Name: _____ **Date:** _____

Secondary 4 Chemistry

Chapter: Electrolysis & Simple Cell

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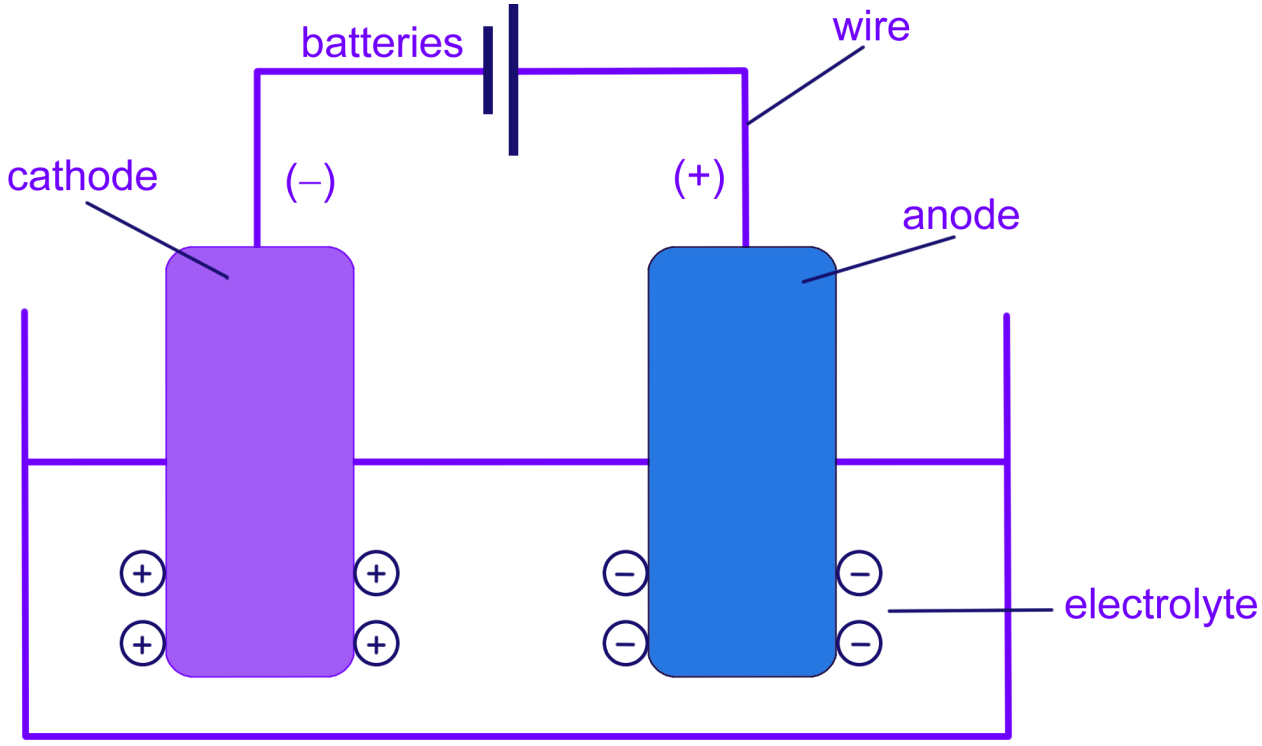
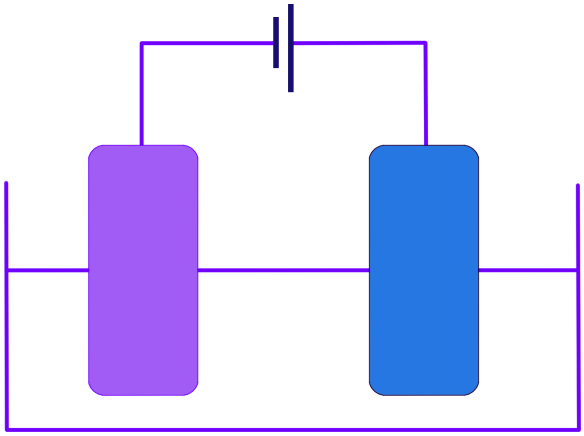
Instructions:

