# Electrolysis

**QUESTIONS**

**2004**

**Question 1.**

Write two applications of electrolysis in which the anode diminishes in mass.
**Answer:**

1. Used in electroplating.
2. Purification of metals.

**Question 2.**
If the compound formed between X (a metal with a valency 2) and Y (a non-metal with a valency 3) is melted and an electric current passed through the molten compound, the element X will be obtained at the…….. and Y at the…… of the electrolytic cell. (Provide the missing words.)

**Answer:**
Cathode, Anode.

**Question 3.**
What kind of particles will be found in a liquid compound which is a non-electrolyte.

**Answer:**
Only molecules.

**Question 4.**
If HX is a weak acid, what particles will be present in its dilute solution apart from those of water.

**Answer:**
Non-ionized molecules, $H^+$ and X".

**Question 5.**
What ions must be present in a solution used for electroplating a particular metal.

**Answer:**
Cations of that particular metal to be deposited.

**Question 6.**
Explain how electrolysis is an example of redox reaction.

**Answer:**
**Redox Reaction:** "A chemical reaction in which loss of electrons and the gain of

electrons takes place simultaneously is called REDOX reaction."

**Example:** Electrolysis of Potassium chloride

$2K - 2e^{1-} \rightarrow 2K^{+}$

$Cl_2 + 2e^{1-} \rightarrow 2Cl^-$

$2K + Cl_2 \rightarrow 2K^{+}Cl^{-}$ or 2KCl

The potassium atoms lose one electron each from their valence shells to form potassium ions. As loss of electrons takes place therefore, potassium metal is oxidised to Potassium ions [$K^+$].
Chlorine atoms gain one electron each in their valence shells to form chloride ions. As gain of electrons take place, therefore, chlorine atoms are reduced to chloride ions ($Cl^-$ ). Since reduction and oxidation takes place simultaneously, therefore, electrolysis is a Redox reaction.

$$KCl \rightleftharpoons K^+ + Cl^-$$

**2005**

**Question 1.**
Explain why copper, though a good conductor of electricity, is a non-electrolyte.

**Answer:**
**Copper metal –** is a good conductor of electricity – but is a non-electrolyte, since-
It does not undergo chemical decomposition due to flow of electric current through it.

**Question 2.**
Name the gas released at the cathode when acidulated water is electrolysed.

**Answer:**
Hydrogen gas.

**Question 3.**
Explain why solid sodium chloride does not allow electricity to pass through.

**Answer:**
Sodium chloride (an ionic solid) does not conduct electricity in its solid state. It is because the anions (chloride – $Cl^-$ ) and cations (sodium -$Na^+$), remain in fact occupying fixed position in the crystal lattice due to strong electrostatic attractive forces among them. The ions, therefore are unable to move to any large extent when electric field is affected. Hence no current.

**Question 4.**
**Fill in the blanks:**

1. As we descend the electro chemical series containing cations, the tendency of the cations to get **reduced** at the cathode increases.

2. The **higher** the concentration of an ion in a solution, the greater is the probability of its being discharged at its appropriate electrode.

**Question 5.**
**State the term used for:**
A liquid or solution, which conducts electricity with accompanying chemical change.

**Answer:**
Electrolyte.

**Question 6.**
Electrons are getting added to an element Y. Which electrode will Y migrate to during electrolysis.

**Answer:**
Cathode.

**2006**

**Question 1.**
Select from the list: —Ammonia, Copper oxide, Copper sulphate, Hydrogen chloride, Hydrogen sulphide, Lead bromide.

1. A solution of this compound is used as the electrolyte when copper is purified.
2. When this compound is electrolysed in the molten state, lead is obtained at the cathode.

**Answer:**

1. Copper sulphate
2. Lead Bromide.

**Question 2.**
State what is observed when copper sulphate solution is electrolysed using a platinum anode.

**Answer:**
Blue colour of the solution disappears.

**Question 3.**
**An electrode 'A' is connected to the positive terminal of a battery and electrode 'B' to the negative terminal.**

1. Give the names of the electrodes A and B.
2. Which electrode is the oxidizing electrode.

**Answer:**

1. Anode, Cathode

2. Anode.

**Question 4.**
Write the equations at the cathode and anode when acidified water is electrolysed.

**Answer:**
**Reaction at Cathode –**
$4H^{1+} + 4e^{-} \rightarrow H \times 4$
$2H + 2H \rightarrow 2H_2$
**Reaction at Anode:**
$40H^{1-} + 4e^{-} \rightarrow OH \times 4$
$4OH \rightarrow 2H_2O + O_2$

**Question 5.**
A soln. of $AgNO_3$ is a good electrolyte but it is not used for electroplating an article with silver. Why.

**Answer:**
Migration of $Ag^{1+}$ ion from the complex salt solution silver cyanide is slow as compared to silver nitrate. That is why silver nitrate solution is not used.

**2007**

**Question 1.**
**From — A: non-electrolyte, B: strong electrolyte, C: weak electrolyte, D: metallic conductor — Match:**

1. Molten ionic compound
2. $CCl_4$
3. An aluminium wire
4. A soln. containing solvent molecules, solute molecules and ions formed by the dissociation of solute molecules.
5. A sugar soln. with sugar molecules and water molecules.

**Answer:**

**Description**

1. (B) Strong electrolyte.
2. (A) Non-electrolyte.
3. (D) Metallic conductor
4. (C) Weak electrolyte
5. (A) Non-electrolyte

**2008**

**Question 1.**
**During the electrolysis of molten lead bromide, which of the following takes place ?**

A. Bromine is released at the cathode
**B. Lead is deposited at the anode**
C. Bromine ions gain electrons
D. Lead is deposited at the cathode

**Question 2(1).**
Here is an electrode reaction:
$Cu \rightarrow Cu^{2+} + 2^{e}$. [i.e. $Cu - 2e^{-} \rightarrow Cu^{2+}$]
At which electrode (anode or cathode) would such a reaction take place ? Is this an example of oxidation or reduction ?

**Answer:**
$Cu \rightarrow Cu^{2+} + 2e^{-}$
This reaction takes place at anode.
This is an example of oxidation

**Question 2(2).**
A soln. contains $Mg^{2+}$ ions, $Fe^{2+}$ ions and $Cu^{2+}$ ions. On passing an electric current through this soln. which ions will be the first to be discharged at the cathode ? Write the equation for the cathode reaction/

**Answer:**
$Cu^{2+}$ (Copper ions will get discharged at cathode)

**2009**

**Question 1.**
**State which from A to E fits the description —'A pink metal is deposited at the cathode during the electrolysis of the soln. of this salt.**
(A) Sulphur
(B) Silver chloride
(C) Hydrogen chloride
**(D) Copper [II] sulphate**
(E) Graphite.

