

Name : _____ ()

Class : 4E1



Greenridge Secondary School

Mid-Year Examination 2007

Pure Chemistry 5068

Paper 2

Secondary Four Express

Date : 2 May 2007

Duration : 1 h 45 min

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READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page and on all separate answer paper used.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions in the spaces provided.

Section B

Answer **all three** questions, the last question is in the form **either/or**.

Write your answers on foolscap papers provided.

At the end of the examination, hand up the foolscap papers separately from the question paper.

The number of marks is given in brackets [] at the end of each question or part question.

A copy of the Periodic Table is printed on page **12**

Parent's Signature & Date

FOR EXAMINER'S USE	
Section A	/50
Section B	/30
Total	/80

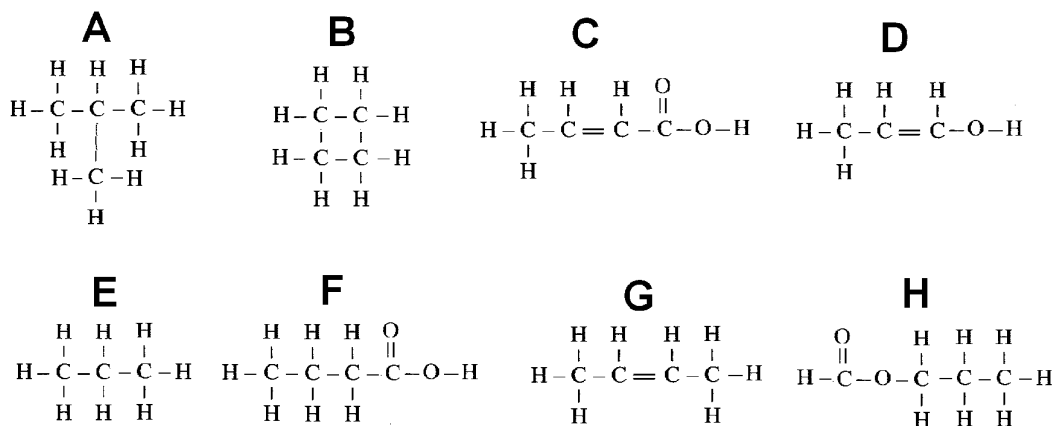
Setter : Mr Victor Lee

*This paper consists **12** printed pages, including this page.*

Section A (50 marks)

Answer ALL questions from this Section.

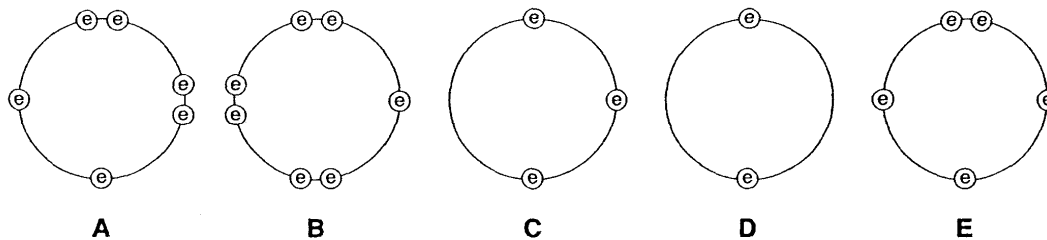
1. The following is a list of structural formulae of organic compounds. [7]



Using only the letters, **A** to **H**, to answer the following questions.

- (a) a compound which dissolves in water to form an acidic solution _____
- (b) an ester called as propyl methanoate _____
- (c) two hydrocarbons which are from the same homologous series _____
- (d) two compounds which react to form an ester _____
- (e) a hydrocarbon which undergoes an addition reaction with steam _____
- (f) two pairs of isomers
- (i) first pair : _____ and _____
- (ii) second pair : _____ and _____

2. These diagrams show the electron arrangement in the outer shells of five elements, **A** to **E**. All elements are from Period 3 of the Periodic Table.