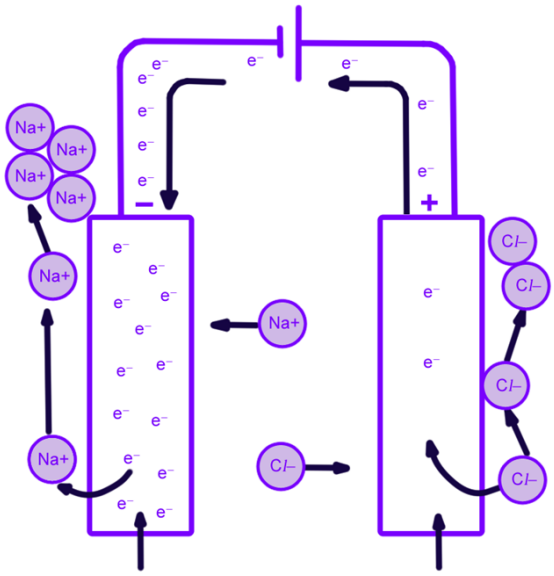
1) The questions in this booklet are organised and categorised into "concepts-level".
2) Read or watch the video of the example.
3) Try the rest of the questions out on your own.
4) Check it against the worked solutions given to you.
5) If you get any of the steps or final answer wrong, watch the teaching video and try the questions again.
6) Do the Higher order thinking questions prepared for you in the next set.

Concept 1: How Does Electrolysis Work?



Concept 2: Electrolysis MOLTEN Sodium Chloride Using Inert Electrode





Ions Available:

Ions attracted to Cathode:

Ions attracted to Anode:

[Reduction occurs at the Cathode]
Cathode Half Equation

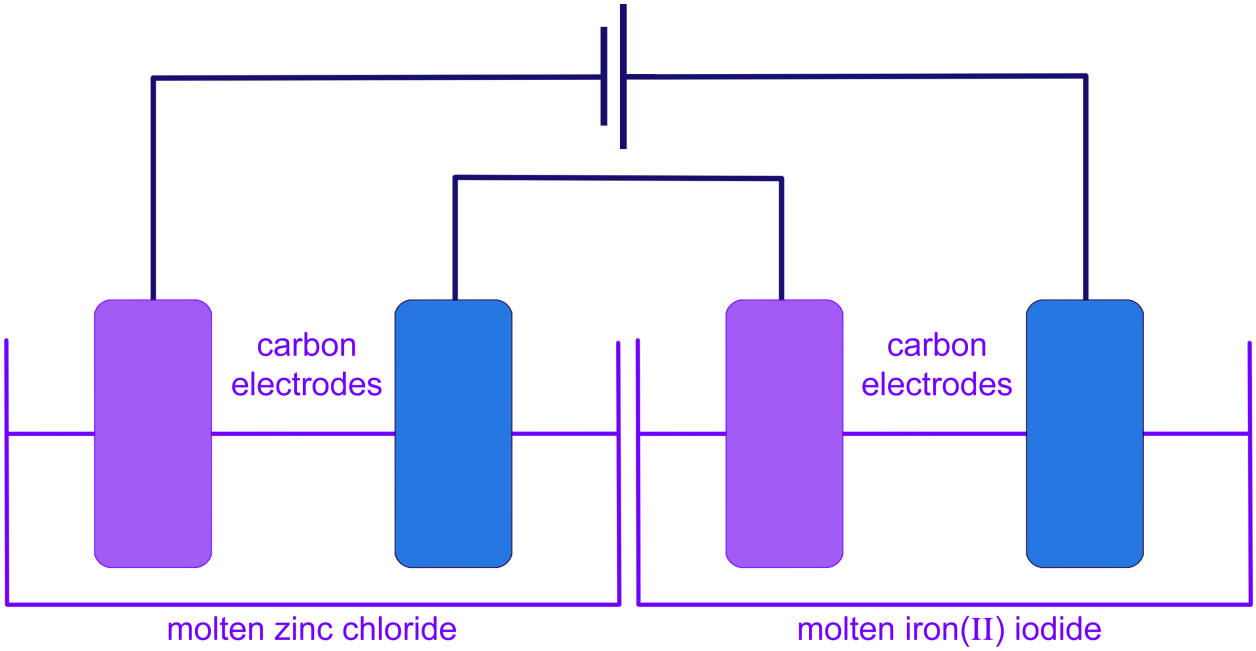
[Oxidation occurs at the Anode]
Anode Half Equation

Observation:

Observation:

Overall Equation:

Exercise 2.1: Electrolysis MOLTEN $ZnCl_2$ & FeI_2 Using Inert Electrode



*Construct the half equations for the four electrodes, **A**, **B**, **C** and **D**.*

