

**ICSE Board**  
**Class X Chemistry**  
**Board Paper – 2014**

**Time: 1½ hrs**

**Total Marks: 80**

**General Instructions:**

1. Answers to this paper must be written on the paper provided separately.
2. You will NOT be allowed to write during the first 15 minutes. This time is to be spent in reading the question paper.

The time given at the head of this paper is the time allowed for writing the answers.

This question paper is divided into two sections.

3. **Section I** contains one question with parts (a) to (h); all the eight parts are to be answered.
4. **Section II** contains six questions numbered 2 to 7. You are to answer any four of these questions.

The intended marks of questions or for parts of questions are given in brackets [ ].

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**SECTION I (40 Marks)**

Attempt **all** questions from this section.

**Question 1**

**(a)** Choose the correct answer from the options given below:

[10]

- i. Ionisation potential increases over a period from left to right because the
  - A. Atomic radius increases and nuclear charge increases
  - B. Atomic radius decreases and nuclear charge decreases
  - C. Atomic radius increases and nuclear charge decreases
  - D. Atomic radius decreases and nuclear charge increases
- ii. A compound X consists of only molecules. Hence, X will have
  - A. A crystalline hard structure
  - B. A low melting point and low boiling point
  - C. An ionic bond
  - D. A strong force of attraction between its molecules
- iii. When fused lead bromide is electrolysed, we observe
  - A. A silver grey deposit at the anode and a reddish brown deposit at the cathode
  - B. A silver grey deposit at the cathode and a reddish brown deposit at the anode
  - C. A silver grey deposit at the cathode and reddish brown fumes at the anode
  - D. Silver grey fumes at the anode and reddish brown fumes at the cathode
- iv. The main ore used for the extraction of iron is
  - A. Haematite
  - B. Calamine
  - C. Bauxite
  - D. Cryolite

- v. Heating an ore in a limited supply of air or in the absence of air at a temperature just below its melting point is known as
- Smelting
  - Ore dressing
  - Calcination
  - Bessemerisation
- vi. If an element A belongs to Period 3 and Group II, then it will have
- 3 shells and 2 valence electrons
  - 2 shells and 3 valence electrons
  - 3 shells and 3 valence electrons
  - 2 shells and 2 valence electrons
- vii. The molecule containing a triple covalent bond is
- Ammonia
  - Methane
  - Water
  - Nitrogen
- viii. The electrolyte used for electroplating an article with silver is
- Silver nitrate solution
  - Silver cyanide solution
  - Sodium argentocyanide solution
  - Nickel sulphate solution
- ix. Aluminium powder is used in thermite welding because
- It is a strong reducing agent.
  - It is a strong oxidising agent.
  - It is corrosion resistant.
  - It is a good conductor of heat.
- x. The IUPAC name of acetylene is
- Propane
  - Propyne
  - Ethene
  - Ethyne

**(b)** Fill in the blanks from the choices given within brackets:

- The basicity of acetic acid is----- (3, 1, 4).
- The compound formed when ethanol reacts with sodium is----- (sodium ethanoate, sodium ethoxide, sodium propanoate).
- Quicklime is not used to dry HCl gas because----- (CaO is alkaline, CaO is acidic, CaO is neutral).
- Ammonia gas is collected by----- (an upward displacement of air, a downward displacement of water, a downward displacement of air).
- Cold, dilute nitric acid reacts with copper to form----- (hydrogen, nitrogen dioxide, nitric oxide).

**(c)** Give one word or phrase for the following:

- The ratio of the mass of a certain volume of gas to the mass of an equal volume of hydrogen under the same conditions of temperature and pressure
- Formation of ions from molecules
- Electrolytic deposition of a superior metal on a baser metal
- Hydrocarbons containing a  $\text{C}=\text{C}$  - functional group
- The amount of energy released when an atom in the gaseous state accepts an electron to form an anion

[5]

**(d)** Match the options A to E with the statements (i) to (v):

[5]

A	Alkyne	(i)	No. of molecules in $22.4 \text{ dm}^{-3}$ of carbon dioxide at STP
B	Alkane	(ii)	An element with electronic configuration 2,8,8,3
c	Iron	(iii)	$\text{C}_n\text{H}_{2n+2}$
D	$6.023 \times 10^{23}$	(iv)	$\text{C}_n\text{H}_{2n-2}$
E	Metal	(v)	The metal which forms two types of ions