- (a) Put the letters **A** to **E** in the table to show which elements are metals and which are non-metals. [3]

	Metals	Non-metals
Elements		

(b) Which element is most likely to be in Group VI? [1]

(c) Which element will form an ion of the type X^{2+} ? [1]

(d) Which element has an atomic number of 15? [1]

(e) Which two elements will form an ionic compound with a formula of the type YZ_2 ? [1]

3. Chlorine can form either covalent or ionic bonds.

(a) Draw a 'dot-and-cross' diagram (*showing only outer electron shells*) to show the bonding in

(i) sodium chloride, NaCl, [2]

(ii) chlorine gas, Cl₂ [2]

(b) Explain why sodium chloride has a higher melting point than chlorine. [3]

4. (a) What is meant by 'catalyst'? [1]

(b) Name a catalyst used for each of the following conversions. [1]

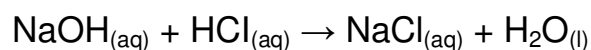
(i) nitrogen to ammonia

(ii) sulphur dioxide to sulphur trioxide [1]

(iii) an alkene to an alcohol [1]

(iv) an alkene to an alkane [1]

5. Aqueous sodium chloride can be prepared by titrating aqueous sodium hydroxide with dilute hydrochloric acid. The equation for this reaction is shown below.

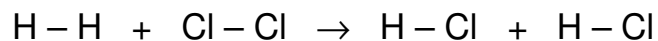


In this titration, 25.0 cm³ of 1.5 mol/dm³ sodium hydroxide was used.

(a) Calculate the volume of 2.0 mol/dm³ hydrochloric acid needed to neutralise the alkali. [2]

(b) Calculate the mass of sodium chloride formed. [2]

6. Hydrogen chloride can be manufactured by reacting hydrogen and chlorine together. The reaction is exothermic.



- (a) What is the meaning of the term exothermic? [1]

- (b) Explain, in terms of bond breaking and bond making, why the reaction between hydrogen and chlorine is exothermic. [2]

7. When copper(I) oxide dissolves in dilute sulphuric acid, copper(II) sulphate and copper metal are produced.

- (a) Write the balanced chemical equation for the reaction. [1]

- (b) Discuss the changes in the oxidation states of copper in this reaction. [2]

- (c) Is copper(I) oxide oxidised or reduced this reaction? [1]

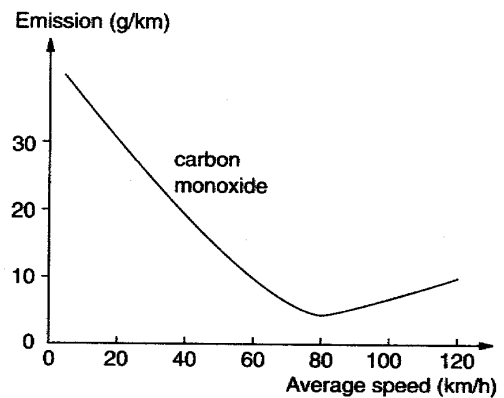
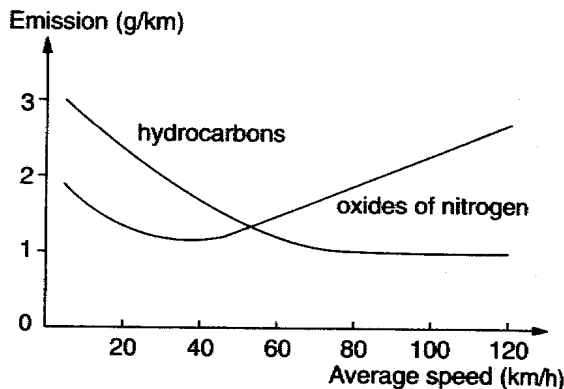
- (d) This reaction is called a disproportionation reaction. From your answer in (ii), deduce one characteristic feature of a disproportionation reaction. [2]

8. (a) Apart from fuel, what is the other substance needed for combustion or burning? [1]

- (b) Petrol is a hydrocarbon. What are the products of complete combustion of petrol in a car engine? [1]

- (c) How does the supply of air affect the products of combustion? [1]

- (d) The graphs below show approximately how the emissions of hydrocarbons, oxides of nitrogen and carbon monoxide vary with speed. Emissions are measured in g/km, but note the scale for carbon monoxide emissions are ten times greater than that for the other two pollutant gases.



