



**Mark**

## Junior Lyceum Programme

**TIME: 1h 30min**

**Class:**

$$Q = It$$

Faraday Constant =  $96\,500\text{ Cmol}^{-1}$

1		2																				3		4		5		6		7		0																							
																										1 H 1																												4 He 2	
7 Li 3		9 Be 4																				11 B 5		12 C 6		14 N 7		16 O 8		19 F 9		20 Ne 10																							
23 Na 11		24 Mg 12																				27 Al 13		28 Si 14		31 P 15		32 S 16		35.5 Cl 17		40 Ar 18																							
39 K 19		40 Ca 20		45 Sc 21		48 Ti 22		51 V 23		52 Cr 24		55 Mn 25		56 Fe 26		59 Co 27		59 Ni 28		63.5 Cu 29		65 Zn 30		70 Ga 31		73 Ge 32		75 As 33		79 Se 34		80 Br 35		84 Kr 36																					
85 Rb 37		88 Sr 38		89 Y 39		91 Zr 40		93 Nb 41		96 Mo 42		99 Tc 43		101 Ru 44		103 Rh 45		106 Pd 46		108 Ag 47		112 Cd 48		115 In 49		119 Sn 50		122 Sb 51		128 Te 52		127 I 53		131 Xe 54																					
133 Cs 55		137 Ba 56		139 La 57		178 Hf 72		181 Ta 73		184 W 74		186 Re 75		190 Os 76		192 Ir 77		195 Pt 78		197 Au 79		201 Hg 80		204 Tl 81		207 Pb 82		209 Bi 83		210 Po 84		210 At 85		222 Rn 86																					

$\overset{a}{\underset{b}{\text{X}}}$	relative atomic mass symbol atomic number
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**Section A: Answer ALL questions in this section, using the spaces provided.**

**This section carries 60 marks.**

1. The following is a simple form of the Periodic Table.

Li	Be			C			F	Ne
Na							Cl	

Using only the chemical symbols shown in the table, complete the following:

- a. An element which forms an ionic oxide \_\_\_\_\_
- b. An element which forms an acidic oxide \_\_\_\_\_
- c. The most reactive metal \_\_\_\_\_
- d. The most reactive non-metal \_\_\_\_\_
- e. An element which forms a chloride  $\text{XCl}_2$  \_\_\_\_\_
- f. An element that forms no compounds \_\_\_\_\_

(6 marks)

2. The following are the group 1 elements as they appear in the periodic table.

Lithium

Sodium

Potassium

Rubidium

- a. How many shells of electrons are there in a Rubidium (Rb) atom? \_\_\_\_\_ (1 mark)
- b. Sodium is in the same group of Rubidium. Is Rubidium more or less reactive than sodium? Give a reason for your answer.

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(2 marks)

c. Write a balanced equation for the reaction of rubidium with water.

\_\_\_\_\_ (2 marks)

d. Write down the formulae of:

i. Rubidium nitrate \_\_\_\_\_ ii. Rubidium sulphate \_\_\_\_\_ (2 marks)

3. This question is about group 2 metals.

a) A student was investigating the reaction of magnesium in cold water. She found out that magnesium reacts very slowly with water to form two products.

i) Write a balanced equation for this reaction.

\_\_\_\_\_ (2 marks)

ii) Draw a labelled diagram of the apparatus she would use to perform this experiment.

(3 marks)

iii) Since the reaction is very slow, the student decided to react magnesium with steam. At the end of the experiment the student realised that white ashes remained and a gas was produced.

Write a balanced equation for the reaction of magnesium with steam.

\_\_\_\_\_ (2 marks)

4. Write ionic equations (omitting spectator ions) for the following reactions and state what general type of reaction they represent. (Barium forms an ion  $\text{Ba}^{2+}$ )

i)  $\text{BaCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow 2\text{NaCl}(\text{aq}) + \text{BaSO}_4(\text{s})$

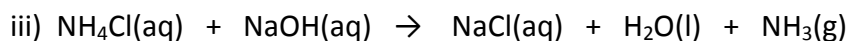
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

Type of reaction: \_\_\_\_\_ (1 mark)



\_\_\_\_\_  
\_\_\_\_\_  
(2 marks)

Type of reaction \_\_\_\_\_ (1 marks)



\_\_\_\_\_  
\_\_\_\_\_  
(2 marks)

Type of reaction \_\_\_\_\_ (1 marks)

5. State whether the substance in **bold** in each of the following equations has been oxidised or reduced. Give a reason for your answer as indicated in the brackets.



\_\_\_\_\_  
(2 marks)



\_\_\_\_\_  
(2 marks)



\_\_\_\_\_  
(2 marks)

6. This question is about the displacement of metals.

Say whether the following are **true** or **false**.

(a) Copper will replace zinc from a solution of zinc nitrate. \_\_\_\_\_

(b) Iron will replace copper from a solution of copper (II) sulphate. \_\_\_\_\_

(c) Aluminium will replace magnesium from a solution of magnesium chloride. \_\_\_\_\_

(d) Iron will liberate hydrogen from dilute hydrochloric acid. \_\_\_\_\_

(e) Copper will liberate hydrogen from dilute sulphuric acid. \_\_\_\_\_

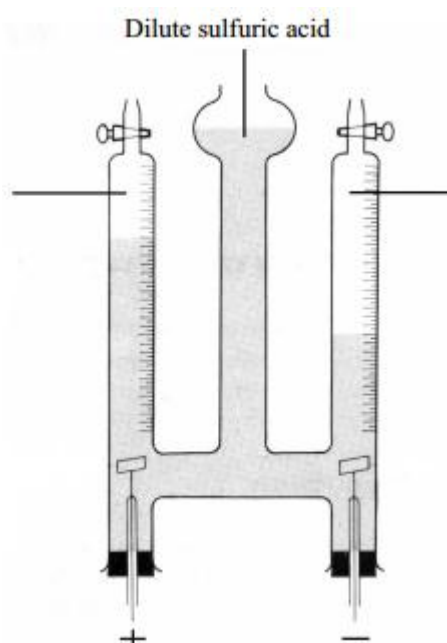
(5 marks)

