Name : _____ ( ) Class : 4E1

Greenridge Secondary School
Mid–year Examination 2009

Subject : Pure Chemistry (5072)
Secondary Four Express
Paper 2

Date : 8 May 2009 (Fri) **Duration : 1 h 45 mins**

INSTRUCTIONS TO CANDIDATES

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

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 any lined pages provided and/or a separate answer paper.
All essential working must be shown.

INFORMATION FOR CANDIDATES
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 14** .

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

Name of Setter: Mr Victor Lee

This question paper consists of **15** printed pages including this cover page

Section A

Answer **all** the questions in this section in the spaces provided.
The total mark for this section is 50.

A1 (a) A gas jar at room temperature contains a mixture of equal volumes of hydrogen gas and oxygen gas.

(i) Which molecules, hydrogen or oxygen, are moving faster? Give a reason for your answer. [2]

(ii) Using Kinetic Particle Theory, explain what happens to the molecules if the mixture is warmed to 100°C? [2]

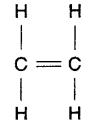
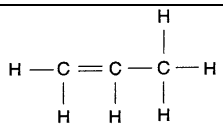
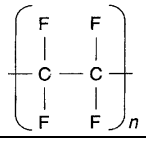
(b) A lighted splint is introduced into the gas jar in (a).

(i) Describe and explain your observation. [2]

(ii) Write the chemical equation for the reaction taking place in (b). [1]

(iii) Name the substances which will be present in the gas jar after the reaction. [2]

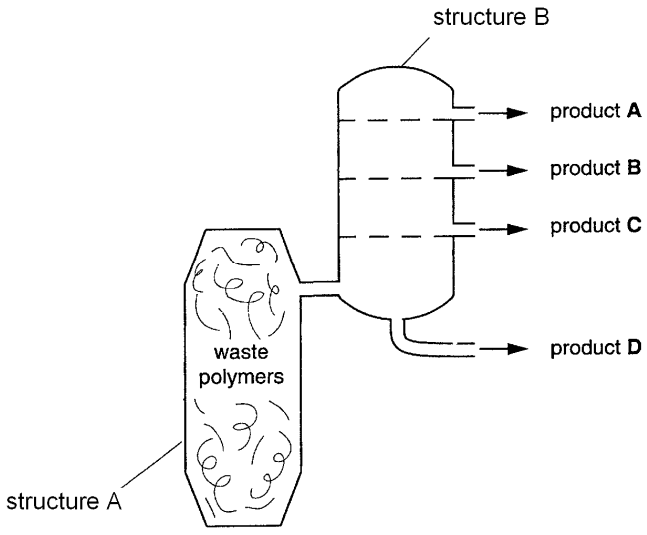
A2 The table contains some information about three addition polymers and the monomers from which they are made.

polymer	monomer		polymer	
	name	**structural formula**	**name**	**structural formula**
X	ethene		poly(ethene)	
Y	propene			
Z			polytetrafluoroethene	

(a) Complete the table by filling in the empty boxes. [5]

(b) Explain what is meant by the terms '*polymer*' and '*monomer*'. [2]

(c) Waste polymers can be recycled by heating in a furnace. The waste decomposes into a mixture of hydrocarbons which can be separated as shown below.

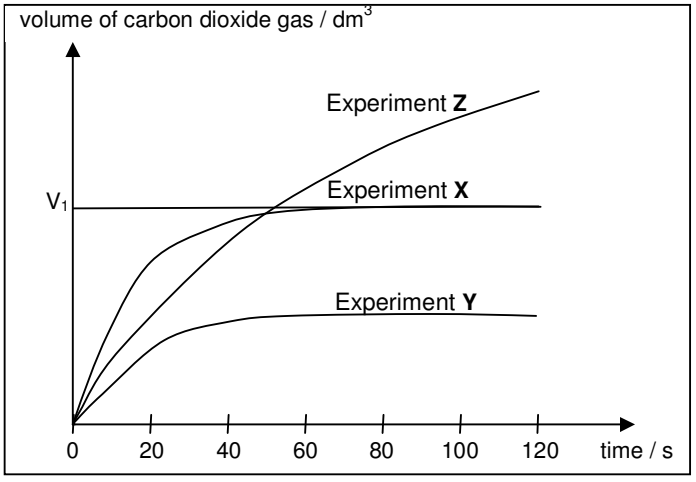


(i) Name the separation technique used in *structure B*? [1]

(ii) Which of the products, **A**, **B**, **C** or **D**, has the highest boiling point? Explain. [2]

(iii) Which of the polymers in (a) would **not** decompose to give hydrocarbons? Explain. [2]

A3 The graphs below show the results of three separate experiments conducted to investigate the speed of reaction between hydrochloric acid and calcium carbonate in a reaction flask. The volume of gas collected was plotted against time.



