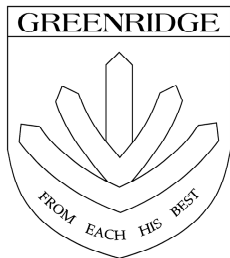


Name : _____ ()

Class : 4E1



Greenridge Secondary School

2nd Preliminary Examination 2005

Subject : Chemistry (5068)
Secondary Four Express
Paper 2

Date : 22 Sep 2005

Duration : 1 h 45 min

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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.

Write your answers in the spaces provided on the question paper.

Section B

Answer **three** questions. Do **not** answer both of **B11** and **B12**.

Write your answers on the separate foolscap paper.

At the end of the examination, hand up the foolscap papers separately from the question 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 10**.

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

This paper consists of 10 printed pages, including this page.

Section A

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

The total mark for this section is 50.

A1 Choose from the following substances to answer the questions below. [7]

Concentrated sulphuric acid

Manganese (IV) oxide

Phosphoric (V) acid

Copper (II) sulphate

Vanadium (V) oxide

Aluminium oxide

Titanium

Nickel

Yeast

Iron

Each substance can be used once, more than once or not at all.

Name a catalyst for each of the following reactions:

- (a) Decomposition of hydrogen peroxide _____
- (b) Contact process _____
- (c) Haber process _____
- (d) Hydration of ethene to produce ethanol _____
- (e) Hydrogenation of margarine _____
- (f) Catalytic cracking of naphtha to produce ethene _____
- (g) Fermentation of sugar to produce ethanol _____

A2 Chlorine is a reactive halogen. It forms compounds with both bromine and sodium.

Bromine chloride (BrCl) melts at -66°C and sodium chloride (NaCl) melts at 808°C .

(a) Name the types of bonds present in each substance. [2]

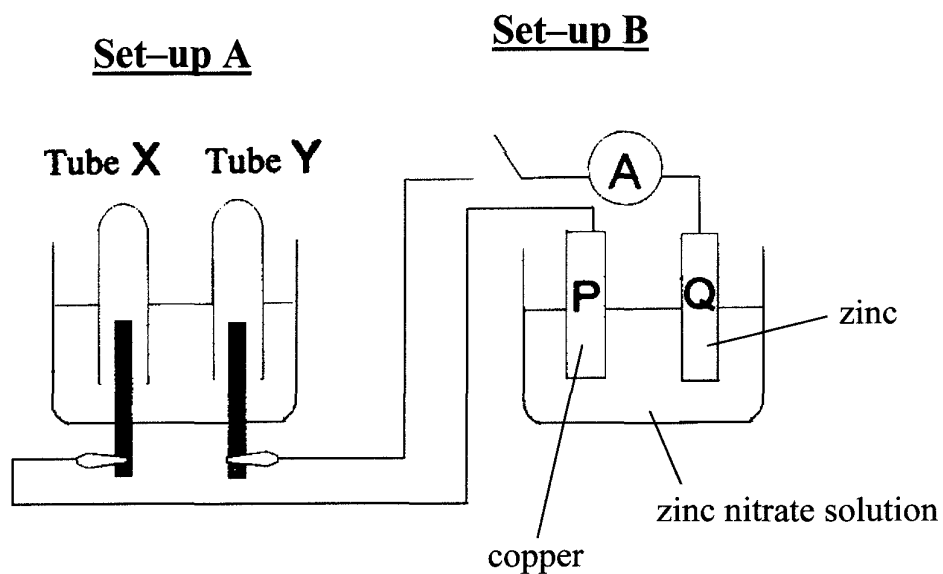
Bromine chloride : _____

Sodium chloride : _____

(b) Explain the difference in melting points in terms of their bondings. [4]

(c) Draw a 'dot' and 'cross' diagram to show the bonding in bromine chloride. Show only the outer shell electrons. [2]

- A3 The following experimental set-up which was used by a student to perform a experiment. The two black colour electrodes used are graphite electrodes.



- (a) What is the function of **Set-up B** in this experiment? [1]

- (b) When the switch is closed, what would be observed in **Set-up B**? [2]

- (c) If the electrolyte used in **Set-up A** is dilute aqueous copper (II) chloride, name the products produced at the cathode and anode in **Set-up A**. [2]

Cathode : _____

Anode : _____

- (d) Give the half equation of the reaction that occur at the cathode in **Set-up A**. [1]

- (e) If the electrolyte used in **Set-up A** is changed to concentrated sodium chloride solution and both the electrodes changed to copper. Give the half equation of the reactions that occur at the cathode and anode respectively. [2]

Equations at cathode : _____

Equations at anode : _____

A4 A new element Lerine has been isolated. It is a reactive poisonous gas at room temperature and pressure. It is slightly soluble in water forming an acidic solution. Lerine reacts violently with molten sodium to form a white solid. This white solid has a melting point of 909°C. It is also a good conductor of electricity in both aqueous and molten state.

