JUNIOR LYCEUM AND SECONDARY SCHOOL
ANNUAL EXAMINATIONS 2009

Directorate for Quality and Standards in Education
Educational Assessment Unit

FORM 4 **CHEMISTRY** **TIME: 1h 30min**

Name: _____ **Class: _____**

Useful Data: A copy of the Periodic Table is printed below.
Relative atomic mass may be taken as: C=12, O=16, H=1, Na=23
One mole of any gas occupies 22.4 dm^3 at standard temperature and pressure
Standard temperature and pressure (stp) = O^oC and 760 mm Hg
Faraday constant = 96 500$Cmol^{-1}$
Q=It
All equations must include state symbols

PERIODIC TABLE

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

Marks Grid [For Examiners use only]

Question N°.	Section A						Section B			
	1	2	3	4	5	6	7	8	9	
Max Mark	10	10	10	10	10	10	20	20	20	Theory Total
Actual Mark										

85% of Theory Paper	15% Practical	**100% Final Score**

Section A: Answer **ALL** questions in this section, using the spaces provided.
This section carries 60 marks.

1. This question refers to the Periodic Table of elements printed on the front page of this examination paper.

Fill in the **spaces** provided.

a. The atoms of elements in Group 1 of the Periodic Table have an outermost electron shell that contains _____ electron.

b. Elements in Group O have a full _____ shell of electrons and so, they are _____.

c. On going **down** the Group, the reactivity of elements in Group 1 _____ but the reactivity of elements in Group 7_____.

d. All elements in Group 1 react violently with _____ to liberate hydrogen.

e. Aluminium is a metal found in Group 3; its oxide is _____ because it shows acidic and basic properties.

f. Iron and copper are known as _____ elements because they exhibit more than 1 valency.

g. The elements in Group 7 are known as _____ .

h. The elements in Groups 1 and 2 tend to lose electrons to form changed particles called _____.

[10]

2. a. State what you **observe** when small pieces of clean magnesium are:

(i) placed in cold water _____

(ii) heated in steam _____

(iii) placed in dilute hydrochloric acid _____

(iv) placed in dilute sulfuric acid _____

[4]

b. Freshly-cut calcium burns readily when heated but calcium that has been stored for some time is difficult to ignite.

(i) Which flame colour confirms the presence of calcium? _____

(ii) Why is stored calcium difficult to ignite?

_____

[2]

c. Give **one reason** for each of the following:

(i) Copper does not react with water, steam or dilute sulfuric acid.

_____

(ii) Aluminium reacts very little or none at all with dilute sulfuric acid.

_____

[4]

3. a. To identify the chloride ion in a salt, a student added aqueous silver nitrate (acidified with dilute nitric acid) to a solution of copper (II) chloride.

(i) What did the student **observe** during the reaction that identifies the chloride ion?

_____

(ii) Name the two products formed.

_____ _____

(iii) Write an ionic equation for this reaction, omitting spectator ions.

_____

[5]

b. To identify the sulfate ion in a salt, the student added aqueous barium chloride (acidified with dilute hydrochloric acid) to a solution of copper (II) sulfate.

(i) What did the student **observe** during the reaction that identifies the sulfate ion?

_____

(ii) Name the two products formed.

_____ _____

(iii) Write an ionic equation for this reaction, omitting spectator ions.

_____

[5]

4. A solution of hydrochloric acid is titrated against a standard solution of sodium hydroxide solution. 15 cm^3 of hydrochloric acid neutralise 25 cm^3 of 0.1 M (0.1 mol dm^{-3}) sodium hydroxide solution. The equation for the reaction is:

$$HCl(aq)+NaOH(aq)\rightarrow NaCl(aq)+H_2O(l)$$

a. The equation shows that l mole of sodium hydroxide is neutralised by _____ of hydrochloric acid.

[1]

b. (i) A 0.1 M (0.l mol dm^{-3}) solution of sodium hydroxide is one that contains 0.1 mole of pure sodium hydroxide dissolved in _____ of solution.

(ii) In a 1 M (1 mol dm^{-3}) solution of sodium hydroxide, the mass of sodium hydroxide is ___ dm^{-3}. So, in a 0.1 M(0.1mol dm^{-3}) solution, the mass of sodium hydroxide is ____ dm^{-3}.

[3]

c. (i) Calculate the number of moles of NaOH present in 25 cm^3 of solution.

_____

(ii) Use the mole ratio of NaOH:HCl to find the number of moles of HCl taking part in the reaction.

_____

(iii) Use your answer to question c (ii) to find the molarity of the HCl solution.

_____

[5]

d. Give one precaution necessary to produce accurate results in a titration.

