

JUNIOR LYCEUM ANNUAL EXAMINATIONS 2008

Educational Assessment Unit - Education Division

FORM 5

CHEMISTRY

TIME: 1h 45min

Name: _____

Class: _____

Useful Data: A copy of the Periodic Table is printed below.
 Relative atomic mass may be taken as: Zn = 65
 One mole of any gas occupies 22.4 dm³ at standard temperature and pressure

PERIODIC TABLE

1	2											3	4	5	6	7	0						
		<table border="1" style="margin: auto;"> <tr> <td style="text-align: center;">1 H 1</td> </tr> </table>										1 H 1									<table border="1" style="margin: auto;"> <tr> <td style="text-align: center;">4 He 2</td> </tr> </table>		4 He 2
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						

Key

<i>a</i>	relative atomic mass
X	symbol
<i>b</i>	atomic number

Marks Grid [For Examiners use only]

Question N°.	Section A							Section B			
	1	2	3	4	5	6	7	8	9	10	
Max Mark	8	5	12	10	5	10	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. Select from the following list of substances:

iodine, zinc, methane, ammonium sulfate,
calcium carbonate, carbon, aluminium.

A substance which –

- a) is present in a stalactite _____
- b) is the main constituent of natural gas _____
- c) produces a gas when heated with sodium hydroxide _____
- d) is a solid at room temperature and sublimes on heating _____
- e) has an allotrope which conducts electricity _____
- f) is used to galvanize iron _____
- g) is extracted by electrolysis of its molten oxide _____
- h) is used as a fertiliser _____

(8 marks)

2. The questions below refer to the following elements, $_{13}\text{Al}$ and $_{9}\text{F}$.

- a) These two elements can both form ions. Complete the table below to give the missing information.

element	electron configuration		charge on ion
	of atom	of ion	
aluminium			
fluorine			

(3 marks)

- b) Draw a dot / cross diagram showing only the **outer** electron shells to show the bonding in a fluorine molecule.

(2 marks)

3. a) Consider the following terms that describe the action of electricity on materials.

A = strong electrolyte

B = weak electrolyte

C = conductor but not an electrolyte

D = non-conductor and non-electrolyte

Select, from A to D, the term that describes:

(i) dilute ethanoic acid _____

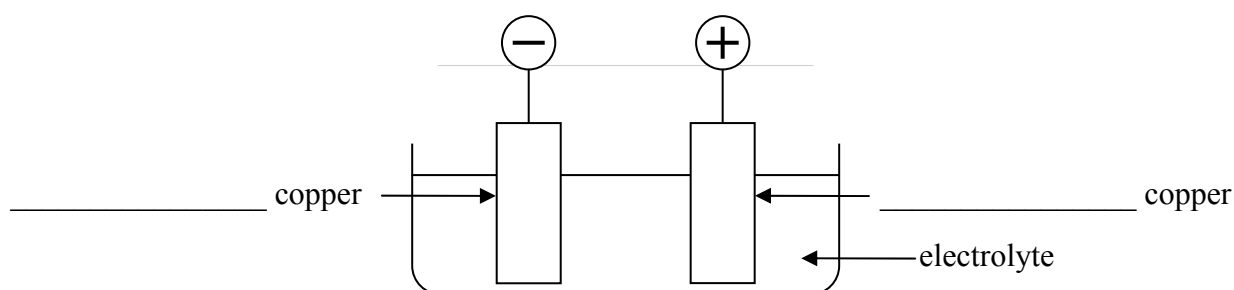
(ii) molten lead _____

(iii) dilute sulfuric acid _____

(iv) ethanol _____

(4 marks)

- b) One application of electrolysis is the purification of copper. This process is represented in the diagram below.



- (i) On the diagram, label the electrodes to show which would be impure copper and which would be pure copper. (2 marks)

- (ii) Give the **name** of a solution which would be a suitable electrolyte.

_____ (1 mark)

- (iii) Give the ionic half equation for the electrode reaction at the cathode.

_____ (1 mark)

- (iv) Give one use of copper and state the property on which the use depends.

use _____

property _____ (2 marks)

- c) Give **two** typical properties of copper that are due to the fact that it is a **transition** metal.

_____ (2 marks)

4. a) Each of the gases – carbon monoxide, hydrogen and methane burns with a blue flame. Select the gas that burns in an excess of air to form:

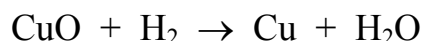
(i) water only _____

(ii) carbon dioxide only _____

(iii) both water and carbon dioxide _____

(3 marks)

- b) Each of these gases can also act as a **reducing agent**.
- (i) Give **one** observation and explain why hydrogen acts as a reducing agent in the following reaction.



observation: _____

hydrogen acts as a reducing agent because:

_____ (2 marks)

- (ii) Write a balanced equation to show how carbon monoxide reduces iron (III) oxide to iron in the Blast Furnace.

_____ (2 marks)

- (iii) Experiments have shown that methane can reduce zinc oxide to zinc metal. Use the idea of oxidation number to explain why the zinc in zinc oxide is reduced.

_____ (1 mark)

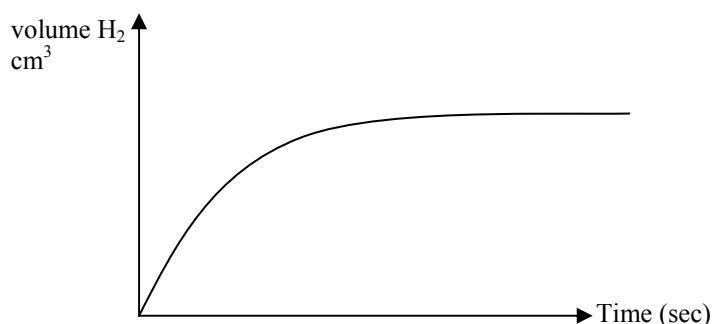
- c) Give **two physical** properties in which carbon monoxide, hydrogen and methane are **similar**.

