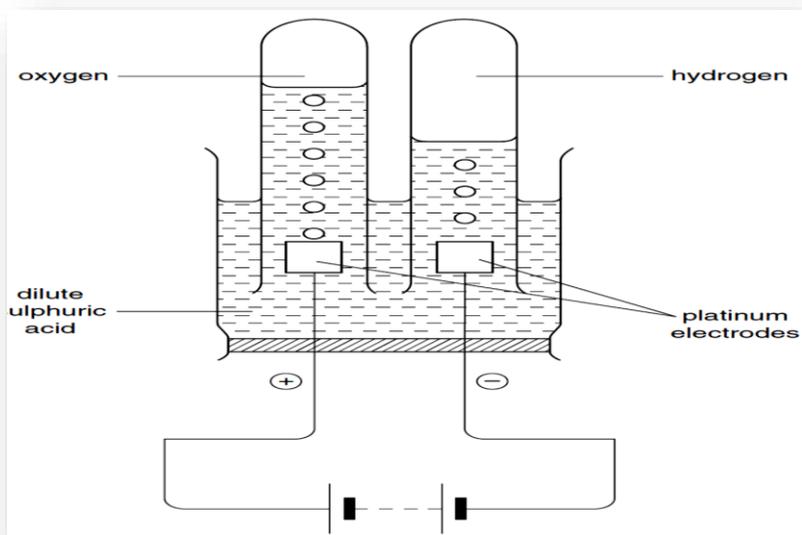


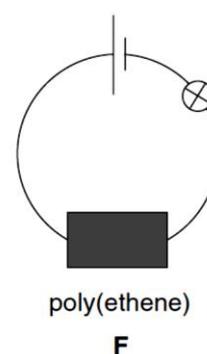
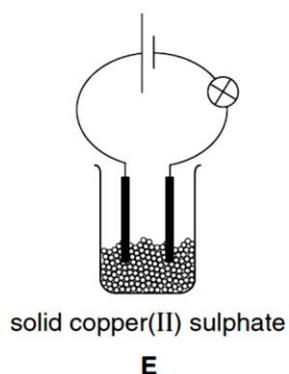
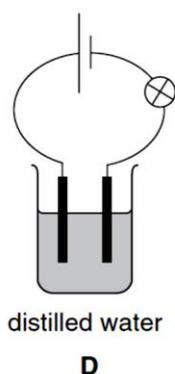
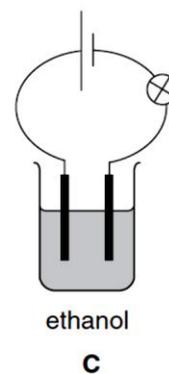
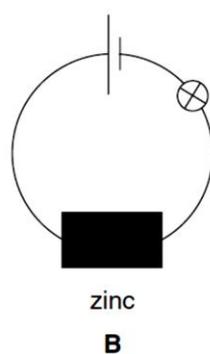
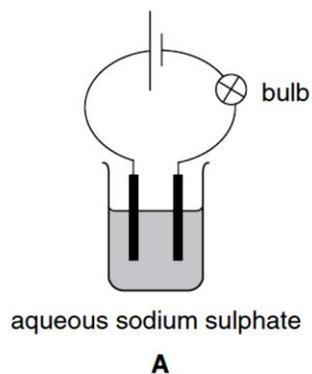
- 1 The diagram represents an experiment in which an electric current is being passed through dilute sulphuric acid.



- (a) Give the formulae of all the ions present in this solution.
Construct an ionic equation for the reaction at each electrode.
Describe the test for oxygen.

[5]

- 2 (a) A student tried to pass an electric current through some solids and liquids. The six experiments are represented by the diagrams below.



- (i) In which experiments will the bulb light?

.....2]

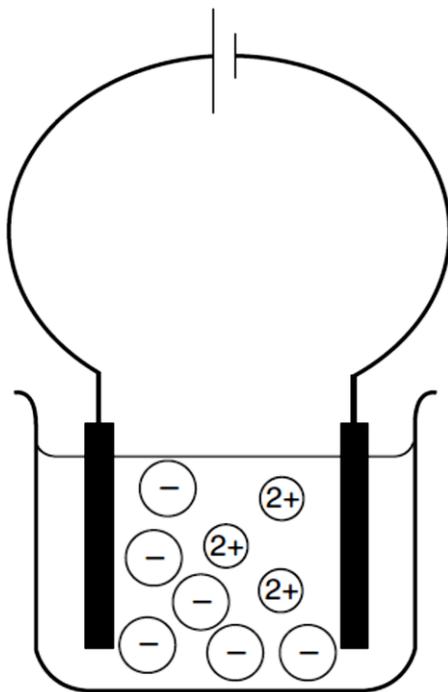
- (ii) Give the name of an electrolyte shown in the diagram.

.....1]

- (iii) In which experiment will oxygen be produced?

.....1]

(b) The following diagram represents the electrolysis of molten substance, **X**.



(i) Label the anode and cathode on the diagram.

(ii) Suggest the name of substance **X**.

.....