**Question 2.**
**Select the correct answer — The aqueous solution of the compounds which contains both ions and molecules is:**

(A) Sulphuric acid
(B) Hydrochloric acid
(C) Nitric acid
**(D) Acetic acid**

**Question 3.**
Correct the following statements conducts electricity.

**Answer:**
Molten lead bromide conducts electricity.

**Question 4.**
**A metal article is to be electroplated with silver. The electrolyte selected is sodium argentocyanide.**

1. What kind of salt is sodium argentocyanide.
2. Why is it preferred to silver nitrate as an electrolyte?
3. State one condition to ensure that the deposit is smooth, firm and long lasting.
4. Write the reaction taking place at the cathode.
5. Write the reaction taking place at the anode.

**Answer:**

1. It is a complex salt.
2. Silver nitrate is not used as an electrolyte since deposition of silver is rapid and the coating is not uniform. Hence sodium argentocyanide is used.
3. A direct current of smaller magnitude should be applied for a longer time.
   **Dissociation reaction:**

$$Na[Ag(CN)_2] \rightleftharpoons \underbrace{Na^+ + Ag^+}_{\text{cations}} + 2CN^-$$

$\longrightarrow$ cathode

   Both $Na^+$ and $Ag^+$ will migrate towards cathode but $Ag^+$ ions will be discharged.
4. Reaction at cathode

$$Ag^+ + 1e^- \longrightarrow \underset{\text{bonds}}{(C - Cl) \text{ covalent}}$$

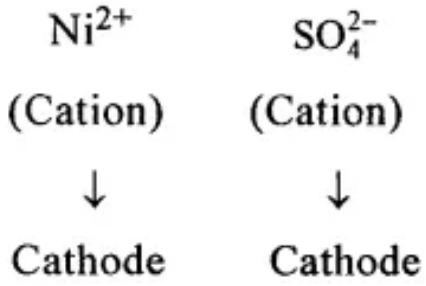
5. **Reaction at anode**
   The silver atoms from the anode lose electrons and other into the solution as silver ions

$$Ag - 1e^- \longrightarrow \underset{\substack{\text{(Silver ions} \\ \text{released in solution)}}}{Ag^+}$$

**Question 5.**
**Aqueous solution of Nickel sulphate contains $Ni^{2+}$ and $SO_4^{2+}$ ions**

1. Which ions moves towards the cathode ?
2. What is the product at the anode ?

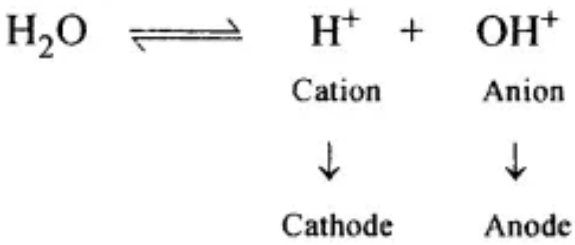
**Answer:**




1. Nickel ions moves towards the cathode
2. Reaction At anode: (with nickel electrodes)


Hence nickel dissolves from the anode by forming nickel ions.
**(if electrodes used of platinum).**

Then being an aqueous solution hydrolysis of water will also take place




**At Anode:** $4OH^- - 4e^- \rightarrow 4OH$
$4OH \rightarrow 2H_2O + O_2 \uparrow$
Hence oxygen gas will be released if electrodes used are of platinum.

**2010**

**Question 1.**
**Select the correct answer —** A compound which liberates reddish brown gas around the anode during electrolysis in its molten state is :
(A) Sodium chloride
(B) Copper (II) oxide
(C) Copper (II) sulphate
**(D) Lead (II) bromide**

**Question 2.**
**During electroplating of an article with nickel –**
**(1) Name**

1. The electrolyte
2. The cathode

**(2) Give the reaction of the electrolysis at**

1. The cathode .

2. The anode

**Answer:**

**(1)**
(a) Nickel sulphate
(b) Article
(c) Pure nickel plate / rod

**(2)**
(a) **At Cathode:** $Ni^{2+} + 2e^- \rightarrow Ni(s)$
(b) **At Anode:** $Ni(s) - 2e^- \rightarrow Ni^{2+}$

**Question 3.**
A, B and C are three electrolytic cells, connected in different circuits. Cell 'A' contains NaCl soln., and the bulb in the circuit glows brightly, when the circuit is completed. Cell 'B' contains acetic acid and the bulb glows dimly. Cell 'C' contains sugar soln., and the bulb not glow. Give reasons for each observation.

**Answer:**
Electrolytic cell A has completely ionised sodium chloride solution. Thus, the ions can easily migrate to oppositely charged poles and hence bulb glows brightly. To conclude sodium chloride solution is a strong electrolyte.
Electrolytic cell B has a weak electrolyte as only 5% of the acetic acid molecules ionise. Thus, a weak current flows through it and hence the bulb glows dimly.
Electrolytic cell C has a non-electrolyte. Sugar molecules do not ionise and hence no current flows through. Thus, the bulb does not glow.

**2011**

**Question 1.**
**Give reasons –** The electrolysis of acidulated water is considered to be an example of catalysis.

**Answer:**
The amount of acid in the water does not change. Furthermore, it does not take part in electrochemical reaction, but makes the water a good conductor of electricity.

**Question 2.**
**During electrolysis of $CuSO_4$ using platinum [cathode] and carbon [anode]:**

1. State what you observe at the cathode and anode.
2. State the change noticed in the electrolyte
3. Write the reactions at the cathode and anode.

**Answer:**

1. **Cathode:** Reddish brown deposition of copper occurs at cathode.
   **Anode:** Colourless gas is evolved at anode.
2. On prolonged electrolysis, the blue electrolyte turns colourless. .
3. **Cathode:** $Cu^{2+} + 2e^- \rightarrow Cu$
   **Anode:** $OH^-$— $le^- \rightarrow OH$
   $4OH \rightarrow 2H_2O + O_2 \uparrow$

**Question 3.**
Differentiate between electrical conductivity of – copper sulphate solution and of copper metal.

**Answer:**

| **Electrical conductivity of copper sulphate solutions** | **Electrical conductivity of copper metal** |
|---|---|
| 1. Flow of electricity takes place the molten or dissolved state. | 1. Flow of in electricity place in the solid state. |
| 2. Flow of electricity is due to the movement of ions. | 2. Flow of electricity is due to the movement of electrons. |
| 3. There is chemical decomposition of the copper sulphate sol. | 3. There is no chemical decomposition. |
| 4. The electrical conductivity increases with the increase in temperature. | 4. The electrical conductivity with increase in temperature, decreases |

**2012**

**Question 1.**
Rewrite the correct statement with the missing word/s: Cations migrate during electrolysis.
**Answer:**
Cation migrates to cathode during electrolysis.