_____ (2 marks)

5. The rate of reaction between hydrochloric acid and granulated (lumps) of zinc can be followed by collecting the hydrogen gas liberated and recording its volume at fixed time intervals.

- a) Give the name of the apparatus suitable for collecting and recording the volume of hydrogen _____ (1 mark)

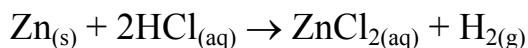
- b) The sketch below shows the slope of the curve obtained when an excess of 2.0M hydrochloric acid was added to a known mass of zinc.



Sketch, on the same axes, the curve you would expect if:

- (i) an excess of 1.0 M hydrochloric acid is added to the same mass of zinc – label this curve A.
- (ii) the same mass of powdered zinc is reacted with the same excess of acid – label this curve B. (2 marks)

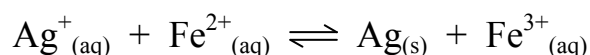
- c) Excess dilute hydrochloric acid reacts with zinc according to the following equation:



If 0.267g of zinc are used in this experiment, calculate the volume of hydrogen, in cm^3 , that would be liberated at stp.

(2 marks)

6. The following equation represents a system in equilibrium.



- a) Name **two** solutions of **compounds** that you could mix to make the system shift from left to right.

(i) solution containing $\text{Ag}^+_{(aq)}$ _____

(ii) solution containing $\text{Fe}^{2+}_{(aq)}$ _____ (2 marks)

- b) State **one** thing you would expect to **see** if the equilibrium does shift from left to right.

_____ (1 mark)

- c) (i) In which direction would the equilibrium shift if a solution containing iron (III) ions is added to the system?

_____ (1 mark)

- (ii) Give a **reason** for your answer to c) (i).

_____ (1 mark)

- d) The forward and backward reactions are also **redox** reactions. Going from left to right, state which ion (Ag^+ or Fe^{2+}) is oxidised, giving a reason in terms of electrons.

_____ (2 marks)

- e) (i) **Name** the reagent which can be used to prove that a solution contains Fe^{2+} or Fe^{3+} ions.

_____ (1 mark)

- (ii) Give an **IONIC** equation (omitting spectator ions) for the reactions of this reagent with either $\text{Fe}^{2+}_{(aq)}$ or $\text{Fe}^{3+}_{(aq)}$ ions.

_____ (2 marks)

7. a) Give the name **or** molecular formula for the **product** of the reaction of ethene with each of the following:
- (i) bromine _____
 - (ii) steam in the presence of hot phosphoric acid catalyst _____
 - (iii) hydrogen (in the presence of nickel catalyst) _____
 - (iv) more ethene (under suitable conditions) _____ (4 marks)
- b) (i) The reactions described in a) (i) to (iv) are similar types of reaction. What is the **general term** used to describe these reactions?
- _____
- (ii) What is the specific name given to the type of reaction in a) (iv)?
- _____ (2 marks)
- c) Write balanced equations for any **two** of the reactions described in a) (i) to a) (iv).
- _____
- _____ (4 marks)

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

8. This question is about the following three gases:

sulfur dioxide, chlorine and hydrogen chloride.

- a) Construct a table to show (i) the names **or** formulae of the reagents required to prepare these gases **in the laboratory**; (ii) a test for each of these gases. (9 marks)
- b) Write a balanced equation for the preparation of **one** of these gases. (2 marks)
- c) Hydrogen chloride, chlorine and carbon dioxide are dissolved in water containing pH indicator. Describe the different result that will be obtained for each solution of gas. (3 marks)
- d) Ammonia is an alkaline gas that can be prepared in the laboratory by heating calcium hydroxide with ammonium chloride.
 - (i) Write a balanced equation for the preparation of ammonia.
 - (ii) Give a reason why its solution in water is only slightly alkaline. (3 marks)
- e) Nitrogen dioxide is another acidic gas. It is prepared by the thermal decomposition of lead (II) nitrate. Write an equation for the decomposition and say how the gas is identified. (3 marks)

9. a) A student decides to investigate if some red cabbage juice is composed of one or more colours.
Draw a diagram of the experiment set-up, describe the experiment procedure and indicate what would be seen if the red cabbage juice is in fact composed of several colours. (10 marks)
- b) Red cabbage juice can be used as an **indicator** in an acid / alkali **titration** in order to determine the **end-point**.
- (i) Name **one** other indicator that would be suitable for an acid / alkali titration and state its colour in acid and alkaline solutions. (3 marks)
- (ii) Name **four** items of apparatus that would be required to carry out the titration. (4 marks)
- (iii) Explain what is meant by the 'end-point'. State two important practical steps in order to determine an exact end-point. (3 marks)
10. Explain each of the following statements.
Give equations in your answers to parts a) and b) only.
- a) Soap (e.g. sodium stearate, Na St) produces a **scum** with hard water. (4 marks)
- b) Since sulfuric acid is a dibasic acid it can react with sodium hydroxide to form both a **normal salt** and an **acid salt**. (6 marks)
- c) The solid, liquid and gaseous states may be explained in terms of the **arrangement** and **movement** of the particles present. (6 marks)
- d) Air is a mixture of gases (mainly nitrogen and oxygen) and not a chemical compound. (4 marks)