Experiment **X** : 10g powered $CaCO_3$ + 500cm^3 of 2.0mol/dm^3 HCl
Experiment **Y** : 10g powered $CaCO_3$ + 200cm^3 of ***M*** mol/dm^3 HCl
Experiment **Z** : 50g powered $CaCO_3$ + 500cm^3 of 1.0mol/dm^3 HCl

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

(b) Find, V_1, the volume of carbon dioxide produced in experiment **X**. [2]

(c) The volume of gas produced in experiment **Y** is half of that in experiment **X**. Find the concentration, ***M***, of the hydrochloric acid used. [2]

(d) According to the graph, the volume of carbon dioxide gas collected for experiment **Z** is only 1.5 times that of experiment **X**. Calculate the theoretical value of this volume and explain the difference. [3]

A4 Oxalic acid is a weak dibasic acid. Hydrated oxalic acid has the formula $H_2C_2O_4.2H_2O$. Oxalic acid dehydrated crystals were dissolved in water to make up oxalic acid. 25.0 cm^3 of this solution required 24.6 cm^3 of 1.5 mol/dm^3 of sodium hydroxide for complete neutralization.

(a) What is meant by a *'weak acid'* ? [2]

(b) Explain the term '*dibasic'*. [1]

(c) Write the chemical equation for the above neutralization reaction. [1]

(d) Write an ionic equation for neutralization reaction. [1]

A5 Manganese (VI) oxide is a catalyst used in the decomposition of aqueous hydrogen peroxide.

(a) Explain the term *'catalyst'*. [1]

(b) When hydrogen peroxide is added to aqueous acidified potassium manganate(VII) , the purple solution turns colourless.

$5H_2O_{2(l)} + 2KMnO_{4(aq)} + 3H_2SO_{4(aq)} \rightarrow 2MnSO_{4(aq)} + K_2SO_{4(aq)} + 5O_{2(g)} + 8H_2O_{(l)}$

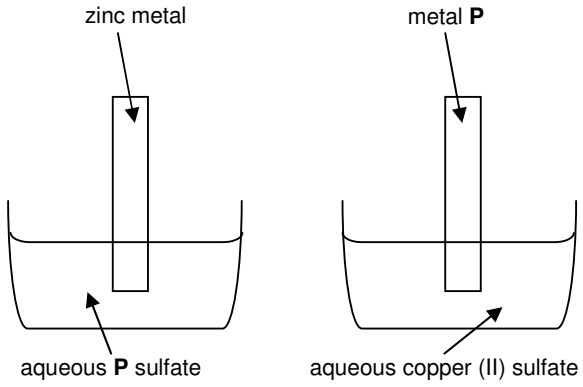
Is hydrogen peroxide acting as an oxidizing agent or reducing agent in the above reaction? Explain your answer in terms of oxidation states. [2]

(c) Write an ionic equation for the reaction in (b). [1]

A6 (a) **X**, **Y** and **Z** are three metals. Red hot carbon reduces the oxides of **Y** and **Z** but **not** oxide of **X**. Metal **Z** reacts slowly with hot dilute sulfuric acid while **Y** has **no** visible reaction with hot dilute sulfuric acid. Arrange the three metals in order of ***decreasing*** reactivity. [1]

(b) Explain why a piece of aluminium foil shows very **little** reaction when placed in dilute sulfuric acid. [1]

(c) Strips of metal zinc and **P** were dipped into two solutions as shown below.

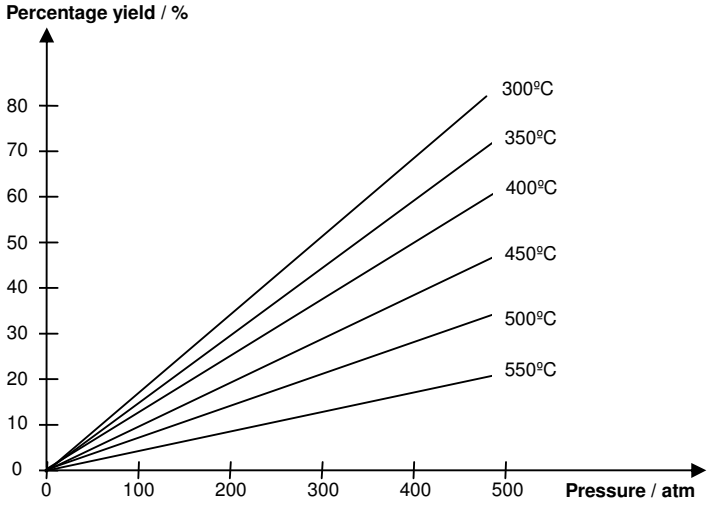


A metallic deposit appears on both strips.