**Question 2.**
**Identify the weak electrolyte from the following:**
(A) Sodium Chloride solution
(B) Dilute Hydrochloric acid
(C) Dilute Sulphuric acid
**(D) Aqueous acetic acid.**

**Question 3.**
**Match the following in column A with the correct answer from the choices given in column B.**

| Column A | Column B |
|---|---|
| 1. Ammonium hydroxide soln. | A: Contains only ions |
| 2. Dilute hydrochloric acid | B : Contains only molecules |
| 3. Carbon tetrachloride | C : Contains ions and molecules |

**Answer:**

| Column A | Column B |
|---|---|
| 1. Ammonium hydroxide soln. | C : Contains ions and molecules |
| 2. Dilute hydrochloric acid | A: Contains only ions |
| 3. Carbon tetrachloride | B : Contains only molecules |

**Question 4.**
**Give reasons:** An aqueous solution of sodium chloride conducts electricity.

**Answer:**
Aqueous solution of sodium chloride contains very large number of sodium ions ($Na^+$) and chloride ions ($Cl^-$ ). On the passage of electric current these ions migrate to the oppositely charged electric poles and the conduction of electricity takes place.

**Question 5.**
**Select the correct answer from the list in brackets:**

1. An aqueous electrolyte consists of the ions .mentioned in the list, the ion which could be
   discharged most readily during electrolysis. [$Fe^{2+}$, $Cu^{2+}$, $Pb^{2+}$, $H^+$].
2. The metallic electrode which does not take part in an electrolytic reaction. [Cu, Ag, Pt, Ni].
3. The ion which is discharged at the anode during the electrolysis of copper sulphate solutions using copper electrodes as anode and cathode. [$Cu^{2+}$, $OH^-$, $SO_4^{2-}$-, $H^+$].
4. When dilute sodium chloride is electrolysed using graphite electrodes, the cation is discharged at the cathode most readily. [$Na^+$, $OH^-$, $H^+$, $Cl^-$].
5. During silver plating of an article using potassium argentocyanide as an electrolyte, the anode material should be [Cu, Ag, Pt, Fe].

**Answer:**
(1) $Cu^{2+}$ (2) Pt (3) $Cu^{2+}$ (4) $H^{1+}$ (5) Ag

**2013**

**Question 1.**
State one appropriate observation for : Electricity is passed through molten lead bromide.

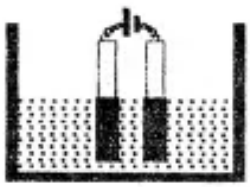
**Answer:**
The molten lead bromide breaks into lead metal which discharges at cathode and bromine gas which discharged at anode.

**Question 2.**
State which of these will act as non-electrolyte ?

**(A) Liquid carbon tetrachloride**
(B) Acetic acid
(C) Sodium hydroxide aqueous solution acid.
(D) Potassium chloride aqu. solution.

**Answer:**
(A) Liquid carbon tetrachloride is non-electrolyte

**Question 3.**
**Copper sulphate soln. is electrolysed using copper electrodes as seen in diagram**



1. Which electrode to your left or right is known as the oxidising electrode and why?
   **Ans.** The electrode on left hand side donates electrons and hence is oxidising electrode.
2. Write the equation representing the reaction that occurs.
   **Ans.** $Cu - 2e^{-} \rightarrow Cu^{2+}$
3. State two appropriate observations for the above electrolysis reaction.
   **Ans.** The size of anode gradually decreases and that of cathode gradually increases. However, there is no change in the colour of copper sulphate solution.
4. Name: A gas which in the liquid state does not conduct electricity but conducts when dissolved in water.
   **Ans.** Hydrogen chloride gas.

**2014**

**Question 1.**
**The observation seen when fused lead bromide is electrolysed is:**
A: a silver grey deposit at anode and a reddish brown deposit at cathode.
B: a silver grey deposit at cathode and a reddish brown deposit at anode.
**C: a silver grey deposit at cathode and reddish brown fumes at anode.**
D: silver grey fumes at anode and reddish brown fumes at cathode

**Question 2.**
**During electroplating an article with silver, the electrolyte used is:**
A: silver ifitrate solution

B: silver cyanide solution
**C: sodium argentocyanide solution**
D: nickel sulphate solution

**Question 3.**
**Give one word or phrase for:** Electrolytic deposition of a superior metal on a baser metal.

**Answer:**
Electrolytic deposition of a superior metal on a baser metal→ Electroplating.

**Question 4.**
**State your observation:**
At the cathode when acidified aq. $CuSO_4$ spin. is electrolyzed with copper electrodes.

**Answer:**
Pure copper will deposit at cathode.

**Question 5.**
State which electrode: anode or cathode is the oxidising electrode. Give a reason for the same.

**Answer:**
Anode is the oxidising electrode.

**Question 6.**
**Name the kind of particles present in:**

1. Sodium Hydroxide soln.
2. Carbonic acid.
3. Sugar sol.n.

**Answer:**

1. **Particles present in sodium hydroxide a strong alkali solution:** Sodium ($Na^+$) ions and hydroxide ($OH^-$) ions.
2. **Particles present in carbonic acid (a weak acid) solution:** Ions ($H^+$, $HCO_3^-$, $CO_3^{2-}$) and molecules ($H_2CO_3$)
3. **Particles present in sugar (a non-electrolyte) solution:** Molecules of sugar ($C_{12}H_{22}O_{11}$)

**Question 7.**
$M_2O$ is the oxide of a metal 'M' which is the above hydrogen in the activity series. $M_2O$ when dissolved in water forms the corresponding hydroxide which-is a good conductor of electricity.

1. State the reaction taking place at the cathode.
2. Name the product at the anode.

**Answer:**

1. Reaction of cathode: $M^+ + e \rightarrow M$
2. Product at anode: $O^2 + O^{2-} \rightarrow O_2$ (Oxygen)

**2015**

**Question 1.**
State one observation for. 'At the Anode when aqueous copper sulphate solution is electrolysed using copper electrodes'.

**Answer:**
Blue $Cu^{2+}$ ions formed.

**Question 2.**
**Give scientific reasons:**

1. During electrolysis of molten lead bromide graphite anode is preferred to other electrodes.
2. Electrical conductivity of acetic acid is less in comparison to the of dil. $H_2SO_4$ – at a given concentration
3. Electrolysis is of molten lead bromide is considered to be a redox reaction.

**Answer:**

1. During the electrolysis of molten lead bromide, a graphite anode is preferred because graphite remains unaffected by the reactive bromine vapours which are released at the anode.
2. Sulphuric acid is a strong acid compared to acetic acid. A strong acid has more ions than a weak one, and so, its solution will be a better electrical conductor than a weak acid. So, electrical conductivity of acetic acid is less in comparison of electric conductivity of sulphuric acid.
3. In the electrolysis of molten lead bromide, the following reactions take place:

   **At the cathode:** $Pb^{2+}$ (l) + $2e^-$ → Pb(l)

   **At the anode:** 2Br (l) → $Br_2$ (g) + $2e^-$

   Lead (II) ions ($Pb^{2+}$) are attracted to the negative electrode, and the $Pb^{2+}$ ions are forced to accept two electrons. $Pb^{2+}$ ions are reduced.

