

JUNIOR LYCEUM ANNUAL EXAMINATIONS 2006

Educational Assessment Unit - Education Division

FORM 4

CHEMISTRY

TIME: 1h 30min

Name: _____

Class: _____

Useful Data: A copy of the Periodic Table is printed below.
 Relative atomic masses may be taken as: Ag = 108
 One mole of any gas occupies 22.4 dm³ at standard temperature and pressure.
 Standard temperature and pressure (stp) = 0°C and 760 mm Hg
 Faraday constant = 96 500 Cmol⁻¹
 Q = It

PERIODIC TABLE

1	2											3	4	5	6	7	0							
																								4 He 2
																								20 Ne 10
																								40 Ar 18
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	8	10	10	10	12	10	20	20	20	
Actual Mark										Theory Total

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 concerns the following elements which are found in different Groups or particular areas of the Periodic Table

- A. copper B. chlorine C. magnesium D. hydrogen
E. sodium F. neon G. sulfur H. aluminium

Select, from A to H, the element which fits the following descriptions.

- (i) It is soft, can be cut with a knife and floats on water.
It reacts on exposure to air so it is stored under oil. _____
- (ii) A gas that burns in air to form a neutral liquid. This gas is used as rocket fuel.

- (iii) A yellow solid that burns in air to form an acidic oxide. _____
- (iv) It is extracted from its oxide by electrolysis and is used in alloys for aircraft construction.

- (v) A dense, poisonous gas, which is obtained as a by-product in the electrolysis of brine.

- (vi) It forms compounds in which it has a charge of +1 or +2.
It melts at 1083°C and is used in electrical wiring. _____
- (vii) It is a monoatomic gas, does not tend to react and is used in advertising signs.

- (viii) Some of its compounds are responsible for hardness of water. _____

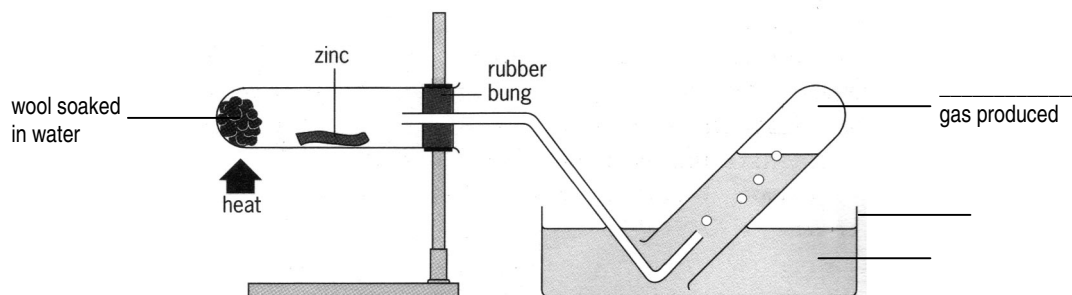
(8 marks)

2. This question is about the reactivity of metals with water and steam.

- (a) Use your knowledge of metals and the reactivity series to give the **name** of a metal that would:
- (i) react vigorously with water _____
- (ii) hardly react with water but reacts with steam _____
- (iii) **not** react with water or steam _____

(3 marks)

b) A teacher demonstrated the reaction of zinc with steam using the apparatus shown below.



(i) Complete the labelling of the diagram. (3 marks)

(ii) Write an equation for this reaction

_____ (2 marks)

(iii) Complete this observation:

The residue was _____ while hot but turned white when cold (1 mark)

(c) Give one safety precaution (other than wearing safety glasses and a lab coat) that must be taken when carrying out this experiment. _____

_____ (1 mark)

3. The letters A to D denote the following types of reactions:

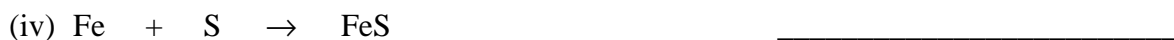
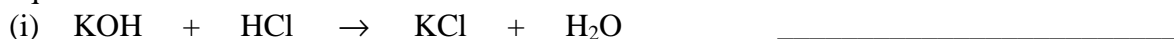
A synthesis

B neutralisation

C precipitation

D thermal decomposition

(a) Select, from A to D, the term which describes the reactions represented by the following equations.