- (i) What speed is best for reducing the emission of hydrocarbons? [1]

- (ii) What speed is best for reducing the emission of carbon monoxide? [1]

- (iii) What speed is best for reducing the overall emission of these gases? [1]

9. Some pills for headaches consist of a drug to stop the pain, a powdered solid acid and a powdered carbonate. The pills come sealed in foil. When the pills are placed in water there is effervescence of a gas. The liquid is then swallowed when the effervescence stopped.

(a) (i) Name the gas that produces the effervescence. **[1]**

(ii) Why does the reaction only take place in water? **[1]**

(b) Why do the pills contain the acid and carbonate as powders? **[1]**

(c) Why is it necessary to keep such pills sealed in foil? **[1]**

(d) Write the ionic equation for the reaction between the acid and the carbonate when they are dissolved in water. **[1]**

Section B (30 marks)

Answer ALL **THREE** questions from this Section.

Each question is allocated **TEN** marks

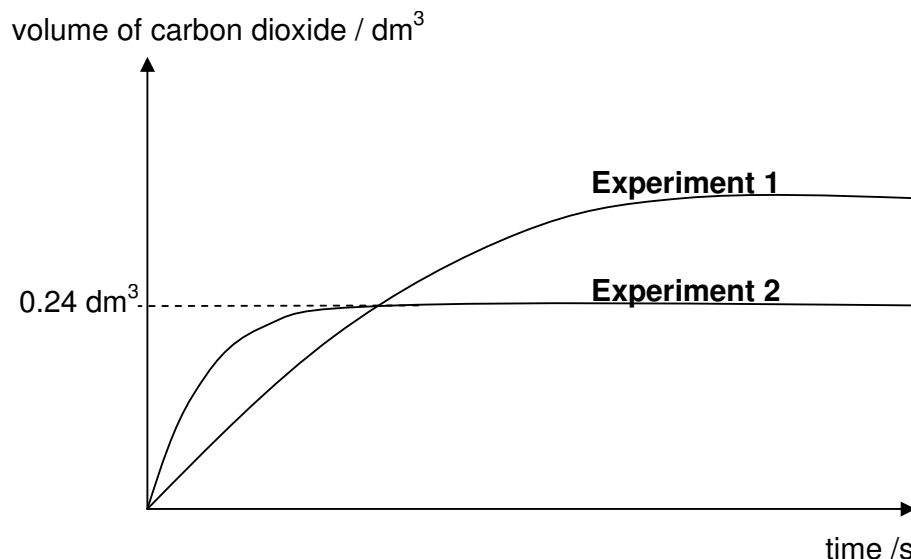
10. An experiment was carried out to measure the rate of reaction between powdered calcium carbonate and dilute acids.

(a) In **Experiment 1**, 30cm³ of 1.0 mol/dm³ hydrochloric acid was used to react with 10g of powdered calcium carbonate.

(i) Write a balanced equation, *including state symbols*, for the reaction between powdered calcium carbonate and dilute hydrochloric acid. [2]

(ii) Calculate the total volume of carbon dioxide that is made from this reaction at room temperature and pressure. [2]

(b) A further experiment using hydrochloric acid, **Experiment 2**, was carried out. The results of **Experiments 1** and **2** are shown on the graph.



Suggest the concentration and volume of acid used for **Experiment 2**. [2]

(c) **Experiment 3** was carried out using 30 cm³ of 2.0 mol/dm³ sulphuric acid. The initial rate of reaction for **Experiment 3** was faster than for the other experiments but the reaction stopped suddenly after only a small amount of gas had been given off.