   Bromide ions ($Br^-$ ) are attracted to the positive electrode and the bromide ions are forced to give away their extra electron to form bromine atoms. Thus, bromide ions are oxidised. So, electrolysis of molten lead bromide is a redox reaction.

**Question 3.**
**Differentiate between the terms strong electrolyte and weak electrolyte, (stating any two differences)**
**Answer:**

| | |
|---|---|
| | |

| Strong Electrolytes | Weak Electrolytes |
|---|---|
| (1) Electrolytes which allow a large amount of electricity to flow through them.<br><br>(2) The solution of a strong electrolyte contains only free mobile ions. | (1) Electrolytes which allow a small amount of electricity to flow through them.<br><br>(2) The solution of a weak electrolyte contains ions and molecules. |

**Question 4.**
**During purification of copper – State:**

1. The anode used
2. The electrolyte used.

Write the equation taking place at the anode in the above.

**Answer:**
(1)

| | Anode | Electrolyte |
|---|---|---|
| Purification of copper | Impure copper | Solution of copper sulphate and dilute sulphuric acid |

(2) **Equation at the anode:**
$Cu - 2e^- \rightarrow Cu^{2+}$ (Anode)

**2016**

**Question 1.**
**The particles present in strong electrolytes are:**
**Select the correct answer from A, B, C and D:**
A: only molecules
**B: mainly ions**
C: ions and molecules
D: only atoms

**Question 2.**
**Write equations for the reactions taking place at the two electrodes during the electrolysis of:**

1. Acidified $CuSO_4$ with copper electrodes.
2. Molten $PbBr_2$ with inert electrodes. (mention clearly the name of the electrode in each case)

**Answer:**

**(1) Dissociation reaction:**

$$CuSO_4 \rightleftharpoons Cu^{2+} + SO_4^{2-}$$

$$H_2O \rightleftharpoons H^+ + OH^-$$

$$H_2SO_4 \rightleftharpoons 2H^+ + SO_4^{2-}$$

Cations Anions

**At cathode** (negative terminal of battery)

$$Cu^{2+} + 2e^- \rightarrow Cu(s)$$

copper metal gets deposited

At anode (positive terminal of battery)

**$Cu \rightarrow Cu^{2+} + 2e^-$**

**(2) Dissociation reaction:**

$$PbBr_2\,(m) \rightleftharpoons Pb^{2+} + 2Br^-$$

Cation Anion

↓ ↓

Cathode Anode

**At cathode** (negative terminal of battery)

$Pb^{2+} + 2e^- \rightarrow Pb$

Lead metal is obtained in molten state At anode (positive terminal of battery)

$Br - e^- \rightarrow Br$

$Br + Br \rightarrow Br_2$

Reddish brown vapours of bromine are formed

**Question 3.**
**Name:**

1. the product formed at the anode – during electrolysis of acidified water using platinum electrodes.
2. the metallic ions that should be present – in the electrolyte when an article made of copper is to be electroplated with silver.

**Answer:**

1. Oxygen
2. Silver ions

**Question 4.**
**Give reasons why:**

1. Sodium Chloride will conduct electricity only in fused or aq. soln. state.
2. In the electroplating of an article with silver, the electrolyte sodium argentocyanide soln. is preferred over silver nitrate solution.

3. Although copper is a good conductor of electricity,it is a non-electrolyte. `

**Answer:**

1. Sodium chloride is a solid, ionic compound, it has strong electrostatic forces of attraction. Only in the fused or aqueous solution, it forms ions which are capable of conducting electricity.
2. It is preferred over silver nitrate because the dissociation of $AgN0_3$ will be very fast and deposit will not be smooth and uniform.
3. Because it does not form ions.

**2017**

**Question 1.**
**Identify the substance underlined, in each of the following-**

1. The elctrolvte used for electroplating an article with silver.
2. The particles present in a liquid such as kerosene, that is a non-electrolyte.

**Answer:**

1. Sodium argentocyanide or Potassium argentocyanide solution.
2. Molecules

**Question 2.**
**State the observations at the anode & at the cathode during the electrolysis of –**

1. Fused lead bromide using graphite electrodes.
2. Copper sulphate solution using copper electrodes.

**Answer:**

1. At cathode silvery droplets of molten lead appear.
   At anode reddish vapours of bromine are given out.
2. Brown metal copper is deposited at cathode.
   $Cu^{2+}$ ion is liberated at anode.
   Colour of $CuSO_4$ solution (blue colour) does not fade.

**Question 3.**
**Select the ion in each case, that would get selectively discharged from the aqueous mixture of the ions listed below:**
(1) $S0_4^{2-}$, $NO^-_3$ and $OH^-$ ;
(2) $Pb^{2-}$, $Ag^+$ and $Cu^{2+}$.

**Answer:**

1. OH ion will get discharged in preference to $SO_4^{2-}$ or $NO_3^-$ ions.
2. $Ag^+$ ions will get discharged in preference to $Pb^{2+}$ or $Cu^{2+}$ ions.

**ADDITIONAL QUESTIONS**

**Question 1.**
**Define:**

1. Electrolysis
2. Electrodes
3. Ions
4. Electrolytic dissociation.

**Answer:**

**(1) Electrolysis:** "The process of decomposition of a chemical compound in aqueous solution or in molten state accompanied by chemical change."
**(2) Electrodes:** Electrodes allow the electric current to enter or leave the electrolyte solution.
**(3) Ions:** They are atoms which carry a positive or negative charge and become free and mobile when an electric current is passed through an aqueous solution of a chemical compound.
**(4) Electrolytic dissociation:** The process due to which an ionic compound in the fused or in aqueous solution dissociates into ions by passage of electric current through it is called electrolytic dissociation.

**Question 2.**
**Differentiate between**

1. Electrolytes and Non-electrolytes
2. Strong and Weak electrolytes
3. Anode and Cathode
4. Electrolytic dissociation and Ionisation with suitable examples.

**Answer:**

**Question 2(1).**
**Electrolytes and Non-electrolytes**

**Electrolytes:**

Chemical compound – which conduct electricity in the fused or in aq. solution state and -undergo chemical decomposition due to the flow of current through it.
**Electrolytes –** are ionic compounds
**Particles in Electrolytes** – ions only or Ions and molecules only
**Examples:**
Acids – dil. HCl, $HNO_2$ $H_2SO_4$ Alkalis – KOH, NaOH solutions Ionic salts – $PbBr_2$ [molten],
$CuSO_4$ [aq.]

**Non-electrolytes:**

Chemical compound – which do not conduct electricity in the fused or aq. soln. state and – do not undergo chemical decomposition due to the flow of current through it.
**Non-electrolytes –** are covalent compounds
**Particles in non-electrolytes –** Molecules only
**Example:**
Pure or distilled water, Alcohol, Kerosene, Carbon disulphide, carbon tetrachloride, sucrose, glucose, sugar solution.