(i) Suggest an identity of **P**. [1]

(ii) Explain your choice of **P**. [1]

A7 Ammonia is produced from hydrogen and nitrogen using Haber Process. Haber Process is a reversible reaction. The graph below shows the percentage yield of ammonia formed in the equilibrium mixture under the different conditions of temperature and pressure.



(a) (i) Write the chemical equation, *with state symbols*, for Haber Process. [1]

(ii) Is Haber Process an exothermic or endothermic reaction? Explain. [2]

(b) A catalyst is used in Haber Process.

(i) Name the catalyst. [1]

(ii) Explain why catalyst must be used in powdered form. [1]

(c) Industrial production of ammonia employs the conditions of 250 atm and 450℃. Why is a pressure of 500 atm and 300 ℃ **not** chosen for a much higher yield? [2]

Section B

Answer all **three** questions from this section.
The last question is in the form either/or and only one of the alternatives should be attempted.
The total mark for this section is 30.
Write your answers on any lined pages provided and/or a separate answer paper.

B8

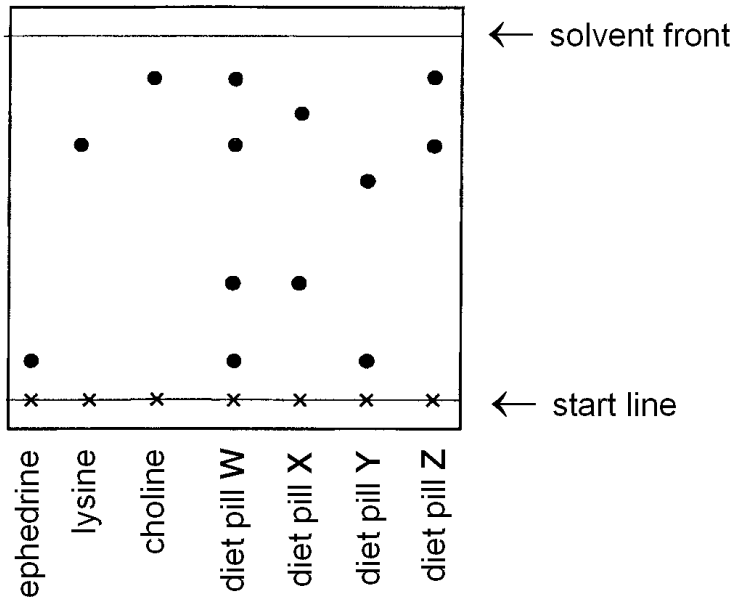
FACT SHEET

Ephedrine
Ephedrine, caffeine and salicin are used together in thermogenic weight loss pills to *speed up the metabolism and thus cause food energy to burn faster*. It is a popular supplement taken by body builders before workouts due to the increased amount of energy and alertness. However, Ephedrine-based diet pills are **banned** from over-the-counter sales as U.S. Food & Drug Administration (or FDA) has received reports of 150 deaths and 16,000 complaints associated with the use of the stimulant diet pills.

Choline
Choline assists in *controlling one's weight* as well as *cholesterol levels*, keeping cell membranes healthy and in preventing gallstones. It is also most useful in the maintenance of the nervous system, assisting memory and learning, and may help to fight infections, including hepatitis and AIDS. Choline is critical for normal membrane structure and function.

Lysine
Lysine is required for growth and bone development in children, assists in calcium absorption and *maintaining the correct nitrogen balance in the body and maintaining lean body mass*. Furthermore it is needed to produce antibodies, hormones, enzymes, collagen formation as well as repair of tissue.

Some common diet pills were tested together with ephedrine, lysine and choline. After separation by chromatography, a locating agent was used on the chromatogram. The diagram shows a chromatogram for ephedrine, lysine, choline and four diet pill samples.



(a) (i) What is a locating agent? [1]

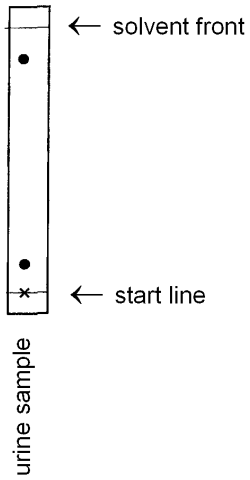
(ii) Explain why a locating agent needs to be used. [1]

(b) Draw a labeled diagram to show how the above separation is carried out? [3]

(c) Which diet pill(s) should be **banned**? Explain. [2]

(d) Which diet pill(s) may **not** have any effect on weight control? Explain. [2]

(e) A patient was admitted to hospital when he collapsed due to accelerated, irregular heart beat. He was suspected to have taken Ephedrine. His urine was tested and the diagram below shows the chromatogram of his urine test.