7. Complete this table

Substance electrolysed	Which substance is formed at the cathode?	Which substance is formed at the anode?
a. molten lead iodide		
b. magnesium nitrate solution		
c.	aluminium	oxygen
d. potassium iodide solution		

(Total: 7 marks)

8. A student is doing the electrolysis of acidified water (dilute sulphuric acid) in the laboratory. He chose to use this piece of apparatus to complete his experiment.



(a) What is the name of this apparatus? \_\_\_\_\_ (2 marks)

(b) Complete the diagram by labelling the gases produced at the anode and cathode. (2 marks)

(c) Write down the ionic half equations for the electrode reactions.

cathode \_\_\_\_\_ anode \_\_\_\_\_ (4 marks)

(d) In another experiment, a current of 1.93 A is passed for 16 minutes 40 seconds through fused magnesium chloride. During this electrolysis experiment a mass of magnesium is formed.

(i) Calculate the quantity of charge passing through the circuit.

(2 marks)

(ii) Convert your answer to Faradays

(1 mark)

(iii) Calculate the mass of magnesium produced.

(2 marks)

**Section B: Answer any TWO questions in this section on the separate sheets provided.**

**Each question carries 20 marks.**

9. Explain the following observations and give equations for the chemical reactions that are taking place.

(a) When hydrochloric acid is added to a sample of calcium carbonate in a test tube, effervescence occurs. On testing, this gas turns lime water milky. (4 marks)

(b) When magnesium is added to dilute hydrochloric acid there is vigorous effervescence but there is no effervescence when copper is added to dilute hydrochloric acid. (5 marks)

(c) When a piece of lithium is added to cold water, there is a slow reaction and few bubbles are given off. However when a small piece of sodium is added to cold water there is a vigorous reaction. (5 marks)

(d) During the electrolysis of sodium chloride solution, it was found that one of the gases produced turned damp blue litmus paper red and then was bleached. If a few drops of universal indicator are added to the remaining solution, it turns to blue. (6 marks)

10. This question is about the reactivity of metals.

(a) A piece of magnesium is dipped into copper (II) sulphate solution

as shown in the diagram. A chemical reaction occurs.

(i) Mention two observations that you are likely to see.

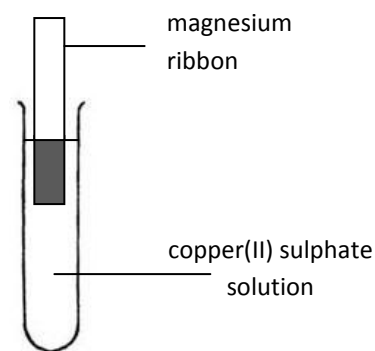
(ii) Explain what is happening in this chemical reaction.

(iii) Write down a balanced equation for this reaction.

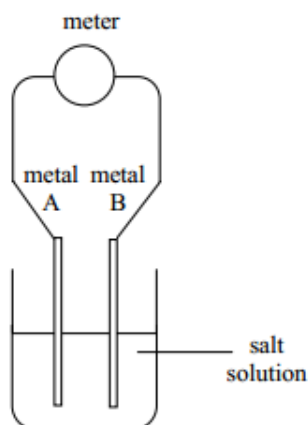
(iv) Displacement reactions are also redox reactions. Write down the ionic equation for this reaction.

(v) State whether magnesium in this reaction has been oxidised or reduced and give reasons.

(10 marks)



(b) Some students made a simple cell. Two pieces of metal foil were dipped into a beaker containing salt solution as shown in the diagram below. The voltage was measured.



(i) Name the piece of apparatus that was used to measure the voltage.

Experiment	Metal A	Metal B	Voltage obtained / Volts
1	magnesium	copper	1.6
2	zinc	copper	0.6
3	iron	copper	0.3
4	copper	copper	0.0

(ii) What is the relationship between the reactivity of the metal and the voltage obtained.

(iii) Predict the voltage obtained if aluminium was used as metal A and copper was used as metal B.

(iv) When silver was used as metal A, a voltage of 0.05 V was obtained. Explain this result.

(v) What is the name of this type of set up?

(10 marks)

11. A student is doing the electrolysis of aqueous copper (II) sulphate solution using different electrodes. He first performed the experiment using carbon electrodes and then repeated the experiment using copper electrodes.

- (a) Write down the ions present in the copper sulphate solution. (2 marks)
- (b) Which ions are selected for discharge at the cathode and anode. Give reasons for your answer. (4 marks)
- (c) Write down any observations at the cathode and anode (2 marks)
- (d) What is the remaining solution in the cell. Comment on the pH of the solution. (2 marks)
- (e) When the experiment was repeated using copper electrodes a different result was obtained. Draw a well labelled diagram that illustrates the apparatus that the student used during this experiment. Illustrate also any changes in the electrodes. (5 marks)
- (f) Write the ionic half equations for the electrode reactions. (2 marks)
- (g) Write down any observations at the electrodes. (2 marks)
- (h) Is there a change in the colour of the solution. Give a reason for your answer. (1 mark)