(4 marks)

b) Write ionic equations, **omitting spectator ions**, for the reactions in (a)(i) and (a)(ii) above.

(i) _____

(ii) _____ (2 marks)

c) (i) Write the **ionic half equations** for the reactions in (a) (iv) above.

_____ (2 marks)

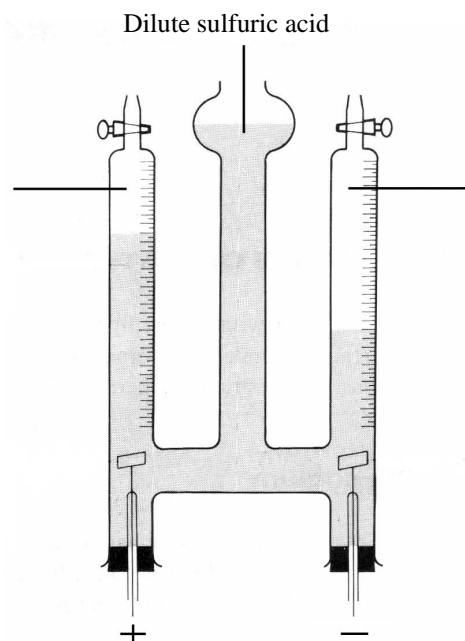
(ii) Explain why this is also a redox reaction.

_____ (2 marks)

4. The diagram shows a Hofmann Voltmeter which is a suitable apparatus to collect the gases liberated during the electrolysis of acidified water, (dilute sulfuric acid).

(a) Label the names of the gases.

(2 marks)



(b) Fill in the table of results below

	At cathode	At anode
ions migrating to the electrodes	H^+	
ionic half equations for the electrode reactions		

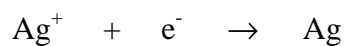
(5 marks)

(c) In another experiment, an electric charge of 1930 coulombs was passed through a solution of silver nitrate.

(i) Convert 1930 coulombs into Faradays.

(1 marks)

(ii) Calculate the mass of silver deposited.



(2 marks)

5. (a) The passage below refers to the manufacture of sulfuric acid by the Contact process. Complete the passage by filling the blank spaces with the correct figures or words selected from the following list. [N.B. Some of these will not be used.]

2, 200, 450, 600, hydrogen, oxygen, water, sulfur dioxide, sulfur trioxide, iron, vanadium (v) oxide, pesticides, fertilisers.

In the first stage of the Contact process, sulfur is burned in air to form _____ . This gas is then used in the second stage of the process. It is mixed with _____ gas, then passed over the catalyst _____ at a temperature of _____ °C and _____ atmospheres pressure. The product of this reaction is _____ gas. Finally, this gas is absorbed in concentrated sulfuric acid forming a liquid called 'oleum' to which the correct amount of _____ is added in order to obtain ordinary concentrated sulfuric acid. One use of sulfuric acid is to make _____ .

(8 marks)

- (b) A sample of sulfur dioxide gas has a volume of 500cm^3 at 25°C and 750mm Hg pressure. This volume of gas is then stored at standard temperature and pressure conditions (0°C and 760mm Hg).

- (i) Convert both temperatures from degrees Celsius to Kelvin temperatures.

_____ (1 mark)

- (ii) Write the 'ideal gas equation' for converting the volume of a gas from one set of conditions to another.

(1 mark)

- (iii) Calculate the volume of sulfur dioxide at stp.

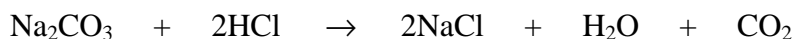
(2 marks)

6. This question refers to a titration experiment to determine the unknown concentration of hydrochloric acid solution using a standard solution of sodium carbonate of molar concentration 0.1M (0.1 mol dm⁻³). 25cm³ portions of sodium carbonate were measured out, placed in three conical flasks and a suitable indicator was added.