(iii) State the formula of the cation in **X**.

.....

(iv) Explain why substance **X** conducts electricity when molten, but not when solid.

.....

.....

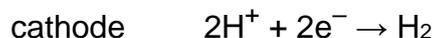
.....[5]

3. Chlorine, hydrogen and sodium hydroxide are made by the electrolysis of concentrated aqueous sodium chloride.

(a) Aqueous sodium chloride contains the following ions, Na^+ , H^+ , OH^- and Cl^- .

Concentrated aqueous sodium chloride can be electrolysed using inert electrodes.

The electrode reactions are represented below.



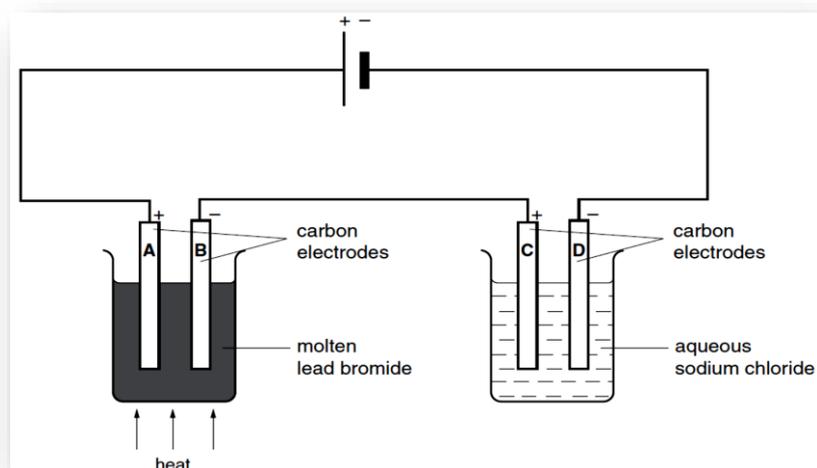
(i) Explain why hydrogen, **not** sodium, is formed at the cathode.

.....

(ii) Suggest why, as the electrolysis proceeds, the concentration of sodium hydroxide in the electrolyte increases.

.....
[2]

4 A student electrolysed lead bromide and aqueous sodium chloride in the apparatus shown below.



Each of the electrodes is labelled with a letter.

(a) Why was it necessary for lead bromide to be molten?

.....[1]

(b) (i) What was produced at electrode **A**?

.....

(ii) What was the appearance of this product?

.....

(iii) What was produced at electrode **B**?

.....

(iv) Where did this product collect?

.....[4]

(c) Gases were produced at electrodes **C** and **D**. In each case name the gas and give a test to confirm its presence.

(i) the gas produced at **C**

test for this gas

.....

(iii) gas produced at **D**

.....

test for this gas

.....[4]

(d) What change should be made so that sodium is produced at one of the electrodes?

.....[1]

5. A student carried out an electrolysis of dilute sulphuric acid and collected the gases formed.

(a) Draw a labelled diagram to show the apparatus used.

[2]

(b) (i) Give the formulae of all the ions present in the solution.

.....

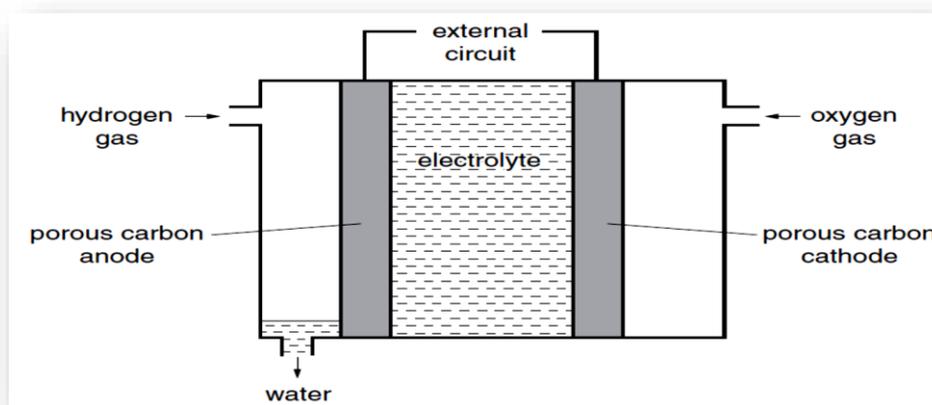
(ii) Write half equations for the reactions at the anode and cathode. Use the half equations to construct an overall equation for the reaction and give tests for any gases evolved.

(iii) Use your equations to explain how the composition of the solution changes after the electrolysis has been running for some time.

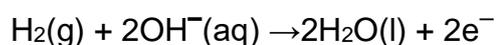
[6]

Q One of the first buses to use hydrogen as a fuel was operated in Erlangen, Germany, in 1996. The hydrogen was stored in thick pressurized tanks on the roof of the bus.

(a) Some buses use hydrogen to generate electrical energy from a fuel cell. The structure of a typical fuel cell is shown.