**Question 2(2).**
**Strong and Weak electrolytes:**

Strong electrolytes:

1. The compounds which in their aqueous solution or in fused state are almost completely ionised are called strong electrolytes.
2. They allow a large amount of electricity to flow through them and hence are good conductors of electricity.
3. In aqueous solution or molten state, only ions are present.
   **Examples:**
   **Strong acids:** HCl, $H_2SO_4$,$HNO_3$
   **Strong bases:** NaOH, KOH
   **Salts:** NaCl, $NaNO_3$, $K_2S0_4$

**Weak electrolytes:**

1. The compound which in their aqueous solution or in fused state are partially ionised are called weak electrolytes.
2. They allow small amount of electricity to flow through them and hence are poor conductors of electricity.The compound which in their aqueous solution or in fused state are partially ionised are called weak electrolytes.
   In aqueous solution or molten state ions as well as unionised molecules are present.
   **Examples:**
   **Weak acids:** $CH_3COOH$, $H_2CO_3$
   **Weak bases:** $NH_4OH$, $Ca(OH)_2$
   **Salts:** $CH_3COONH_4$

**Question 2(3).**
**Anode and Cathode:**

**Anode:**

1. It is the electrode connected to the positive terminal of the battery
2. Anions migrate to anode.
3. The anions donate excess electrons to the anode and they are oxidised to neutral atoms.

**Cathode:**

1. It is the electrode connected to the negative terminal of the battery.
2. Cations migrate to cathode.
3. The cations gain excess electrons from the cathode and they are reduced to neutral atoms.

**Question 2(4).**
**Electrolytic dissociation and ionisation with suitable examples.**

**Dissociation:**

1. Separation of ions which are already present in an ionic compounds.
2. Electrovalent compounds show dissociation e.g. potassium chloride, lead bromide.
   $KCl \rightarrow K^+ + Cl^-$

**Ionisation**

1. Formation of positively or negatively charged ions from molecules which are not intially in the ionic state.
2. Polar covalent compounds show ionisation.
   e.g. HCl, $H_4CO_3$ , $NH_4OH$
   $HCl \xrightarrow{H_2O} H^+ + Cl^-.$

**Question 3.**
**Compare the flow of electricity through a nickel wire and nickel sulphate solution.**

**Answer:**
**Flow of electricity through nickel wire**

1. It is due to the flow of electrons.
2. It is a physical change.
3. It can take place in solid state.
4. Electrical conductivity is more.

**low of electricity through nickel sulphate solution**

1. It is due to the flow of ions.
2. It is a chemical change.
3. It cannot take place in solid state.
4. Electrical conductivity is less.

**Question 4.**
Name three organic compounds and one neutral liquid which are non-electrolytes.

**Answer:**
**Organic compounds which are non-electrolyte:**
Sugar, glucose, naphthalene

**Neutral liquid which are non-electrolytes:**
Carbon tetrachloride, carbon disulphide

**Question 5.**
State which of the following solutions are weak electrolytes – dil. HCI ; carbonic acid ; $NH_4OH$ ; dil. $H_2SO_4$ ; $AgNO_3$ ; $Na_2CO_3$ ; $PbBr_2$ ; KOH ; HI ; oxalic acid, $NaHCO_3$ ; sodium acetate ; $Na_2SO_4$ ; NaOH.

**Answer:**
**Weak Electrolytes:** Carbonic acid, $NH_4OH$, $Na_2CO_3$ oxalic acid.

**Question 6.**
State which of the following solutions contain (1) molecules only (2) ions only (3) both molecules and ions – $CS_2$ ; $CH_3COOH$ ; $NH_4OH$ ; NaOH ; dil. $HNO_3$ ; $Na_2CO_3$ ; $CuCl_2$ ; oxalic acid ; pure $H_2O$,
kerosene ; HI.

**Answer:**

| Molecules | Ions | Both molecules and ions |
|---|---|---|
| Pure water | NaOH | $CH_3COOH$ |
| Kerosene | dil $HNO_3$ | Oxalic acid, $NH_4OH$ |
| $CS_2$ | $CuCl_2$, HI, $Na_2CO_3$ | |

**Question 7.**
**State giving reasons, in which state or medium does**
(1) NaCl, (2) HCI gas (3) $NH_3$ gas conduct electricity.

**Answer:**

1. NaCl will conduct electricity only molten state or when dissolved in water. This is because the $Na^+$ and $Cl^-$ ions present in solid NaCl are too big to move under the influence of applied electric field.
2. HCI gas is a polar covalent compound when dissolved in water, it will ionise to give $H^+$ and CP ions. Under the influence of applied electric field these ions can easily move in an aqueous solution and thus conduct electricity. Thus HCI (g) when dissolved in water conducts electricity.
3. $NH_3(g)$ will dissolved in water to give $NH_4OH$.
   $NH_3(g) + H_2O\ (l) \rightarrow NH_4OH\ (aq)$
   $$NH_4OH\ (aq) \rightleftharpoons NH_4^+\ (aq) + OH^-\ (aq)$$
   $NH_4OH$ will ionise to give $NH_4^+$ and $OH^-$ ions. Under the influence of applied electric field these ions can migrate in an aqueous solution and hence conduct electricity. Thus $NH_3$ (g) when dissolved in water conduct electricity.

**Question 8.**
State on what basis are acids, bases and salts classified as strong and weak electrolytes.

**Answer:**
**Strong electrolytes –** Compound which in the fused or in the aqueous solution state are almost completely dissociated and are good conductors of electricity are called.

**Weak Electrolytes –** Compound which in the fused or in the aqueous solution state are feebly or partially dissociated and are poor conductors of electricity are called – weak electrolytes.

**Question 9.**
**Explain the terms**

1. metal activity or electro chemical series
2. selective discharge of ions.

**Answer:**

1. Depending on the ease with the metals lose their electrons and form ions – they are arranged in a series known as – metal activity series or electro chemical series.
   The arrangement is so done that the elements that – ionize most readily [discharged with great difficulty]- are placed at the top of the series and other elements in the descending order.
2. **Selective discharge of ions:** The preferential discharge of ions present in an electrolyte at the respective electrodes is known as selective discharge of ions.

**It depends upon the following factors:**

- **Relative position of the ion in the electo chemical series:** Lower the position of the ion in the series, easier to discharge.
- **Concentration of the ion:** More the concentration of the ion, easier to discharge.
- **Nature of the electrode:** Inert electrodes (graphite, platinum) do not take part in the electrolytic reaction.
  Active electrodes (Cu electrodes for electrolysis of aq. $CuSO_4$, Ag electrodes for electrolysis of aq. $AgNO_3$ etc.) take part in electrolytic reactions.