**(e)** Write balanced equations for the following:

- Action of heat on a mixture of copper and concentrated nitric acid
- Action of warm water on magnesium nitride
- Action of concentrated sulphuric acid on carbon
- Action of dilute hydrochloric acid on sodium sulphide
- Preparation of ethane from sodium propionate

[5]

**(f)** Distinguish between the following pairs of compounds using the test given within brackets:

- Iron (II) sulphate and iron (III) sulphate (using ammonium hydroxide)
- A lead salt and a zinc salt (using excess ammonium hydroxide)
- Sodium nitrate and sodium sulphite (using dilute sulphuric acid)
- Dilute sulphuric acid and dilute hydrochloric acid (using barium chloride solution)
- Ethane and ethene (using alkaline potassium permanganate solution)

[5]

(g)

- i. Oxygen oxidises ethyne to carbon dioxide and water as shown by the equation:



What volume of ethyne gas at STP is required to produce 8.4 dm<sup>3</sup> of carbon dioxide at STP? [H = 1, C = 12, O = 16]

- ii. A compound made up of two elements X and Y has an empirical formula X<sub>2</sub>Y. If the atomic weight of X is 10 and that of Y is 5 and the compound has a vapour density 25, find its molecular formula. [5]

## SECTION II (40 Marks)

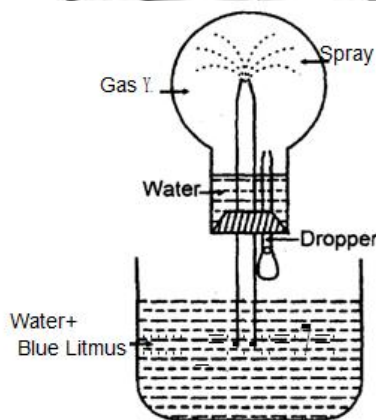
Attempt any **four** questions from this section.

### Question 2

- (a) State your observation in each of the following cases:

- When dilute hydrochloric acid is added to sodium carbonate crystals.
- When excess sodium hydroxide is added to calcium nitrate solution.
- At the cathode, when acidified aqueous copper sulphate solution is electrolysed with copper electrodes.
- When calcium hydroxide is heated with ammonium chloride crystals.
- When moist starch iodide paper is introduced into chlorine gas. [5]

- (b) Study the figure given below and answer the questions which follow:



- Identify the gas Y.
- What property of gas Y does this experiment demonstrate?
- Name another gas which has the same property and can be demonstrated through this experiment. [3]

(c)

- Name the other ion formed when ammonia dissolves in water.
- Give one test which can be used to detect the presence of the ion produced. [2]

### Question 3

(a) State the conditions required for the following reactions to take place:

- i. Catalytic hydrogenation of ethyne
- ii. Preparation of ethyne from ethylene dibromide
- iii. Catalytic oxidation of ammonia to nitric oxide
- iv. Any two conditions for the conversion of sulphur dioxide to sulphur trioxide [5]

(b) State the main components of the following alloys:

- i. Brass
- ii. Duralumin
- iii. Bronze [3]

(c) Give balanced equations for the following:

- i. Laboratory preparation of nitric acid
- ii. Preparation of ethanol from monochloroethane and aq. sodium hydroxide [2]

### Question 4

(a) Give the structural formula of the following:

- i. Ethanol
- ii. 1-propanal
- iii. Ethanoic acid
- iv. 1,2-dichloroethane [4]

(b) Draw the structure of the stable positive ion formed when an acid dissolves in water. [2]

(c) State the inference drawn from the following observations:

- i. On carrying out the flame test with a salt P, a brick red flame was obtained. What is the cation in P?
- ii. A gas Q turns moist lead acetate paper silvery black. Identify the gas Q.
- iii. pH of liquid R is 10. What kind of substance is R?
- iv. Salt S is prepared by reacting dilute sulphuric acid with copper oxide. Identify S. [4]