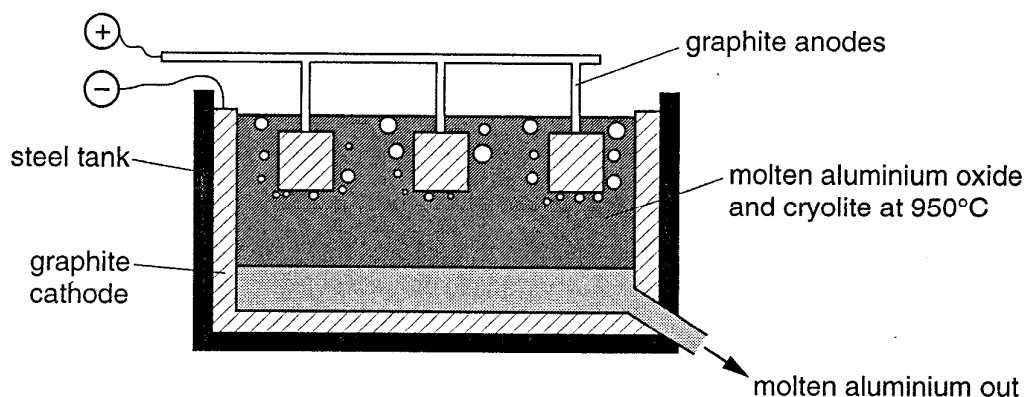
(i) Name the salt formed in **Experiment 3**. [1]

(ii) Explain why the reaction stops suddenly. [1]

(iii) Explain why the initial rate of reaction was faster than for the other experiments. [2]

11.

- (a) This diagram shows an electrolysis tank used industrially to produce aluminium from aluminium oxide.