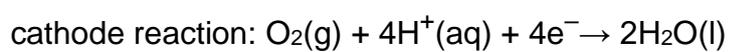
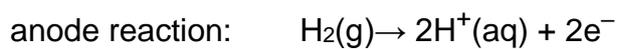
(i) The equation for the reaction at the anode is shown.



What type of reaction is this? Explain your answer. [1]

- (ii) At the cathode oxygen reacts with water to form hydroxide ions. Write an ionic equation for this reaction. [1]

- (b) In some fuel cells an acidic electrolyte is used.



- (i) Write an overall equation for the reaction occurring in this fuel cell.

[1]

Topic: Redox Reactions

Prepared by: **NAEEM ISHTIAQ** (M.Sc Chemistry U.O.P Lahore)

Multiple choice questions

- the diagram shows the electrolysis of which of the following is an example of redox reaction
 - $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$
 - $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 - $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$
 - $\text{CO}_2 + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
- Which of the following conversions is an example of reduction?
 - From iron(II) oxide to iron(II) sulphate
 - from copper(II) oxide to copper
 - from zinc nitrate to zinc chloride
 - from hydrochloric acid to chlorine
- in which of the following reaction is the underlined substance acting as an reducing agent?
 - $\text{H}_2 + \underline{\text{Cl}_2} \rightarrow 2\text{HCl}$
 - $\underline{3\text{CuO}} + 2\text{NH}_3 \rightarrow 3\text{Cu} + 3\text{H}_2\text{O} + \text{N}_2$
 - $4\text{HCl} + \underline{\text{MnO}_2} \rightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
 - $\underline{2\text{KI}} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{I}_2$
- which element in the reaction below is oxidised

$$2\text{FeSO}_4 + \text{Cl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + 2\text{HCl}$$
 - Chlorine
 - hydrogen
 - iron
 - sulphur
- solution X turns acidified potassium dichromate(VI) from orange to green what must be solution X contain?
 - an alkali
 - an oxidizing agent
 - an ammonium salt
 - a reducing agent
- in which of the reaction the oxidation state of iron remains unchanged?
 - $2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$
 - $2\text{FeCl}_2 + \text{Cl}_2 \rightarrow 2\text{FeCl}_3$
 - $\text{Fe} + 2\text{FeCl}_3 \rightarrow 3\text{FeCl}_2$
 - $\text{Fe}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{FeCl}_3 + 3\text{H}_2\text{O}$
- acidified potassium dichromate(VI) can be used to detect the presence of ethanol vapor in the breath of a person who has consumed alcohol a color change from orange to green is observed if ethanol is present. This shows that ethanol is
 - an alkali
 - an oxidizing agent
 - an indicator
 - a reducing agent

8. an oxidizing agent was to observed to change from purple to faint pink colour.
What is it most likely to be?
 (A) acidified potassium manganate(VII) solution
 (B) bromine water
 (C) iron (III) chloride solution
 (D) manganese (IV) oxide
9. chlorine gas is added in small amount to drinking water to kill bacteria.
If too much chlorine is added then excess is removed by adding sulphur dioxide
The reaction is

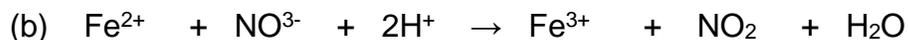
$$\text{Cl}_2 + 2\text{H}_2\text{O} + \text{SO}_2 \rightarrow 2\text{HCl} + \text{H}_2\text{SO}_4$$
 Which one these statement is incorrect
 (A) the oxidizing agent is chlorine
 (B) the oxidation state of the sulphur has increased from +4 to +6
 (C) this is a redox reaction
 (D) water has been oxidized
10. which of the following chemical can act as a reducing agent
 (A) sodium (B) carbon (C) oxygen (D) acidified potassium manganate(VII)

Structure Questions:**[16]**

- 1: For each of the following reaction give the formula of the substance which is
being oxidized



_____ [1]



_____ [1]

- 2: The following reaction occurs when chlorine is bubbled into aqueous iron(II) chloride



- (a) Explain in term of electron why chlorine has been reduced

_____ [1]

- (b) Name the salt formed in the reaction

_____ [1]

- 3: when orange crystal of ammonium dichromate (VI) $(\text{NH}_4)_2 \text{Cr}_2 \text{O}_7$ are heated the product

are green chromium(III)oxide nitrogen and water

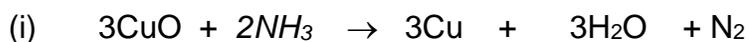
(a) construct the equation for this reaction

_____ [2]

(b) the action of heat on the crystal starts a redox reaction has the chromium been oxidize or reduced explain your answer?

 _____ [2]

4: For each the following reaction state whether the italicized substance is oxidized reduced, or neither oxidized nor reduced



_____ [1]



_____ [1]



_____ [1]



_____ [1]

5. When magnesium metal is added to solution of lead(II) nitrate a redox reaction takes place grey crystal of lead and a colourless solution containing magnesium ions are formed

(i) write the simplest ionic equation for the redox reaction

_____ [2]

(ii) what is an oxidizing agent in the reaction

_____ [1]

(iii) define reducing agent

_____ [1]