### Question 5

**(a)** Name the following:

- i. The property possessed by metals by which they can be beaten into sheets.
- ii. A compound added to lower the fusion temperature of electrolytic bath in the extraction of aluminium.
- iii. The ore of zinc containing its sulphide. [3]

**(b)** Give one equation each to show the following properties of sulphuric acid:

- i. Dehydrating property
- ii. Acidic nature
- iii. As a non-volatile acid [3]

**(c)** Give balanced chemical equations to prepare the following salts:

- i. Lead sulphate from lead carbonate
- ii. Sodium sulphate using dilute sulphuric acid
- iii. Copper chloride using copper carbonate [3]

### Question 6

**(a)**

- i. State Avogadro's Law.
- ii. A cylinder contains 68 g of ammonia gas at STP.
  - a. What is the volume occupied by this gas?
  - b. How many moles of ammonia are present in the cylinder?
  - c. How many molecules of ammonia are present in the cylinder?[N = 14, H = 1] [4]

**(b)**

- i. Why do covalent compounds exist as gases, liquids or soft solids?
- ii. Which electrode—anode or cathode—is the oxidising electrode? Why? [3]

**(c)** Name the kind of particles present in

- i. Sodium hydroxide solution
- ii. Carbonic acid
- iii. Sugar solution [3]

### Question 7

**(a)** An element Z has atomic number 16. Answer the following questions on Z:

- i. State the period and group to which Z belongs.
- ii. Is Z a metal or a non-metal?
- iii. State the formula between Z and hydrogen
- iv. What kind of a compound is this?

[5]

**(b)** M is a metal above hydrogen in the activity series and its oxide has the formula  $M_2O$ . This oxide when dissolved in water forms the corresponding hydroxide which is a good conductor of electricity. In the above context, answer the following:

- i. What kind of combination exists between M and O?
- ii. How many electrons are there in the outermost shell of M?
- iii. Name the group to which M belongs.
- iv. State the reaction taking place at the cathode.
- v. Name the product at the anode.

[5]

**SECTION I**

**Answer 1**

**(a)**

- i. D
- ii. B
- iii. C
- iv. A
- v. C
- vi. A
- vii. D
- viii. C
- ix. A
- x. D

**(b)**

- i. 1
- ii. Sodium ethoxide
- iii. CaO is alkaline
- iv. Downward displacement of air
- v. Nitric oxide

**(c)**

- i. Relative vapour density
- ii. Ionisation
- iii. Galvanisation
- iv. Ketone
- v. Electron affinity

**(d)**

- A – (iv)
- B – (iii)
- C – (v)
- D – (i)
- E – (ii)

(e)

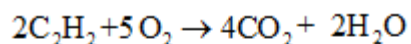
- i.  $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$
- ii.  $\text{Mg}_3\text{N}_2 + 6\text{H}_2\text{O} \rightarrow 3\text{Mg}(\text{OH})_2 + 2\text{NH}_3$
- iii.  $\text{C} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + 2\text{SO}_2$
- iv.  $\text{Na}_2\text{S} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{S}$
- v.  $\text{C}_2\text{H}_5\text{COONa} + \text{NaOH} \xrightarrow[300^\circ\text{C}]{\text{CaO}} \text{Na}_2\text{CO}_3 + \text{C}_2\text{H}_6$

(f)

- i. On addition of ammonium hydroxide to iron sulphate (II), a dirty green precipitate of  $\text{Fe}(\text{OH})_3$  is formed. On treating iron sulphate (III) solution with ammonium hydroxide, a reddish brown precipitate of  $\text{Fe}(\text{OH})_3$  is formed.
- ii. On addition of excess of ammonium hydroxide to lead nitrate, a chalky white ppt. of  $\text{Pb}(\text{OH})_2$  is formed. On addition of excess of ammonium hydroxide to zinc sulphate, a white gelatinous ppt. of  $\text{Zn}(\text{OH})_2$  is formed which is soluble.
- iii. Sodium nitrate on treatment with dilute sulphuric acid gives sodium bisulphate and nitric acid.  
$$\text{NaNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{HNO}_3$$
  
Sodium sulphite on treatment with dilute sulphuric acid gives sodium sulphate and sulphur dioxide.  
$$\text{Na}_2\text{SO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O} + \text{SO}_2$$
- iv. Sulphuric acid precipitates the insoluble sulphate of barium from the solution of barium chloride.  
$$\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$$
  
Dilute HCl does not react with barium chloride solution, and thus, no precipitate is produced in the reaction.
- v. On adding a few drops of alkaline potassium permanganate to ethane, no change is observed, whereas when ethene is added to  $\text{KMnO}_4$ , the purple colour fades.