**Question 10.**
**From the ions –**

1. $SO_4^{2-}$ and $OH^{1-}$
2. $Cu^{2+}$ and $H^{1+}$
3. $Ag^{1+}$ and $H^{1+}$ state giving reasons which ion is discharged at the respective electrode in each case.

**Answer:**

1. Out of $SO_4^{2-}$ and $OH^-$ ions, $OH^-$ ions will be discharged at anode forming $O_2$ gas.
2. Out of $Cu^{2+}$ and $H^+$, $Cu^{2+}$ ions will be discharged because Cu is lower in the electro chemical series than H.
3. Out of $Ag^+$ and $H^+$, $Ag^+$ will be discharged because Ag is lower in the electro chemical
series than H.

**Question 11.**
With reference to nature of electrodes — name three inert and three active electrodes.

**Answer:**
**Inert electrodes**

- Platinum
- Iron
- Graphite

**Active electrodes**

- Copper
- Nickel
- Silver

**Question 12.**
**State the reason for difference in product formed at the anode during electrolysis of aq. $CuSO_4$ using**

1. active electrode – copper anode
2. inert electrode – platinum anode.

**Answer:**

1. **Electrolysis of aq. $CuS0_4$ using copper anode:**
   As copper can easily lose electron, copper from anode will dissolve as $Cu^{2+}$ ions.
   $Cu\ (s) - 2e^- \rightarrow Cu^{2+}\ (aq)$
2. **Electrolysis of aq. $CuS0_4$ using inert platinum anode:** Due to very low tendency of platinum to lose electron platinum anode does not take part in electrolytic reaction. Further tendency of $SO_4^{2-}$ to lose electron is much less than that of $OH^-$(from feebly ionised water). Thus $OH^-$ ions get oxidised in preference to $SO_4^{2-}$ ions to give $O_2$
   $4OH - 4e \rightarrow 4OH$
   $40H \rightarrow 2H_2O + O_{2\uparrow}$

**Question 13.**
**Give the electrode reactions for formation of**

1. Lead metal and bromine vapours from molten $PbBr_2$ using inert electrodes
2. $H_2$ and $O_2$ gas (2:1) from acidified water using inert Pt electrodes.

**Answer:**

1. Electrolysis of molten $PbBr_2$ using inert electrodes.

   $$PbBr_2\ (l) \rightleftharpoons Pb^{2+}\ (l) + 2Br^-\ (l)$$

   **At cathode:** $Pb^{2+}$ (l) + $2e^-$ →Pb (s)
   **At anode:** $2Br^-$ (l) – $2e^-$→ 2Br
   Br + Br→ $Br_2$ (g)
2. Electrolysis of acidified water using Pt electrodes.
   **At cathode:**

   $$4H_2O\ (l) \rightleftharpoons 4H^+\ (aq) + 4OH^-\ (aq)$$

   $4H^+$ (aq) + $4e^-$ → 4H
   2H + $2H^-$→ $2H_2$
   **At anode:**
   $4OH^+$ (aq) – $4e^-$ → 4OH
   4OH→ $2H_2O$ (l) + $O_2$ (g)

**Question 14.**
Starting from aq. copper (II) sulphate solution, give equations for the reactions at the cathode and anode during electrolysis of aq. $CuSO_4$ using active copper electrodes.

**Answer:**
**Electrode reaction:**

$$CuSO_4 \rightleftharpoons Cu^{2+} + SO_4^{2-}$$
$$H_2O \rightleftharpoons H^{2+} + OH^{1-}$$

**Reaction at Cathode:** $Cu^{2+}$ + $2e^-$ → Cu
$Cu^{2+}$ and $H^{1+}$ ions migrate to the cathode.
**Reaction at anode:** Cu – $2e^-$ → $Cu^{2+}$
$S0_4^{2-}$ and $OH^{1-}$ ions migrate to anode but not discharged.

**Question 15.**
**Give reasons for the following changes –**

(1) pure water a non-electrolyte – becomes an electrolyte on addition of dil. $H_2SO_4$
(2) Blue colour of aq. $CuSO_4$ – turns almost colourless on its electrolysis using Pt electrodes.

**Answer:**

1. Pure water is a non electrolyte. It consists of entirely of molecules. It can be electrically decomposed by Addition of traces of dil. Sulphuric acid. Which dissociates into $H^{1+}$ and sulphate ($S0_4^{2-}$) ions.
2. If platinum anode is used the blue colour of $CuS0_4$ solution fades since the blue $Cu^{2+}$ ions which are discharged at the cathode are not replaced or added at the anode.

**Question 16.**
**'Iron is electroplated with silver' –**

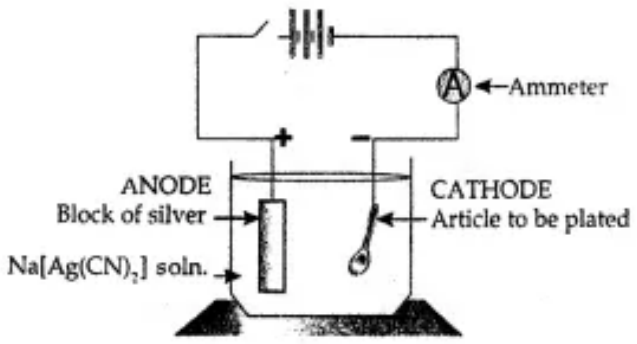
1. define the term in italics
2. state two reasons for electroplating
3. state why the iron is not placed at the anode and silver at the cathode during electroplating.

**Answer:**

1. **Electroplating:** The electrolytic process of deposition of a superior metal on the surface of a baser metal or article is called electroplating.
2. **Reasons for electroplating:**
   - Prevents corrosion or rusting.
   - Makes the article attractive and gives it an expensive appearance.
3. The article to be electroplated is always placed at the cathode because during electrolytic reaction the metal is always deposited at the cathode by gain of electrons.

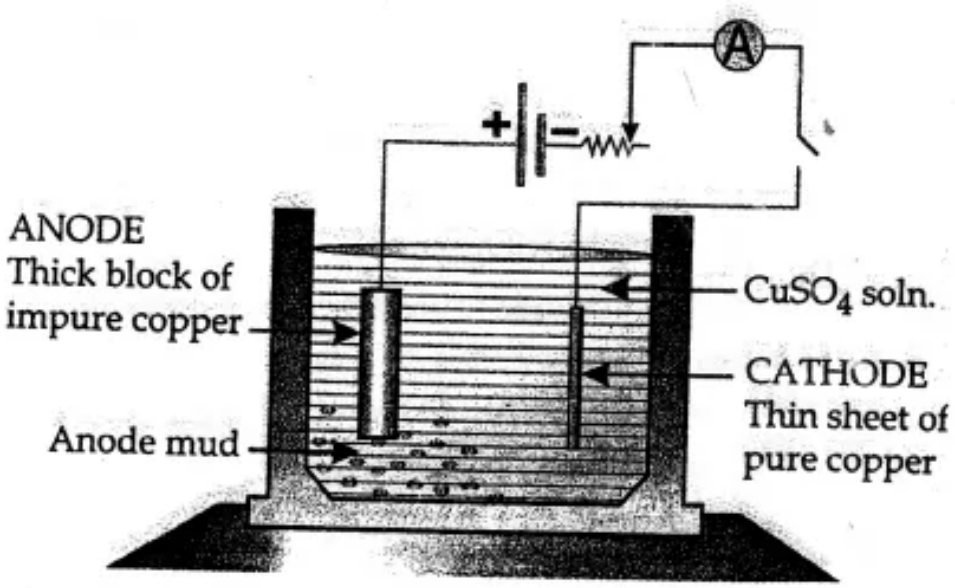
**Question 17.**
**Draw a diagram for –**
(1) electroplating an article with silver;
(2) electrorefining or purification of copper.