***A**:*

***B**:*

***C**:*

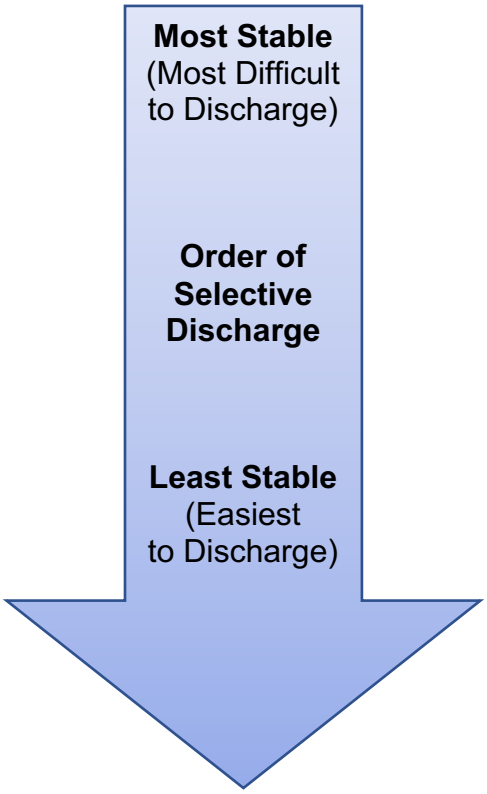
***D**:*

If molten zinc chloride and iron(II) iodide are mixed together in the electrolysis, which cation and anion get discharged?

Concept 3: Selective Discharge

Cations (Positive Ion)

Please	***Potassium***
Stop	***Sodium***
Calling	***Calcium***
Mark	***Magnesium***
A	***Aluminium***
Cool	***Carbon***
Zuckerberg	***Zinc***
In	***Iron***
The	***Tin***
London	***Lead***
He's	***Hydrogen***
Called	***Copper***
Mr	***Mercury***
Social	***Silver***
Guy	***Gold***



Anions (Negative Ion)

SO_4^{2-}

NO_3^-

Group VII

F^-

Cl^-

Br^-

I^-

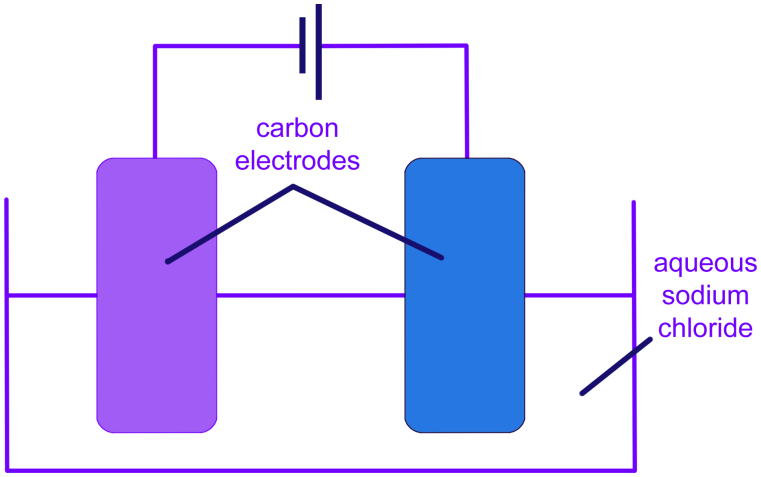
OH^-

The less stable species will be preferentially discharged.

So, which ions are discharged?

Cation: **Anion:**

Concept 4: Electrolysis of AQUEOUS Sodium Chloride Using Inert Electrode



Ions Available:

Ions attracted to Cathode:

[Reduction occurs at the Cathode]
Cathode Half Equation

Observation:

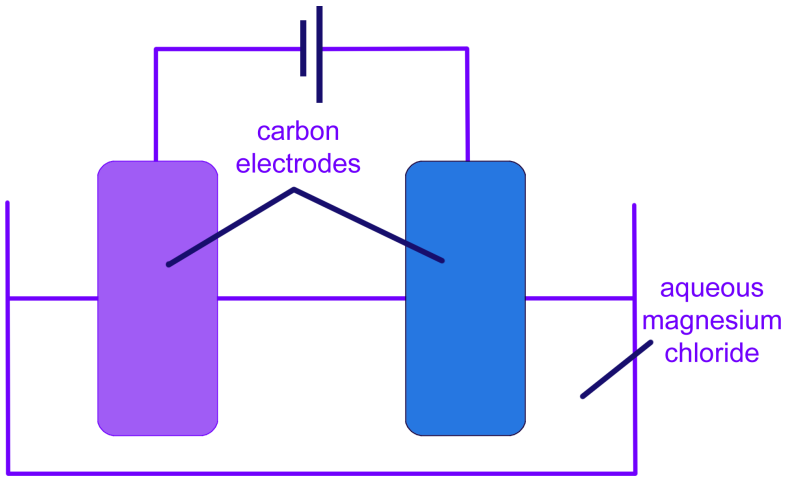
Ions attracted to Anode:

[Oxidation occurs at the Anode]
Anode Half Equation

Observation:

Overall Equation:

Exercise 4.1: Electrolysis of AQUEOUS Magnesium Chloride Using Inert Electrode



Ions Available:

Ions attracted to Cathode:

Ions attracted to Anode:

[Reduction occurs at the Cathode]
Cathode Half Equation

[Oxidation occurs at the Anode]
Anode Half Equation

Observation:

Observation:

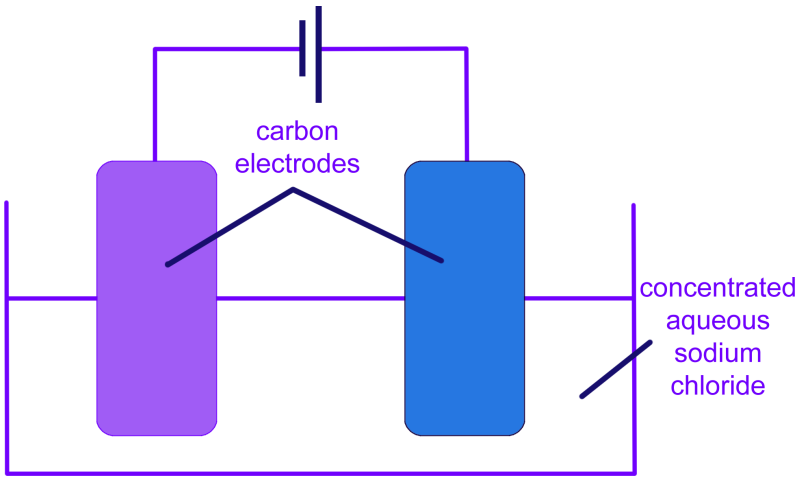
Comment on the pH & concentration of the electrolyte (Refer to page 8)

Overall Equation:

Concept 5: pH Change & Concentration Change

pH 7 = [Concentration of Acid] = [Concentration of Alkali]

Concept 6: Electrolysis of Concentrated Sodium Chloride Using Inert Electrode



Ions Available:

Ions attracted to Cathode:

[Reduction occurs at the Cathode]
Cathode Half Equation

Observation:

Ions attracted to Anode:

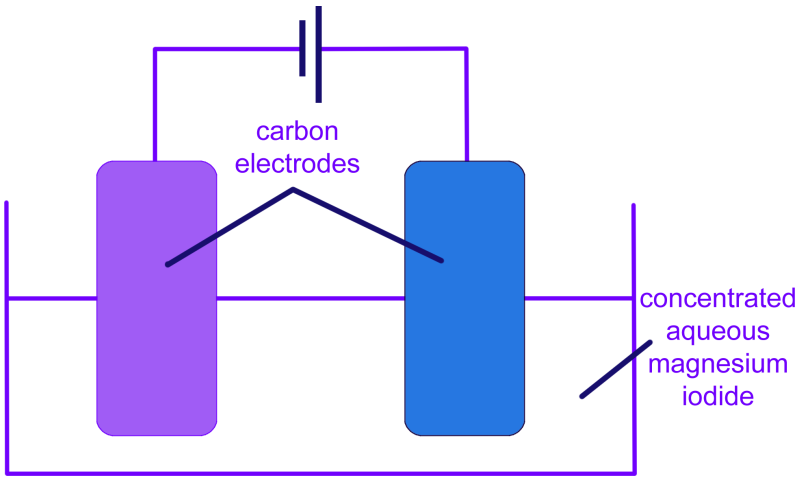
[Oxidation occurs at the Anode]
Anode Half Equation

Observation:

Comment on the pH & concentration of the electrolyte.