(g)

i.



2 moles of  $\text{C}_2\text{H}_2 = 4$  moles of  $\text{CO}_2$

$x \text{ dm}^3$  of  $\text{C}_2\text{H}_2 = 8.4 \text{ dm}^3$  of  $\text{CO}_2$

$$x = \frac{2 \times 8.4}{4} = 4.2 \text{ dm}^3 \text{ of } \text{C}_2\text{H}_2$$

ii.

Empirical formula =  $\text{X}_2\text{Y}$

Atomic Weight (X) = 10

Atomic Weight (Y) = 5

Empirical formula Weight =  $2 \times 10 + 5 = 25$

$$\text{So, } n = \frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{2 \times \text{V.D.}}{\text{Empirical formula weight}}$$

i.

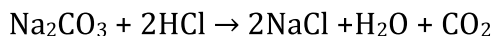
$$n = \frac{2 \times 25}{25} = 2$$

So molecular formula =  $\text{X}_2\text{Y} \times 2 = \text{X}_4\text{Y}_4$

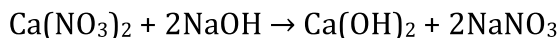
## Answer 2

(a)

- i. Sodium carbonate crystals on reaction with dilute HCl forms sodium chloride, water and carbon dioxide gas, which is evolved with brisk effervescence. This is a neutralisation reaction as sodium carbonate is a basic salt, while hydrochloric acid is an acid. The chemical equation for this reaction is as follows:



- ii. Calcium nitrate solution on reaction with excess of sodium hydroxide produces calcium hydroxide and sodium nitrate. Calcium nitrate reacts with excess of sodium hydroxide to form a white precipitate of calcium hydroxide, which is sparingly soluble, and colourless sodium nitrate. The reaction is as follows:

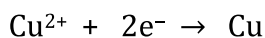


- iii. Acidified aqueous copper sulphate solution is electrolysed with copper electrodes by electrolysis. The electrolysis of an aqueous solution of copper sulphate using copper electrodes (i.e. using active electrodes) results in transfer of copper metal from the anode to the cathode during electrolysis. The copper sulphate is ionised in aqueous solution.

Copper sulphate solution is ionised by the following chemical equation:

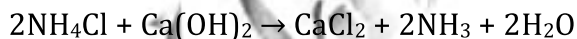


The positively charged copper ions migrate to the cathode, where each gains two electrons to become copper atoms which are deposited on the cathode.



Hence, the colour of copper sulphate changes from blue to colourless.

- iv. When ammonium chloride is heated with calcium hydroxide, ammonia gas is released.



The liberated gas turns red litmus blue.

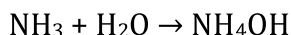
- v. When moist starch iodide paper is introduced into chlorine gas, chlorine oxidises iodide to iodine, which shows up as blue when complexed with starch.

(b)

- i. The gas is HCl (hydrogen chloride) gas.
- ii. The extreme solubility of hydrogen chloride gas is demonstrated by the fountain experiment.
- iii. Another gas which has the same property and can be demonstrated through this experiment is ammonia gas.

(c)

- i. When ammonia dissolves in water, ammonium hydroxide is formed. The chemical equation is as follows:



Ammonium hydroxide further gets ionised as follows:



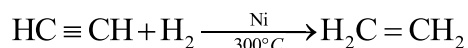
- ii. The other ion is hydroxyl ion due to which the solution becomes basic. The litmus test can be used to detect the presence of this ion. It turns red litmus blue and phenolphthalein solution pink.