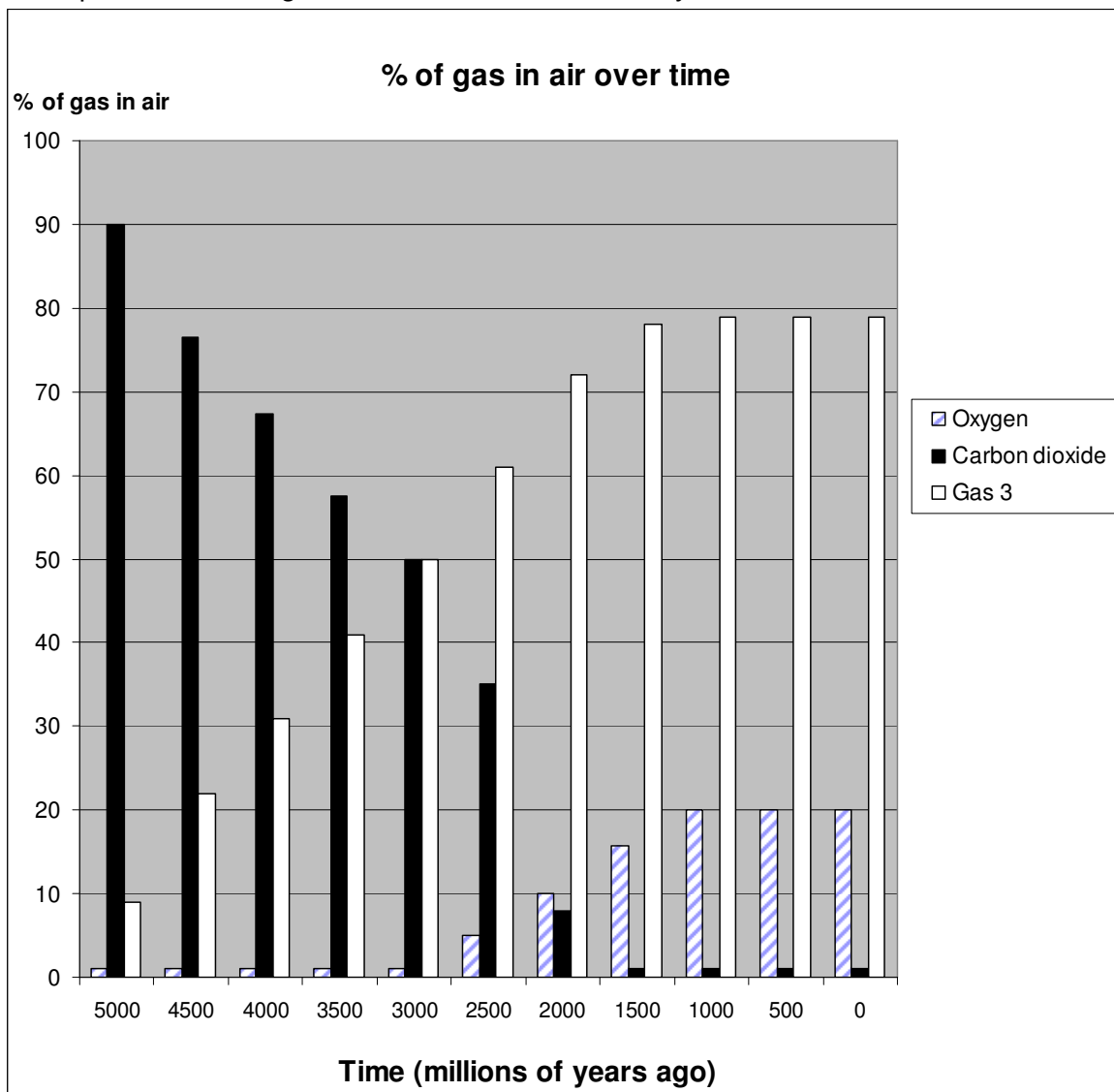


One reason that this process is expensive is that the graphite anodes need replacing regularly.

- (i) Explain, with the help of an equation, why the graphite anodes need replacing regularly. [2]
- (ii) Adding molten cryolite reduces the cost of the process by lowering energy demand. Explain how adding molten cryolite reduces the energy demand of the process. [2]
- (iii) State one use of aluminium. State the property of aluminium which makes it suitable for that use. [1]
- (b) Electrolysis is also used to purify copper.
- (i) Draw and label a diagram of apparatus which could be used to purify a block of impure copper. [2]
- (ii) Describe what happens at each electrode during the electrolysis. Write the equation for the reactions that takes place at the anode and cathode. [3]

12. **EITHER**

This chart shows how the percentage of three of the gases in the Earth's atmosphere has changed over five thousand million years.

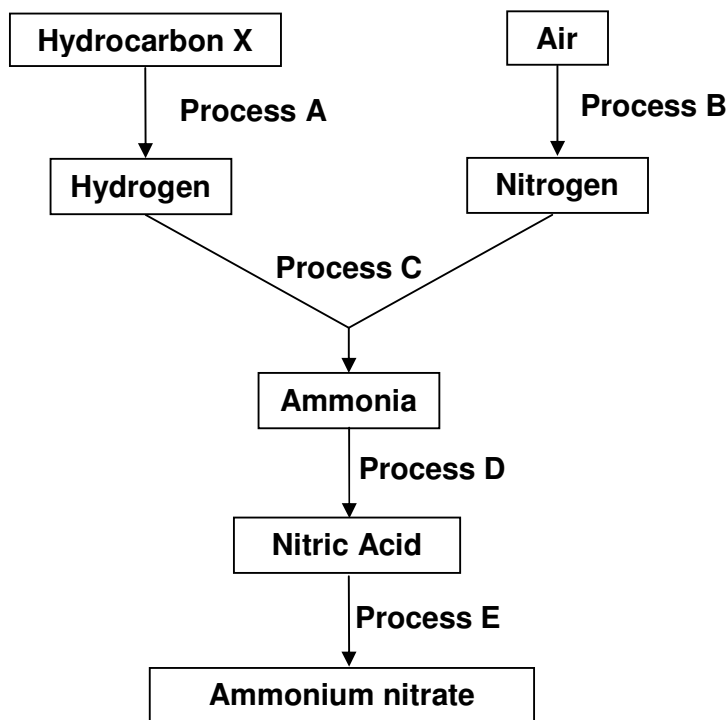


Use information from the chart to answer the following questions.