Three titres were carried out with the following result:

Titre	1	2	3
2 nd Burette reading (cm ³)	30.50	31.60	30.50
1 st Burette reading (cm ³)	0.00	3.00	2.00
titre value (cm ³)	30.5	28.6	28.5

The equation for the reaction is:



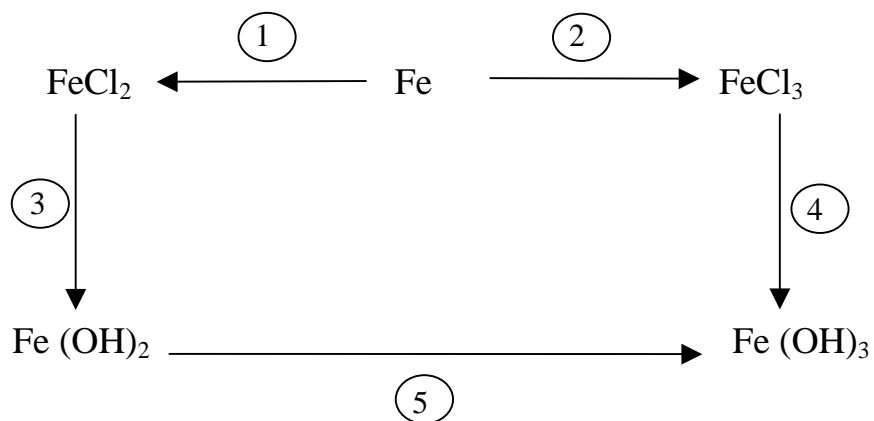
- (a) Name a suitable indicator.
 _____ (1 mark)
- (b) State **two** things that could be done, when close to the 'end point', in order to obtain an exact titre value. _____
 _____ (2 marks)
- (c) (i) Why is one of the titre values ignored?
 _____ (1 mark)
- (ii) Work out the average titre value
 _____ (1 mark)
- (d) Calculate the number of moles of sodium carbonate in 25cm³ of 0.1M solution.
 _____ (2 marks)
- (e) (i) Use the mole ratio of sodium carbonate : acid to find the number of moles of hydrochloric acid that reacted.
 _____ (1 mark)
- (ii) Use your answer to part (e) (i) and the average titre value to find the molarity of the hydrochloric acid.
 _____ (2 marks)

SECTION B:

Answer any TWO questions from this section on the separate sheets provided. Each question carries 20 marks.

7. This question is about ammonia gas and its properties.
- (a) (i) Draw a diagram of the apparatus that can be used to prepare, dry and collect ammonia in the laboratory. (4 marks)
- (ii) Label the diagram, including the names of the reagents and the name of the drying agent. (6 marks)
- (iii) Write a balanced equation for the reaction (2 marks)
- (b) Give **one** observation and **name** a product that is formed when **dry** ammonia **gas** is reacted with- (i) dry hydrogen chloride (ii) heated copper (II) oxide (4 marks)
- (c) What is **seen** when dilute ammonia **solution** is added, first dropwise, then in excess to copper (II) nitrate solution? (2 marks)
- (d) Give an equation for one of the reactions taking place in parts (b) or (c). (2 marks)
8. (a) Imagine that you are provided with **solutions** of the following substances. ammonium carbonate, aluminium sulfate, lead nitrate and sodium iodide.
- (i) Choose any **TWO** of these solutions and state the test (and result) that would confirm the presence of **both** ions in each solution.
(this means that you have to identify **four** ions in all) (8 marks)
- (ii) Give equations for any **THREE** of the tests.
(These may be complete or ionic equations) (6 marks)
- (b) If some solid sodium hydrogencarbonate is decomposed by heat, two gases are liberated and a solid residue is left.
- (i) **Name** the two gases liberated.
- (ii) Describe a test to identify **one** of these gases.
- (iii) Write an equation for the decomposition. (6 marks)

9. The following is a reaction scheme for iron metal and its compounds.



(N.B : note the direction of the arrows)

- (a) for each of the reactions, $\textcircled{1}$ to $\textcircled{5}$, give:
- the name of the reagent (other chemical) required to bring about the change. (10 marks)
 - one observation that would be made during the reaction. (10 marks)
- (b) Write balanced equations for reactions $\textcircled{1}$ to $\textcircled{4}$. (8 marks)
- (c) Use the idea of oxidation numbers to explain why reaction $\textcircled{5}$ is an oxidation reaction (2 marks)

END PAPER