### Answer 3

(a)

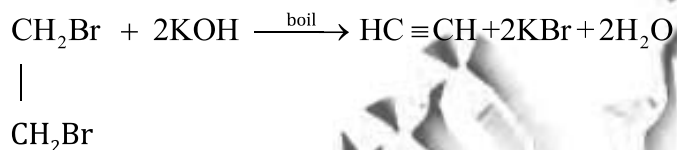
- i. Condition required for the catalytic hydrogenation of ethyne is as follows: Temperature:  $300^\circ\text{C}$ , Catalyst: Nickel

The chemical equation is as follows:



- ii. Condition required for the preparation of ethylene from ethylene dibromide is that the solution should be boiled.

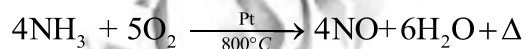
The chemical equation is as follows:



- iii. Condition required for the catalytic oxidation of ammonia to nitric oxide is as follows:

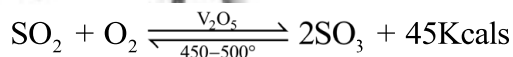
Temperature:  $800^\circ\text{C}$ , Catalyst: Platinum

The chemical equation is as follows:



- iv. Two conditions for the conversion of sulphur dioxide to sulphur trioxide is as follows:

Temperature:  $450-500^\circ\text{C}$  Catalyst:  $\text{V}_2\text{O}_5$



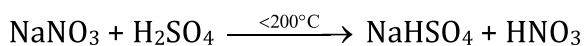
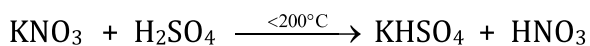
(b)

- i. Main components of brass are copper and zinc.
- ii. Main components of duralumin are aluminium, magnesium, copper and manganese.
- iii. Main components of bronze are copper, zinc and tin.

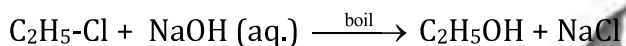
(c)

- i. The balanced chemical equation for the laboratory preparation of nitric acid is as follows:

Nitric acid is prepared by the reaction of conc. sulphuric acid with potassium or sodium nitrate.



- ii. The balanced chemical equation for the preparation of ethanol from monochloroethane and aqueous sodium hydroxide:



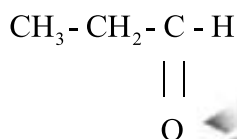
#### Answer 4

(a)

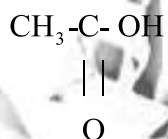
- i. Ethanol:



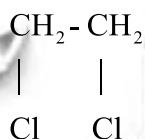
- ii. 1-Propanal:



- iii. Ethanoic acid:

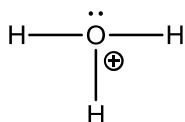


- iv. 1, 2-Dichloroethane:



(b) The stable positive ion formed when an acid dissolves in water is hydronium ion.

The structure of hydronium ion ( $\text{H}_3\text{O}^+$ ) is as follows:



(c)

- On carrying out the flame test with a salt P, a brick red flame is obtained. Hence, the cation P is  $\text{Ca}^{2+}$ .
- A gas Q turns moist lead acetate paper silvery black. Hence, the gas is  $\text{H}_2\text{S}$ .
- pH of liquid R is 10. Hence, the substance R is a base.
- Salt S is prepared by reacting dilute sulphuric acid with copper oxide. Hence, salt S is copper sulphate.

### Answer 5

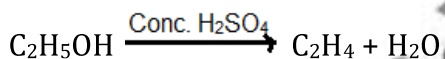
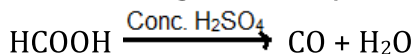
(a) Name the following:

- Malleability
- Cryolite ( $\text{Na}_3\text{AlF}_6$ )
- Zinc blende (Sphalerite)

(b)

- Dehydrating property of sulphuric acid:

$\text{H}_2\text{SO}_4$  has a great affinity for water, and therefore, it acts as a dehydrating agent.

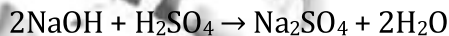
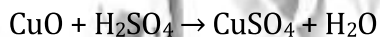
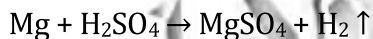


- Acidic nature of sulphuric acid:

It acts as a strong dibasic acid.