(a) (i) Which group in the Periodic Table is Lerine likely to fall in? [1]

(ii) Name another element in the same group that exist as a solid at 25°C. [1]

(b) (i) How many electrons will a Lerine atom have in its outermost shell? [1]

(ii) Give the formula of its ion if its symbol is **Le**. [1]

(c) (i) Using the symbol **Le** for Lerine, write a balanced chemical equation to show its reaction with sodium. [1]

(ii) In this reaction with sodium, is the white solid formed ionic or covalent? Explain. [2]

A5 Sulphuric acid is a strong acid and the carboxylic acid made by the oxidation of Oil of Neem is a weak acid. Both acids will react with calcium carbonate.

(a) Describe what you would see when solid calcium carbonate is added to an aqueous solution of either acid. [1]

(b) Aqueous solutions of the two acids, with the same concentration, react at different rates with the solid carbonate. Suggest a reason why they react at different rates. [2]

A8 Two naturally occurring ores of copper are cuprite, Cu_2O , and tenorite, CuO .

(a) Give the oxidation state of copper in each ore. [2]

(i) oxidation state of copper in Cu_2O _____

(ii) oxidation state of copper in CuO _____

(b) Copper can be extracted from tenorite by heating the ore with powdered carbon.

(i) Write an equation for this reaction. [1]

(ii) Explain, in terms of electrons, why the copper in tenorite has been reduced. [1]

(c) Tenorite is found to contain 20% impurities. How many grams of copper can be extracted from 100g of tenorite? [2]

Section B

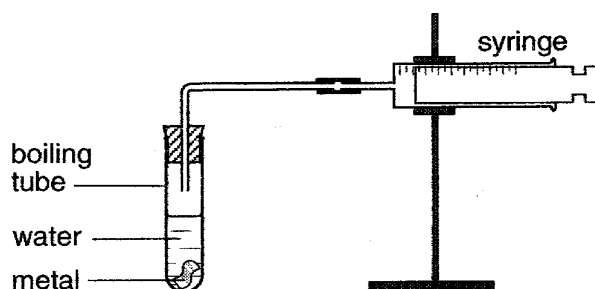
Answer **three** questions

Answer **both** question **B9** and question **B10**.

Choose **either** question **B11** or question **B12**.

B9 Barium was discovered by Humphrey Davy in 1808. It is a silvery-white metal which is more reactive than calcium.

- (a) To which group of the Periodic Table do both barium and calcium belong? [1]
(b) The apparatus below can be used to compare the reactivity of barium and calcium with water.



- (i) Name the gas formed when calcium reacts with water. [1]
(ii) To make the comparison 'fair', the amounts of barium and calcium are kept the same. State **two** other factors which should be kept the same to make the comparison fair. [2]
(iii) After a certain time, the plunger of the syringe in the barium experiment had moved further than that in the calcium experiment. Explain how this shows that barium is more reactive than calcium. [2]
(c) When barium reacts with water, barium hydroxide is formed. The barium hydroxide reacts with hydrochloric acid to form barium chloride. [1]
(i) Write a balanced chemical equation for the formation of barium chloride. [1]
(ii) Write the ionic equation for the formation of barium chloride. [1]
(iii) Barium chloride may be used in testing for sulphate ions. [2]
Give the observation and the ionic equation of the reaction.