_____

[1]

5. The element sulfur exists in a number of **allotropic** forms.

a. Each allotrope has different physical properties but the _____ chemical properties.

[1]

b. Give the names of two allotropes of sulfur.

_____ _____

[2]

c. Write down a chemical equation to illustrate the formation of sulfur dioxide when sulfur is burned in air.

_____

[2]

d. In the lab, sulfur dioxide can be prepared by the action of hot concentrated sulfuric acid on copper.

(i) State by which method the gas is usually collected.

_____

(ii) State what you would **observe** if a filter paper soaked in acidified potassium dichromate solution is placed in sulfur dioxide.

_____

(iii) The reaction in question d.(ii) shows that sulfur dioxide is a

_____

[3]

e. Natural rainwater has a pH of 5.6 but the pH of polluted rainwater lies between pH3 and pH4.8. Sulfur dioxide is considered to be the main culprit.
Sulfur dioxide is formed in the atmosphere because most fossil fuels contain _____.
During combustion, this changes to sulfur dioxide that _____ in rainwater to form acid rain.

[2]

6. a. In the lab., chlorine is prepared by the oxidation of concentrated hydrochloric acid.

(i) Give the name of one substance that can be used to oxidize concentrated hydrochloric acid.

_____

(ii) Give one reason why chlorine is collected by downward delivery.

_____

(iii) Freshly prepared chlorine is usually dried before collected. Name one drying agent suitable to dry chlorine.

_____

[3]

b. Chlorine gas is bubbled through a solution of potassium bromide.

(i) State what you would **observe** during the reaction.

_____

(ii) Write an ionic equation for the reaction omitting spectator ions.

_____

(iii) The reaction shows that chlorine is a powerful _____

[4]

c. In industry chlorine is usually prepared in a membrane cell as a by-product in the electrolysis of brine. Name the other two end products of this electrolysis.

_____ _____

[2]

d. Give one important use of chlorine.

_____

[1]

Section B: Answer **TWO** questions from this section on the separate sheets provided. Each question carries 20 marks.

7. A student was asked to electrolyse a quantity of water acidified with dilute sulfuric acid. Hofmann voltameter was not available; so, the student tried to set up his own apparatus using:

(i) a plastic cup with two holes drilled through the base
(ii) two similar carbon rods
(iii) two similar rubber bungs, each having a middle hole
(iv) two test tubes
(v) a low voltage d.c. supply
(vi) connecting wires with crocodile clips
(vii) other ancillary apparatus.

a. Draw a clear labelled diagram of the experimental set-up showing clearly **where** each end product is collected.

[6]

b. The plastic cup must contain a quantity of acidified water. **Before** conducting the experiment, which other part/s of the apparatus must also contain acidified water?

[1]

c. Give one reason why **carbon** rods are used in this experiment.

[1]

d. What name is given to the carbon rod that is connected to the
(i) **positive** battery terminal (ii) **negative** battery terminal?

[2]

e. Give the name of **each** of the end products collected.

[2]

f. Write down two ionic equations to show how ions are discharged at **each** of the electrodes.

[4]

g. Calculate the quantity of electricity that was used for this experiment if a current of 2.0 Amps flowed through the acidified water for 30 minutes.

[4]

8 Give further explanations and detailed comments (with chemical equations where ap about **each** of the following:

a. The metals iron, copper, silver and gold have been known since ancient times, but metals suc as sodium, calcium and aluminium have been discovered only in the last 200 years.

[5]

b. When volcanoes erupt, the large quantities of sulfur dioxide thrown into the air can affect the earth's climate and the environment.

[5]

c. In the industrial production of nitrogenous fertilizers by the Ostwald process, ammonia is first oxidized to nitrogen dioxide which dissolves in water to form nitric acid. This is then neutralized with a suitable alkali to make nitrates.

[5]

d. In a lime kiln, limestone (calcium carbonate) is heated strongly to produce quicklime (calcium oxide) which dissolves slightly in water to form slaked lime (calcium hydroxide). In the industrial production of bleaches, slaked lime is made to react with chlorine to form bleaching powder.

[5]

9. Explain the meaning of each of the statements below (with special reference to the bold terms) giving chemical equations where appropriate:

a. Gold is extremely **malleable** and copper is very **ductile** but sulfur is neither malleable nor ductile.

[5]

b. Brass is an **alloy** of copper and zinc while bronze is an alloy of copper and tin.

[5]

c. Anhydrous sodium carbonate is **thermally stable** but copper (II) carbonate is easily decomposed by heat.

[5]

d. Some metals are extracted by a process known as **smelting** which involves the **reduction** of a metallic ore by a reducing agent.

[5]