**Answer:**
**(1)**



Electroplating of an article with silver

**(2)**




**Question 18.**
**State the**

1. electrolyte
2. cathode used
3. anode used
4. electrode reaction at cathode
5. electrode reaction at anode
6. product at cathode and anode – during
   (a) electroplating an article with nickel
   (b) electroplating a spoon with silver
   (c) purification of impure copper.

**Answer:**

| Article | Electrolyte | Anode used | Cathode used |
|---|---|---|---|
| (a) Electroplating an article with Nickel. | $NiSO_4$ | Nickel metal | Article to be plated |
| (b) Electroplating spoon with silver. | $Na\ [Ag(CN)_2]$ | Silver metal | Spoon |
| (c) Purification of impure copper. | Aq. $CuSO_4$ | Impure Cu | Pure copper |

**Electrolytic reaction at cathode**

(a) $Ni^{2+} + 2e^- \longrightarrow Ni$ (deposited)

(b) $Ag^{1+} + 1e^- \longrightarrow Ag$ (deposited)

(c) $Cu^{2+} + 2e^- \longrightarrow Cu$ (deposited)

**Electrode reaction at anode**

(a) $Ni - 2e^- \longrightarrow Ni^{2+}$ (cation)

(b) $Ag - 1e^- \longrightarrow Ag^{1+}$ (cation)

(c) $Cu + 2e^- \longrightarrow Cu^{2+}$ (cation)

**Products at cathode**

(a) Ni (ions)
(b) Silver
(c) Copper

**Products at anode**

(a) $SO_4^{2-}$ and $OH^{1-}$-(ions)

(b) $CN^-$ and $OH^{1-}$ (ions)

(c) $SO_4^{2-}$ and $OH^{1-}$ (ions)

**Question 19.**

**Give a reason why metals –**
copper, silver and lead are electrorefined but K, Na and Ca are not.

**Answer:**
Extraction of K, Na and Ca are done by electrolysis and are extracted in their fused state. Their oxides are highly stable and the metal has a strong affinity for oxygen. They do not decompose on thermal decomposition. .

**Question 20.**
Explain the term 'electrometallurgy'. At what electrode is the extracted metal always deposited ?

**Answer:**
**Electrometallurgy –** is the process of extraction of metals by electrolysis. Metals comparatively higher in the electrochemical series are extracted by

electrolysis. During this process, the extracted metal is always deposited on cathode.

**Question 21.**
State how activity series of metals plays a role in extraction of metals from oxides.

**Answer:**
In activity series, metals are placed in decreasing order of reactivity with most reactive metal at the top and least reactive metal at the bottom. Depending upon the reactivity of metals, different methods are used for their extraction from respective ores.
**For example:**

1. **Extraction by electrolysis:** Metals at the top of the activity series are extracted from their ores by electrolysis. Being highly reactive, they cannot be reduced by common reducing agent (C, CO, $H_2$) **For example:** K, Na, Ca, Mg,Al.
2. Extraction by common reducing agents: Metals at the middle of the activity series, being less reactive, can be extracted from their ores by reduction with common reducing agents like C, CO, $H_2$
   **For example:** Zn, Fe, Pb, Cu.
3. **Extraction by thermal decomposition:** Metals near the bottom of the activity series, due to their very low reactivity, can be extracted from their ores, by heating only.
   **For example:** Hg, Ag.
4. Metal at the bottom of the activity series exist in native state (Au, Pt).
5. State the electrode reaction at the respective electrodes during extraction of Al from $Al_2 O_3$.

**Question 22.**
**State the electrode reaction at the respective electrodes during extraction of Al from $Al_2 O_3$.**

**Answer:**
**At cathod:** $2Al^{3+} + 6e^- \rightarrow 2Al$
**At anode:** $3O^{2-} - 6e^- \rightarrow 3|0|$
$3|0|+3|0| \rightarrow 3O_2$

**UNIT TEST PAPER 5 – ELECTROLYSIS**

**Question 1.**

**Match the statements 1 to 5 with their answers selected from A to J.**
A: Cathode, B: Sucrose soln., C: Cl", D : Formic acid, E: Electro metallurgy, F: Ammonia, G: $Mg^{2+}$, H: Electro refining, I: Sulphur dioxide, J: Anode.

1. A compound containing molecules only.
   **Ans.** Sucrose soln.

1. A compound which ionizes in soln. state but not in gaseous state.
   **Ans.** Ammonia

1. The ion which accepts electrons from the cathode and gets reduced to neutral atoms.
   **Ans.** $Mg^{2+}$

1. The electrode to which the cyanide ions of aq. $Na[(Ag(CN)_2]$ migrate during electrolysis.
   **Ans.** Anode

1. An application of electrolysis in which the anode does not generally diminish in size.
   **Ans.** Electro metallurgy.

**Question 2.**
**Complete the table given below**:

| | Nature of anode | Nature of Cathode | Ions present in electrolyte | Ions discharged at | |
|---|---|---|---|---|---|
| | | | | Cathode | Anode |
| 1. Electroplating an iron rod with silver | | | | | |
| 2. Electroplating a copper sheet with nickel | | | | | |
| 3. Electrorefining of silver | | | | | |
| 4. Extraction of potassium from KCl | | | | | |
| 5. Extraction of aluminium from $Al_2O_3$ | | | | | |

**Answer:**

| | Nature of anode | Nature of Cathode | Ions present in electrolyte | Ions discharged at | |
|---|---|---|---|---|---|
| | | | | Cathode | Anode |
| 1. Electroplating an iron rod with silver | Silver | Iron rod | $Na^+$, $CN^-$, $Ag^+$ | $Ag^+$ | Nil |
| 2. Electroplating a copper sheet with nickel | Nickel | Copper sheet | $Ni^{2+}$, $SO_4^{2-}$ | $Ni^{2+}$ | Nil |
| 3. Electrorefining of silver | Impure silver | Pure silver | $Ag^+$, $NO_3^-$ | $Ag^+$ | Nil |
| 4. Extraction of potassium from KCl | Graphite | Iron | $K^+$, $Cl^-$ | $K^+$ | $Cl^-$ |
| 5. Extraction of aluminium from $Al_2O_3$ | Graphite | Graphite | $Al^{3+}$ $O^{2-}$ | $Al^{3+}$ | $O^{2-}$ |

