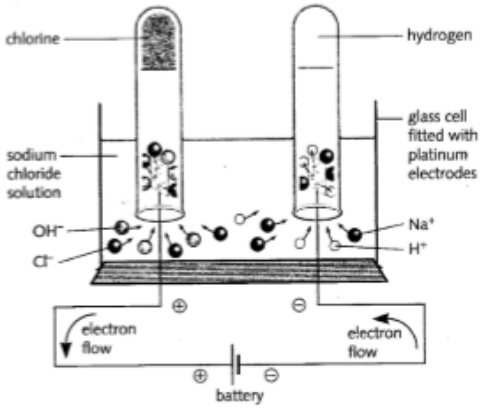
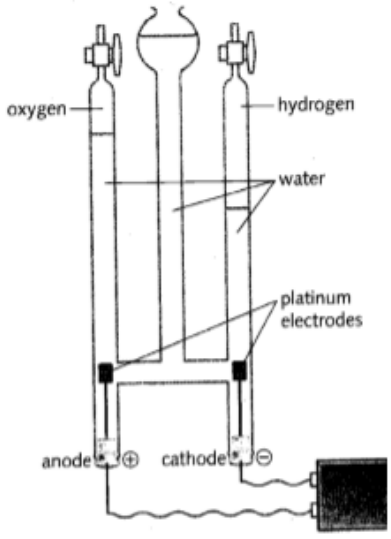
STUDY PACK : 4

CAMBRIDGE
International Examinations

ELECTROLYSIS





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ELECTROLYSIS

1. **A.** What is an Electric Current?

B. What carries electricity in metallic conductors?

C. What carries electricity in an ionic solution?

2. Define the following terms:-

i. Conductor :

ii. Non-conductor :

iii. Electrolyte :

iv. Non-electrolyte :

3. Give common examples for Electrolytes & Non-electrolytes;

Electrolytes :

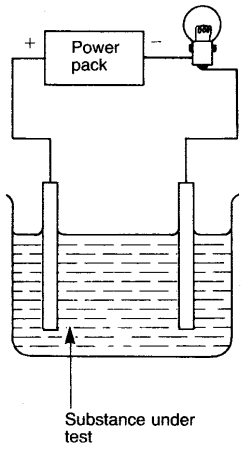
Non-electrolytes :

4. Explain why covalent compounds do not conduct electricity

5. Explain why ionic compounds conduct only in aqueous or molten state but not solid state.

6. Describe a simple experiment, which is to distinguish between Electrolytes & Non-electrolytes.

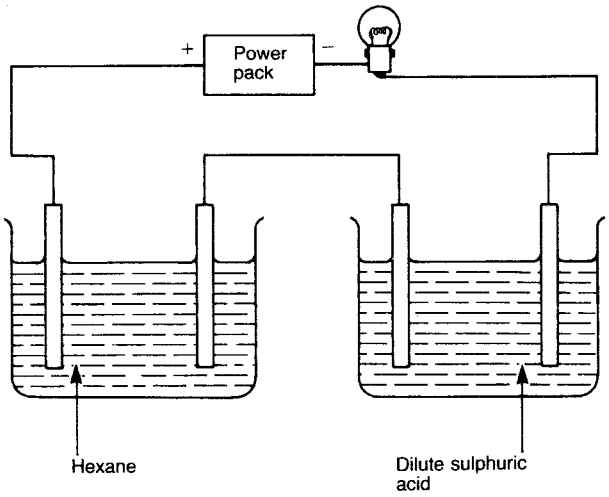
7.



In which of the following cases will the bulb in the given apparatus light up?
When the beaker contains;

i. ethanol
ii. sugar dissolved in water
iii. sodium hydroxide solution
iv. copper (II) sulphate solution
v. molten sugar
vi. molten potassium chloride
vii. solid magnesium oxide

8. Two electrolysis cells are set up as shown below, what happens?



9. **A.** What is meant by the term “Electrolysis”?