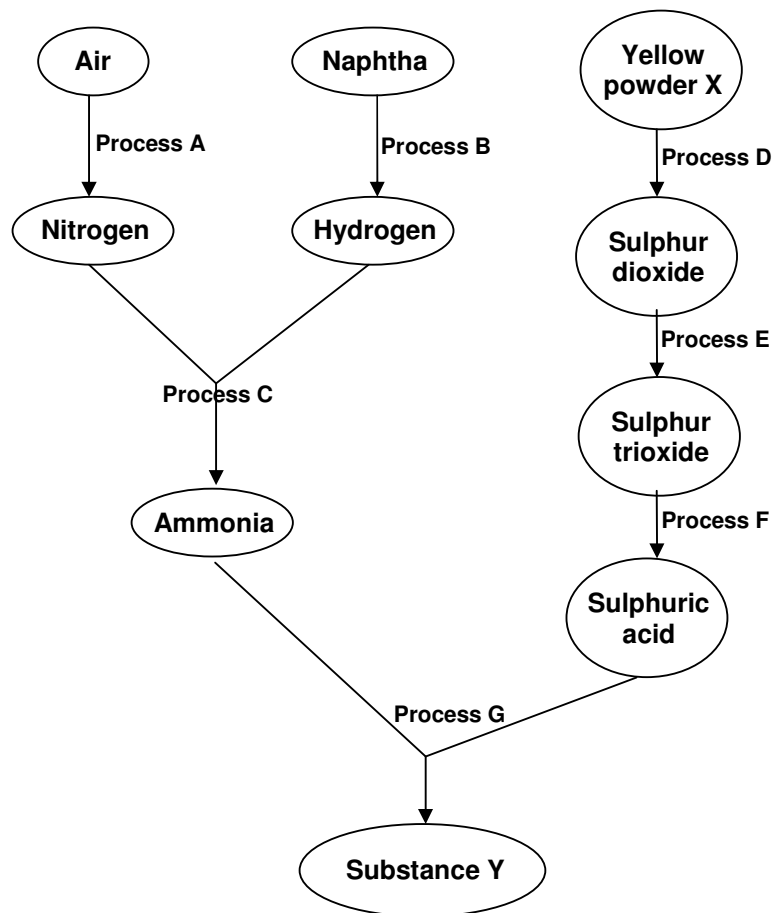
B10 (a) In the Haber process, nitrogen reacts with hydrogen to form ammonia.



In this reaction, some bonds are broken and others are formed.

- (i) What is the total number of bonds in two molecules of ammonia? [1]
(ii) Explain why this reaction is exothermic. [1]
(iii) Sketch the energy profile diagram for the Haber Process. [1]
(b) Give either the name or the symbols of two members of each of the following classes of elements: [3]
(i) the halogens;
(ii) the noble gases;
(iii) the alkali metals;
(c) Recent research has found several other allotropes of carbon, named fullerenes. One of these allotropes has a relative molecular mass, M_r of 720. [1]
(i) Explain what is meant by an allotrope. [1]
(ii) Name the two common allotropes of carbon. [2]
(iii) Calculate the formula of the fullerene with $M_r = 720$. [1]

B11 The flow diagram refers to processes used in manufacturing an important ammonium fertiliser.



- (a) Give the name of
- (i) process A. [1]
 - (ii) process B. [1]
 - (iii) process C. [1]
 - (iv) process D. [1]
 - (v) process E. [1]
- (b) Suggest the identity of
- (i) yellow powder X. [1]
 - (ii) substance Y. [1]
- (c) State the conditions for
- (i) process C. [1]
 - (ii) process E. [1]
- (d) Write a balanced equation to show the formation of substance Y. [1]

B12 The table below shows some data about the homologous series of alkanes.

Alkane	no. of carbon atoms per molecule <i>n</i>	melting point /°C	Boiling point /°C	energy released by complete combustion of one gram of alkane/ kJ <i>E</i>	no. of isomers
methane	1	-183	-162	55.6	1
ethane	2	-183	-89	52	1
propane	3	-188	-42	50.5	1
butane	4	-138	0	49.7	2
pentane	5	-130	36		3
hexane	6	-95	69	48.8	5
heptane	7	-91	98	48.5	9

- (a) Plot a graph of *E* against *n* on the graph paper provided. [3]
(b) Use your graph to estimate the value of *E* for pentane. [1]
(c) Calculate the energy released by the complete combustion of one mole of ethane. [2]
(d) Draw the structural formulae for the three isomers of pentane. [3]
(e) Methane reacts slowly with chlorine in the presence of sunlight to form chloromethane and hydrogen chloride. Draw the structural formula of chloromethane. [1]

~ *The End* ~

The Periodic Table of the Elements

I		II		Group										VII		0											
				III	IV	V	VI	VII																			
7 Li Lithium 3	9 Be Beryllium 4	23 Na Sodium 11	24 Mg Magnesium 12	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	133 Cs Caesium 55	137 Ba Barium 56	178 Y Yttrium 39	89 Zr Zirconium 40	91 Nb Niobium 41	93 Mo Molybdenum 42	96 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	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86		
140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	144 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	232 Pa Protactinium 91	238 U Uranium 92	238 Np Neptunium 93	244 Pu Plutonium 94	244 Am Americium 95	244 Cm Curium 96	244 Bk Berkelium 97	244 Cf Californium 98	244 Es Einsteinium 99	244 Fm Fermium 100	244 Md Mendelevium 101	244 No Nobelium 102	244 Lr Lawrencium 103

* 58 – 71 Lanthanoid series
+ 90 – 103 Actinoid series

Key

a	X
m	
b	

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.)