**Question 3.**
**Select the correct word from the words in bracket to complete the sentence:**

1. The electrode at which anions donate excess electrons and are oxidized to neutral atoms is the…….. (anode / cathode).
   **Ans.** Anode

1. On electrolysis, $Ag^{1+}$ and $H^{1+}$ ions migrate to the……..(cathode / anode) and…… ($Ag^{1+}$ / $H^{,+}$) are discharged.
   **Ans.** Cathode ; $Ag^{I+}$

1. Electrolysis is a / an……. (oxidation / reduction / redox) reaction in which reduction reaction takes place at the……. (cathode / anode)
   **Ans.** redox, cathode

1. According to Arrhenius's theory the amount of electricity conducted by the electrolyte depends on the …… (nature / concentration) of the ions in solution.
   **Ans.** Concentration

1. Salts ionize in aq. soln. on passage of electric current to give…….. (negative / positive) ions other than $H^+$ ions.
   **Ans.** positive.

**Question 4.**
**Give balanced equations for the electrode reactions involved in the**

**following conversions at the respective electrodes:**

1. Aluminium oxide → Oxygen gas ← Copper (II) sulphate
2. Copper metal → Copper ions → Copper metal
3. Lead (II) chloride → Chlorine gas ← Hydrochloric acid
4. Hydroxyl ions ← Acidified water → Oxygen gas
5. Potassium bromide → Bromine gas ← Lead bromide

**Answer:**

1. **Electrolysis of molten $Al_20_3$:**
   $20^{2-} - 4e^- \rightarrow 2\ [O]$
   $[O] + [O] \rightarrow O_2\ (g)$ **(At Anode)**
   **Electrolysis of copper (II) sulphate**
   $4OH^-\ (aq) + 4e^- \rightarrow 4\ [OH]$
   $4\ [OH] \rightarrow 2H_2O\ (l) + O_2\ (g)$ **(At Anode)**
2. $Cu\ (s) - 2e^- \rightarrow Cu^{2+}\ (aq)$ **(At Anode)**
   $Cu^{2+}\ (aq) + 2e^- \rightarrow Cu\ (s)$ **(At Cathod)**
3. **Electrolysis of molten $PbCl_2$**
   $2Cl^-\ (l) - 2e^- \rightarrow 2\ [Cl]$
   $2\ [Cl] \rightarrow Cl_2(g)$ **(At Anode)**
   **Electrolysis of HCl (aq)**
   $2Cl^-\ (aq) - 2e \rightarrow 2\ [Cl]$
   $2\ [Cl] \rightarrow Cl_2\ (g)$
4. **Electrolysis of acidified water**
   $H_2O\ (l) \rightleftharpoons H^+\ (aq) + OH^-\ (aq)$
   $4OH^- - 4e^- \rightarrow 4\ [OH]$
   $4\ [OH] \rightarrow 2H_20\ (l) + O_2\ (g)$ **(At Anode)**
5. **Electrolysis of molten KBr**
   $KBr\ (l) \rightleftharpoons K^+\ (l) + Br^-\ (l)$
   $2Br\ (l) - 2e^- \rightarrow 2\ [Br]$
   $2[Br] \rightarrow Br_2\ (g)$ **(At Anode)**
   **Electrolysis of molten $PbBr_2$**
   $PbBr_2\ (l) \rightleftharpoons Pb^{2+}\ (l) + 2Br^-\ (l)$
   $2Br^-\ (l) - 2e \rightarrow 2\ [Br]$
   $2\ [Br]\ )\ Br_2\ (g)$ **(At anode)**

**Question 5.**
**Select the correct answer from the list in bracket:**

1. The cation discharged at the cathode most readily.[$Fe^{2+}$, $Cu^{2+}$, $Pb^{2+}$, $H^{1+}$]
   **Ans.** $Cu^{2+}$
2. The anion discharged at the anode with most difficulty.[$SO^{2-}_4$, $Br^{1-}$, $N0_3$`-, $OH^1$]
   **Ans.** $OH^1$
3. The metallic electrode which does not take part in an electrolytic reaction. [Cu, Ag, Fe, Ni]
   **Ans.** Fe
4. The ion/s which is / are discharged during electrolysis of aq. $CuSO_4$ using Cu electrode.
   [$Cu^{2+}$, $S0_4^{2-}$, $H^{1+}$, $OH^{1-}$]
   **Ans.** $Cu^{2+}$
5. A covalent compound which in aqueous state conducts electricity. [$CCl_4$, $CS_2$, $NH_3$, $C_2H_4$]
   **Ans.** $NH_3$

**Question 6.**
**Give reasons for the following:**

**Question 1.**
Electrolysis of molten lead bromide is considered a redox reaction.

**Answer:**
**Electrolysis of molten $PbBr_2$ takes place as follows:**

$$PbBr_2 \rightleftharpoons Pb^{2+} + 2Br^-$$

$Pb^{2+}$ + 2e → Pb (at cathode)

$$2Br^- - 2e^- \xrightarrow{\text{Reduction}} 2\,[Br] \text{ (at anode)}$$

2 [Br]→ $Br_2$ ↑
Thus reduction takes place at cathode while oxidation takes place at anode. Therefore, electrolysis of molten $PbBr_2$ is a redox reaction.

**Question 2.**
Lead bromide undergoes electrolytic dissociation in the molten state but is a non-electrolyte in the solid state.

**Answer:**
The ions present in $PbBr_2$ in solid state are held by strong electrostatic forces of attraction and hence cannot move under the influence of applied electric field.

**OR**

In solid state only tiny electrons can move under the influence of applied electric field (e.g., in metals). Ions are too big to move in solid state.

**Question 3.**
The blue colour of aq. copper sulphate does not change when it is electrolysed using copper electrodes.

**Answer:**
For every copper ion ($Cu^{2+}$) discharged at the cathode as neutral copper atom (Cu), a copper ion ($Cu^{2+}$) is released or added to the solution at the anode and hence the total number of $Cu^{2+}$ ions remains the same. Therefore the blue colour of CuSO does not fade in electrolytic reaction.

**Question 4.**
During electrolytic dissociation of sodium chloride, the sodium ions are discharged at the cathode.

**Answer:**
Sodium ions ($Na^{+}$) being positively charged migrate to negative electrode, i.e., cathode. This is due to electrostatic forces of attraction between oppositely charged ions.

**Question 5.**
In the electrolysis of acidified water, dilute sulphuric acid is preferred to dilute nitric acid.

**Answer:**
Since nitric acid is a volatile acid, may decompose and nitrate radical ($N0_3$) may tend to interfere with the electrolytic reaction.