B. Define the below terms;

i. Electrodes :

ii. Electrolytic cell (Voltameter) :

10. Explain how electrolysis occurs?

11. What are the names given for negative & positive electrodes respectively?

12. Describe what happens to the ions when they reach the respective electrodes?

13. Explain ‘Oxidation’ & ‘Reduction’ in terms of electrons;

14. Explain how can we identify an anode & a cathode in an electrolytic cell in terms of reduction & oxidation?

15. Describe the below terms;

Cathode reaction :

Anode reaction :

Overall reaction :

16. **A.** Show what happens during electrolysis of **molten** NaCl using a detail labelled figure.

B. Write the half reactions (cathode & anode reactions) & overall reaction of the above electrolysis of molten NaCl, indicate the oxidation & reduction.

Cathode reaction :

Anode reaction :

Overall reaction :

17. Write the observations of the electrolysis of molten lead (II) bromide.

Hence write the ionic equations representing the reactions at each electrode.

Cathode reaction :

Anode reaction :

Overall reaction :

18. **A.** What are the additional ions present in an aqueous solution than in the molten solution?

B. Write all the ions available in the solutions of $NaCl_{(aq)}$, dilute H_2SO_4, $CuSO_{4(aq)}$

19. Write the ionic half equations for the electrolysis of H_2O

Cathode reaction :

Anode reaction :

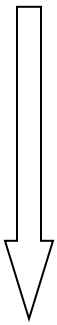
20. **A.** Describe the term '**selective discharge of ions**'

B. What are the factors that affect the selective discharge of ions?

C. Below shown is the table of electrochemical series* of cations & anions in order of their ease of discharge.

Positive ions
Potassium (K^+)
Calcium (Ca^{2+})
Sodium (Na^+)
Magnesium(Mg^{2+})
Aluminium (Al^{3+})
Zinc (Zn^{2+})
Iron (II)(Fe^{2+})
Lead (II) (Pb^{2+})
Hydrogen (H^+)
Copper (II) (Cu^{2+})
Silver (Ag^+)

Negative ions
Sulphate (SO_4^{2-})
Nitrate (NO_3^-)
Hydroxide (OH^-)
Chloride (Cl^-)
Bromide (Br^-)
Iodide (I^-)



Ease of discharge of ions increases downwards

*__Electrochemical series__ is another way to compare reactivities. The metal ions in this series are closely parallel to the reactivity series.

Note the ions below hydrogen & hydroxide which are less reactive, ions above are more reactive.

21. Explain the effect of the position of the group in the electrochemical series in selective discharge of ions

22. Explain the effect of the concentration of ions in selective discharge of ions

23. Similarly, explain the effect of the Nature of the electrode in selection discharge of ions

24. Write the half equations, overall equations & observations in below Electrolysis;

<u>Electrolysis of aqueous NaCl with carbon electrodes:</u>

Cathode Reaction :

Anode Reaction :

Overall Reaction :

What is formed in the Solution :

What you can SEE (observations) :

What is the problem associated with collecting chlorine gas over water?

<u>Electrolysis of aqueous H_2SO_4 with Carbon or Platinum electrodes:</u>

Cathode Reaction :

Anode Reaction :

Overall Reaction :

What is formed in the Solution :

What you can SEE (observations) :

Electrolysis of aqueous $CuSO_4$ with Carbon or Platinum electrodes:

Cathode Reaction :

Anode Reaction :

Overall Reaction :

What is formed in the Solution :

What you can SEE :

Electrolysis of aqueous $AgNO_3$ with carbon electrodes:

Cathode Reaction :

Anode Reaction :

Overall Reaction :

What is formed in the Solution :

What you can SEE :

25. Describe the electrolysis of copper sulfate solution using Copper electrodes. Include cell diagram, observations, anode and cathode reactions and state the uses.

26. Describe an experiment to show the visual confirmation of migration of ions towards the electrodes during electrolysis

27. State some uses of electrolysis.

28.

i. What are the uses of electrochemical cells?

ii. Fill in the blanks.

Electrolysis produces chemical energy from _____ energy.

Cells/ Batteries produce electrical energy from _____ energy.

29. Describe how electrochemical cells (Galvanic cells) works in contrast to an Electrolytic cell.

30. Describe a simple setup to show an Electrochemical cell and state how the voltage could be altered?

31. With the aid of a diagram, explain how to coat a nickel jug with silver.

32. Which diagram shows how to electroplate a copper ring with a coating of nickel?