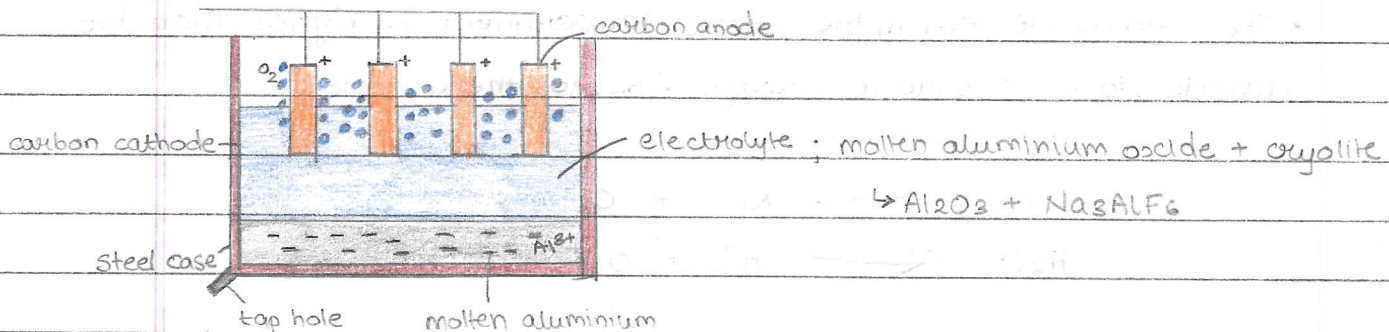
⑨ Chlorine has oxidation no. -1

except ~~with~~ ⁱⁿ compound with O or F, where it is positive.



Q-5) Electrolysis - extraction of Aluminium.

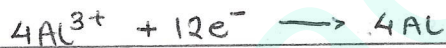
> Aluminium is extracted from bauxite ore.



- * Aluminium is dissolved in molten cryolite because cryolite
 - lowers melting point of Aluminium
 - it improves the electrical conductivity of the electrolyte.

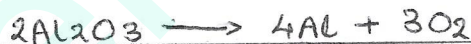
at cathode (reduction). $(Al^{3+} + 3e^- \rightarrow Al) \times 4$ make e⁻ same.

at anode (oxidation) $(2O^{2-} \rightarrow O_2 + 4e^-) \times 3$



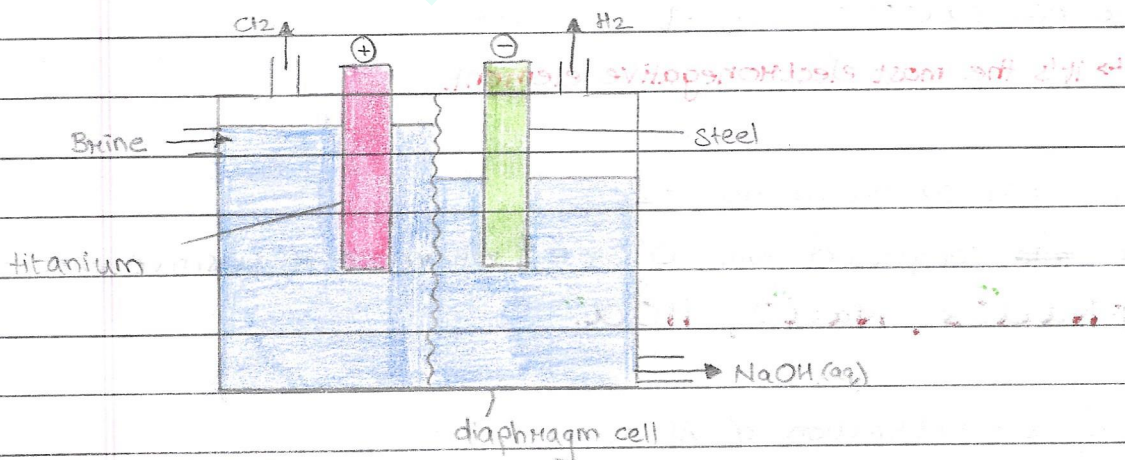
overall reaction: $4Al^{3+} + 6O^{2-} \rightarrow 4Al + 3O_2$

OR

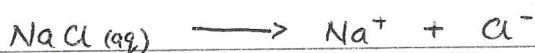


Q-6) Electrolysis of Brine.

- * Brine is concentrated NaCl (aq) - with water.



- * The electrolyte level in the anode compartment is higher than the cathode to make sure it always flows to the cathode.



at anode (oxidation). $2\text{Cl}^- \longrightarrow \text{Cl}_2 + 2\text{e}^-$

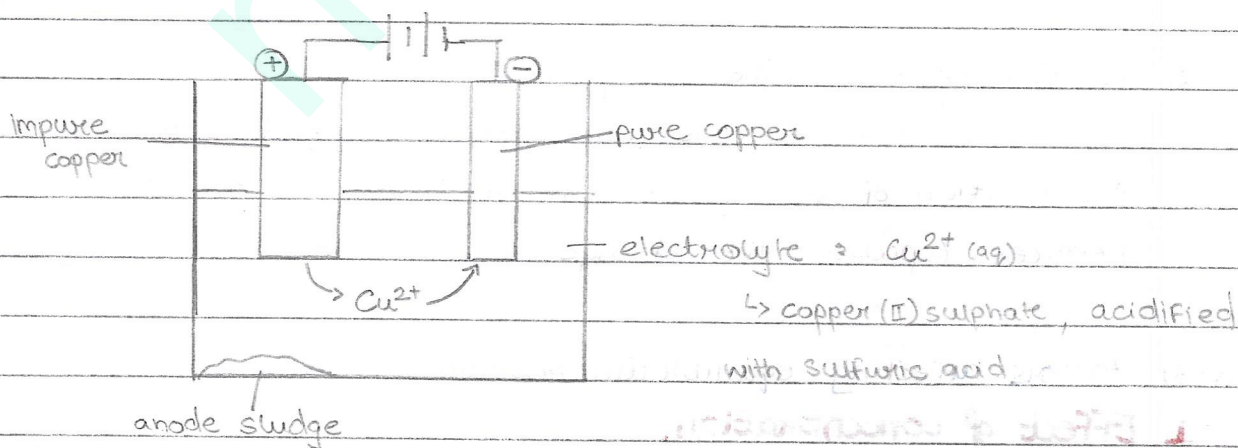
↳ Cl^- is ~~more~~ oxidised because concentration of Cl^- is greater than OH^-

at cathode (reduction) $2\text{H}^+ + 2\text{e}^- \longrightarrow \text{H}_2$

↳ H^+ ions are reduced as they are lower in electronegative chemical series than Na^+ .

* As concentration of H^+ ions reduces, equilibrium shifts to right.

Q-7) Electrolysis - purification of copper.



at anode (oxidation). $\text{Cu(s)} \longrightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$

at cathode (reduction). $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Cu(s)}$

* The anode decreases in thickness & impurities are deposited as anode sludge.

* The cathode increases in thickness and when enough pure copper is deposited, it's replaced.