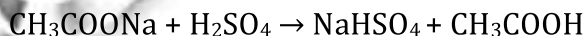
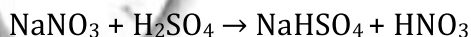
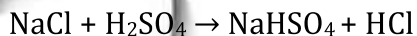


It reacts with metals, metal oxides, metal hydroxides, carbonates etc. to form metallic sulphates and hydrogen at ordinary temperature.



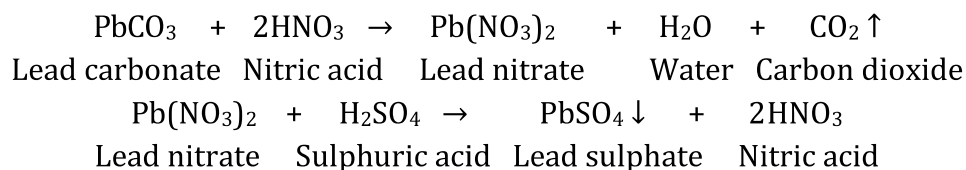
- As a non-volatile acid:

It has a high boiling point, so it is used to prepare volatile acids such as  $\text{HCl}$ ,  $\text{HNO}_3$  and acetic acid from their salts.



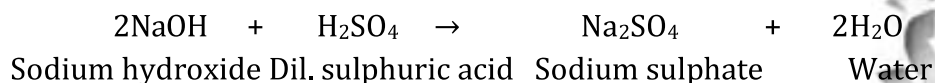
(c) Give balanced chemical equations to prepare the following salts:

i. Lead sulphate from lead carbonate

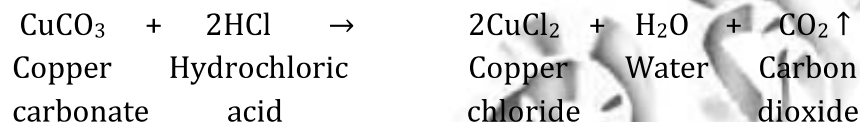


ii. Sodium sulphate using dilute sulphuric acid

Dilute sulphuric acid neutralises bases (oxides and hydroxides) to form salts and water.



iii. Copper chloride using copper carbonate



## Answer 6

(a)

- Avogadro's law: Equal volumes of all gases under similar conditions of temperature and pressure contain the same number of molecules.
- A cylinder contains 68 g of ammonia gas at STP.
  - Molecular weight of ammonia = 17 g/mole  
68 g of ammonia gas at STP = ?  
1 mole = 22.4 dm<sup>3</sup>  
 $\therefore 4 \text{ mole} = 22.4 \times 4 = 89.6 \text{ dm}^3$
  - 4 moles of ammonia gas is present in the cylinder.
  - 1 mole =  $6.023 \times 10^{23}$  molecules  
4 moles =  $24.092 \times 10^{23}$  molecules

(b)

- Covalent compounds have strong covalent bonds between the atoms in a molecule, but the intermolecular forces (Vander Waal's forces) are weak. Hence, covalent compounds are gaseous if molecules are less and liquid or soft solids if molecules are more.
- The anode is the oxidising electrode. An anode is a positively charged electrode, and oxidation means loss of electrons. Thus, electrons lost during oxidation get deposited at the anode. So, the anode is the site of oxidation.

- (c) Name the kind of particles present in
- Positive sodium ions and negative hydroxide ions
  - Hydrogen ions and carbonate ions
  - Glucose, fructose and galactose

**Answer 7**

(a) An element Z having atomic number 16 is Sulphur.

- Sulphur belongs to Period 3 and Group 16.
- Sulphur is a non-metal.
- Two hydrogen atoms combine with one sulphur atom to form hydrogen sulphide ( $\text{H}_2\text{S}$ ) gas.
- Hydrogen sulphide is the chemical compound with the formula  $\text{H}_2\text{S}$ . It is a colourless gas with the characteristic foul odour of rotten eggs; it is heavier than air, very poisonous, corrosive, flammable and explosive.

(b)

- Ionic bond exists between M and O.
- 1 electron is present in the outermost shell of M.
- M belongs to Group 1 in the modern periodic table.
- At cathode:  $\text{M}^+ + 1\text{e}^- \rightarrow \text{M}$
- At anode: Oxygen gas