Show, by using R_f values, whether the patient has taken diet pills containing Ephedrine. [3]

B9 (a) The following shows a sequence of chemical reactions.

ethanol $\xrightarrow{\text{stage A}}$ ***ethanoic acid*** $\xrightarrow{\text{stage B}}$ ***ethyl ethanoate***

(i) At which stage, A or B, is acidified potassium dichromate(VI) added into the solution? [1]

(ii) Explain the role of acidified potassium dichromate(VI) in the stage you named in (a)(i). [1]

(iii) What must be added in stage B to produce ethyl ethanoate. [1]

(b) Ethanol, C_2H_5OH, is used in Brazil as a fuel instead of petrol. In fact, the largest single use of ethanol is as a motor fuel and fuel additive. Ethanol is also used as fuel in more than 90% of new cars sold in Brazil. The ethanol is manufactured by a fermentation process from sugar cane.

(i) Name the process of converting sugar cane into ethanol. [1]

(ii) Give the conditions needed for the process in (b)(i). [1]

(iii) What is the name of the gas produced during this fermentation? [1]

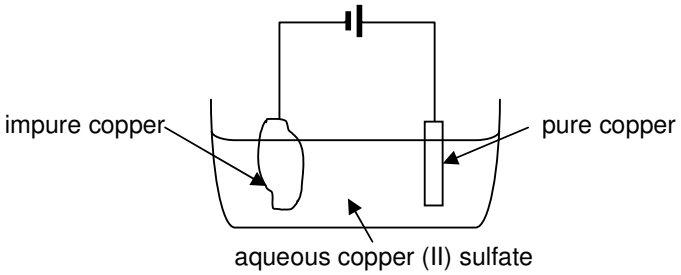
(iv) How would you test for this gas named in (b)(iii)? [1]

(c) When a jug of beer is left to stand for a few days, it turns sour. Explain this phenomenon. [1]

EITHER

B10 Very pure form of copper is needed for electrical wiring to ensure good electrical conductivity.

(a) When copper is extracted from its ore, it contains some impurities. Impure copper is purified by electrolysis, using aqueous copper(II) sulfate as an electrolyte.



(i) When setting up the electrolytic cell, a **mistake** was made in the above setup. State the mistake made, and suggest the correct setup. [2]

(ii) Write equations, including state symbols, for the reactions at each electrode. [2]

(iii) What would be observed during the electrolysis? Explain. [2]

(b) (i) Draw a diagram to show the metallic bonding in pure copper. [2]

(ii) Explain why copper metal conducts electricity and explain how this differs from the conduction of electricity by aqueous copper(II) sulfate. [2]

OR

B10 The table below shows the properties of six substances. Each of substances **A, B, C, D, E** and **F** listed can be an element or a compound.

Substance	when mixed with water containing universal indicator	Melting point /ºC	Boiling point /ºC	Electrical conductivity		
				in aqueous state	in solid state	in molten state
A	dissolves in water, turn universal indicator red	–114	–85	good	non-conductor	non-conductor
B	dissolves in water, turn universal indicator blue	–78	–34	good conductor	non-conductor	non-conductor
C	dissolves in water, turn universal indicator green	801	1465	good conductor	non-conductor	good conductor
D	insoluble in water	1650	2230	non-conductor	non-conductor	non-conductor
E	dissolves in water, turn universal indicator purple	318	1390	good conductor	non-conductor	good conductor
F	reacts with water to form a neutral, colourless gas. solution turns blue.	842	1484	good conductor	good conductor	good conductor

Answer each of the following with a *reason*.

(a) Which substance is a metallic oxide? [2]

(b) Which substance has a giant molecular structure? [2]

(c) Which substance is a simple covalent molecule? [2]

(d) Which substance is a metal? [2]

(e) Which substance(s) is/are ionic compounds. [2]

~ The End ~

The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series

†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key: a / X / b

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Colours of Some Common Metal Hydroxides

Calcium hydroxide	white
Copper(II) hydroxide	light blue
Iron(II) hydroxide	green
Iron(III) hydroxide	red-brown
Lead(II) hydroxide	white
Zinc hydroxide	white

A5c

$$5H_2O_{2(l)} + 2MnO_4^-{}_{(aq)} + 6H^+{}_{(aq)} \rightarrow 2Mn^{2+}{}_{(aq)} + 5O_{2(g)} + 8H_2O_{(l)}$$

B10

A = HCl

B = ammonia

C = sodium chloride

D = silicon dioxide