Overall Equation:

Exercise 6.1: Electrolysis of Concentrated Magnesium Iodide Using Inert Electrode



Ions Available:

Ions attracted to Cathode:

[Reduction occurs at the Cathode]
Cathode Half Equation

Observation:

Ions attracted to Anode:

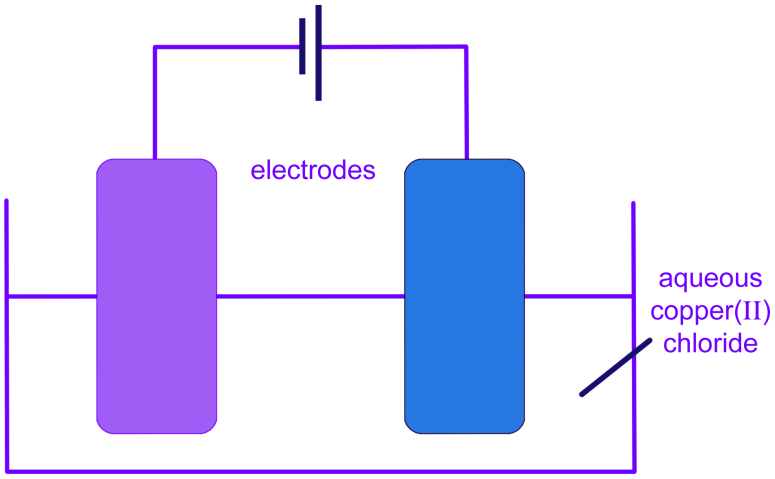
[Oxidation occurs at the Anode]
Anode Half Equation

Observation:

Comment on the pH & concentration of the electrolyte.

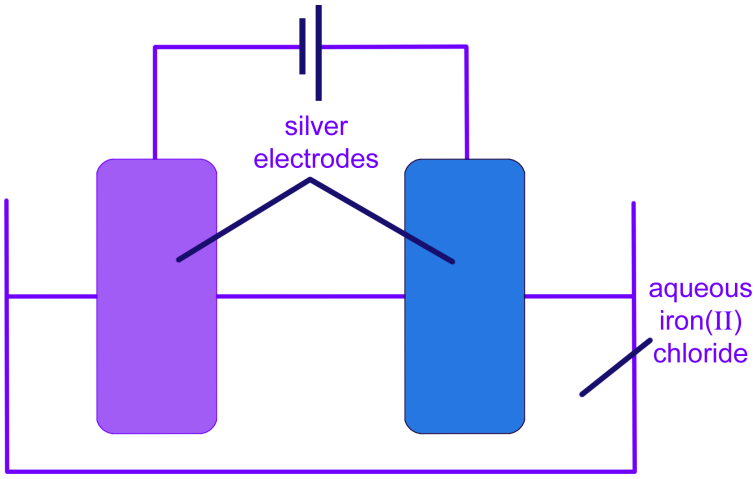
Overall Equation:

Concept 7: Electrolysis of AQUEOUS Sodium Chloride Using Inert VS Reactive Electrode



	Inert Electrodes	Reactive Electrodes
Cathode		
Anode		
Observation		

Exercise 7.1: Electrolysis of AQUEOUS Iron (II) Chloride Using Inert VS Reactive Electrode



	Inert Electrodes	Reactive Electrodes
Cathode		
Anode		
Observation		

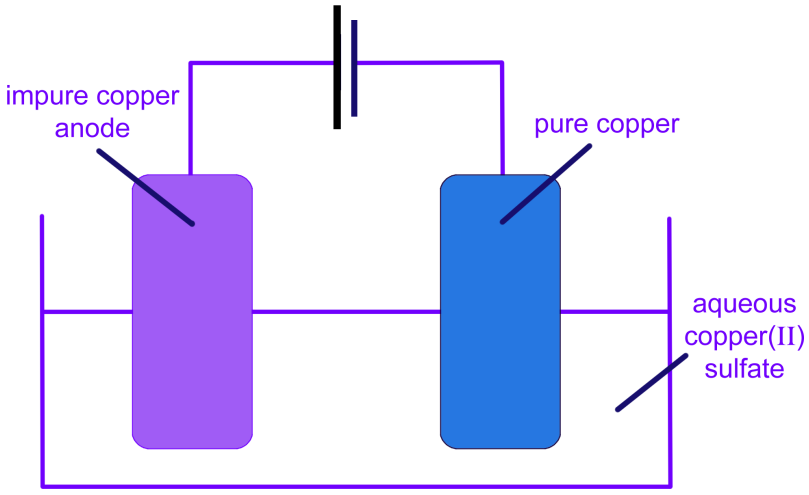
Concept 8: Application of Concept 7 (Purification of Metals)

Copper extracted from copper ores is impure. The impure copper is cast into anodes and refined using electrolysis.