- (a) (i) How long have the percentages of all gases in the atmosphere remained unchanged? [3]
- (ii) Name **gas 3**. Give a reason for your answer. [3]
- (b) (i) Describe how the percentages of carbon dioxide and oxygen have changed.
- (ii) Suggest an explanation for the changes that have taken place in carbon dioxide and oxygen percentages, identifying the processes involved and giving equations for any reactions. [7]

OR

The flow diagram refers to processes used in manufacturing important ammonium compounds.



- (a) Give the name of
- (i) process **A**. [1]
 - (ii) process **B**. [1]
 - (iii) process **C**. [1]
- (b) (i) Name the substance that reacts with nitric acid in process **E** to produce ammonium nitrate. [1]
- (ii) Write a balanced equation for the reaction in **b(i)**. [1]
- (iii) What is the major use of ammonium nitrate? [1]
- (c) State the conditions of process **C** and write an equation to show the formation of ammonia. [3]
- (d) Process **D** involves a three-stage process for converting ammonia into nitric acid.
- Stage 1: $4\text{NH}_{3(g)} + 5\text{O}_{2(g)} \rightarrow 4\text{NO}_{(g)} + 6\text{H}_2\text{O}_{(g)}$
- Stage 2: $4\text{NO}_{(g)} + 2\text{O}_{2(g)} \rightarrow 4\text{NO}_{2(g)}$
- Stage 3: $4\text{NO}_{2(g)} + 2\text{H}_2\text{O}_{(l)} + \text{O}_{2(g)} \rightarrow 4\text{HNO}_{3(l)}$

Use these three equations to write an overall equation for the conversion of ammonia to nitric acid. [1]

~ The End ~

The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0
		1 H Hydrogen							4 He Helium
7 Li Lithium 3	9 Be Beryllium 4								
23 Na Sodium 11	24 Mg Magnesium 12								19 F Fluorine 9
39 K Potassium 19	40 Ca Calcium 20								35.5 Cl Chlorine 17
85 Rb Rubidium 37	88 Sr Strontium 38								79 Se Selenium 34
133 Cs Caesium 55	137 Ba Barium 56								127 I Iodine 53
226 Fr Francium 87	226 Ra Radium 88								209 At Astatine 85
									86 Rn Radon
									86 Rn Radon

11 B Boron 5	12 C Carbon 6	13 Al Aluminium 13	14 N Nitrogen 7	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18
27 Al Aluminium 13	28 Si Silicon 14	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34
49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54	55 Cs Caesium 55	56 Ba Barium 56
81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86	87 Fr Francium 87	88 Ra Radium 88
101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	104 Rf Rutherfordium 104	105 Db Dubnium 105	106 Sg Seaborgium 106	107 Bh Bohrium 107	108 Hs Hassium 108
109 Mt Meitnerium 109	110 Ds Darmstadtium 110	111 Rg Roentgenium 111	112 Cn Copernicium 112	113 Nh Nihonium 113	114 Fl Flerovium 114	115 Mc Moscovium 115	116 Lv Livermorium 116
117 Ts Tennessine 117	118 Og Oganesson 118	119 Uue Ununennium 119	120 Uuo Unbinilium 120	121 Uuq Untrium 121	122 Uuq Unquadrium 122	123 Uuq Unquadium 123	124 Uuq Unquadium 124
125 Uuq Unquadium 125	126 Uuq Unquadium 126	127 Uuq Unquadium 127	128 Uuq Unquadium 128	129 Uuq Unquadium 129	130 Uuq Unquadium 130	131 Uuq Unquadium 131	132 Uuq Unquadium 132
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