Cathode: Pure Copper Cathode

Anode: Impure Copper Anode

Electrolyte: Solution Containing Cu^{2+} Ions



Reaction at anode:

Reaction at cathode:

Observation:

Observation:

Exercise 8.1: Application of Concept 7 (Purification of Metals)

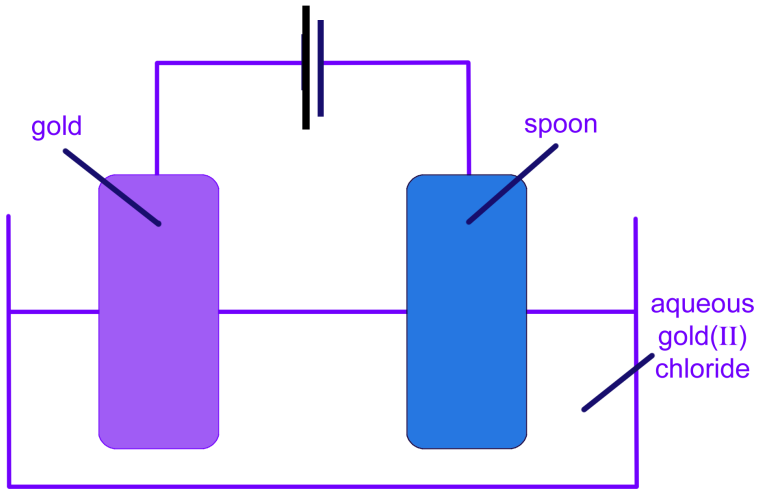
Silver extracted from silver ores is impure. The impure silver is cast into anodes and refined using electrolysis.

Concept 9: Application of Concept 7 (Electroplating of Metals)

Cathode: Spoon

Anode: Gold

Electrolyte: Solution Containing Au^{3+} Ions



Reaction at anode:

Reaction at cathode:

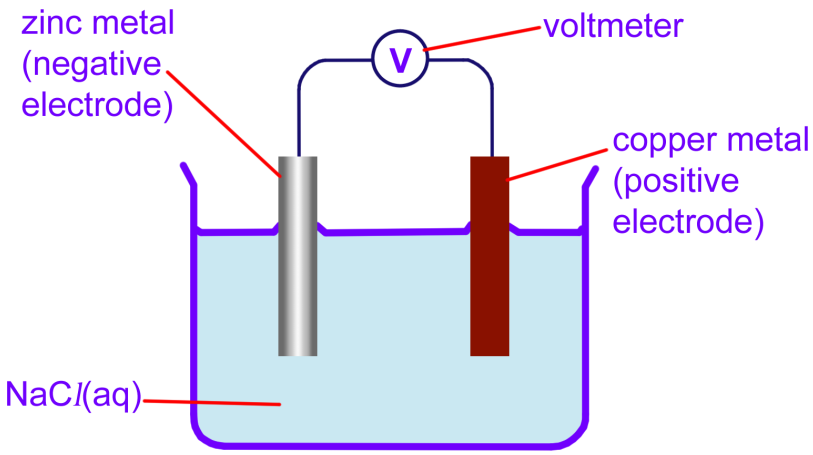
Observation:

Observation:

Exercise 9.1: Application of Concept 7 (Electroplating of Metals)

If Mark wants to Coat silver onto the Fork, explain how he can do it.

Concept 10: Electric Cell/ Simple Cell



Ions in the Electrolyte:

Ions attracted to Cathode:

Ions attracted to Anode:

<u>Cathode Half Equation</u>

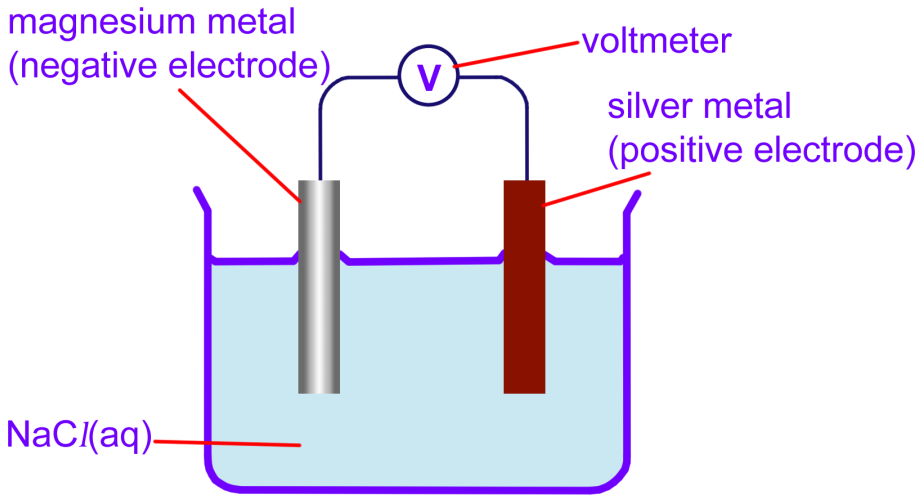
<u>Anode Half Equation</u>

Observation:

Observation:

Comment on the pH & concentration of the electrolyte.

Exercise 10.1 : Electric Cell/ Simple Cell



Ions in the Electrolyte:

Ions attracted to Cathode:

Ions attracted to Anode:

<u>Cathode Half Equation</u>

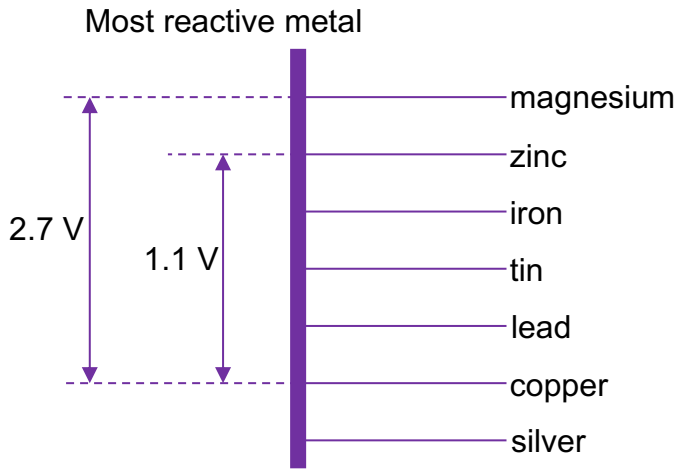
<u>Anode Half Equation</u>

Observation:

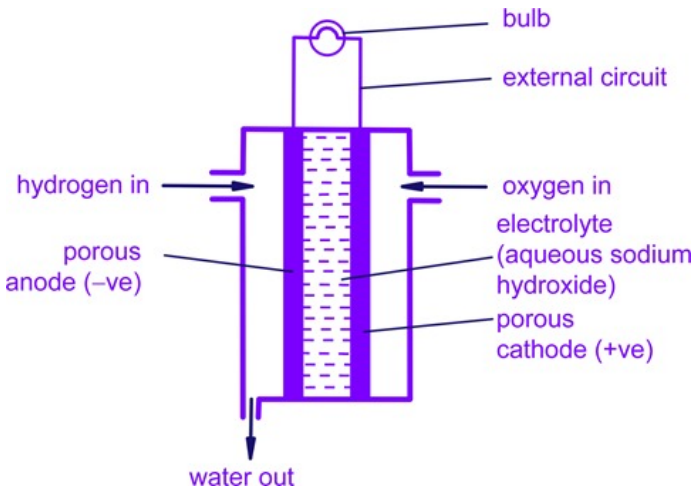
Observation:

Comment on the concentration of the electrolyte.

Concept 11: Voltage & Difference in Reactivity



Concept 12: Fuel Cell (No need to learn in detail)



In a hydrogen-oxygen fuel cell, hydrogen and oxygen gases are pumped into it.

(a) The electrolyte used is an alkali (e.g. aqueous sodium hydroxide).

(b) Carbon electrodes are used with a platinum catalyst.

At the anode (-ve): $H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$
At the cathode (+ve): $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

The overall cell reaction is the conversion of hydrogen and oxygen to water.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$$

Concept 13: Salt Bridge

It maintains electrical neutrality within the internal circuit, preventing the cell from rapidly running its reaction to equilibrium.

If no salt bridge were present, the solution in one half cell would accumulate negative charge and the solution in the other half cell would accumulate positive charge as the reaction proceeded, quickly preventing further reaction, and hence production of electricity