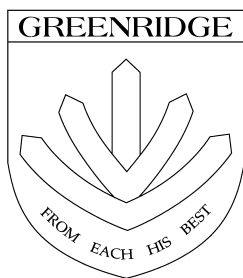


Name : \_\_\_\_\_ ( )

Class : 4E1



# GreenRidge Secondary School

## Mid-Year Examination 2001

**Subject : Chemistry (5069)**  
**Secondary Four Express**  
**Paper 2**

**Date : 14 May 2001**

**Duration : 1 h 30 min**

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### INSTRUCTIONS TO CANDIDATES

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

**HAND UP FOOLSCAP PAPERS and QUESTION PAPER SEPARATELY.**  
**DO NOT STAPLE THEM TOGETHER.**

#### Section A

Answer **all** questions. Write your answers in the spaces provided on the question paper.

#### Section B

Answer any **3** questions. Write your answers on the separate foolscap paper provided.  
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	/45
Section B	/30
Total	/75

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

**Section A (45 marks)**

Answer ALL questions from this Section.

1. The following is a list of formulae of organic compounds.



Which of the above formulae fit the following descriptions?

- a. a compound which dissolves in water to form an acidic solution [1]

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- b. a compound which is not a hydrocarbon [1]

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- c. two compounds which are from the same homologous series [1]

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- d. two compounds which react to form an ester [1]

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- e. a compound which undergoes an addition reaction with steam [1]

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- f. a compound which is oxidised by acidified potassium dichromate(VI) to give propanoic acid [1]

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2. Explain the following observations or reactions:

- a. Copper (II) sulphate crystals can be prepared by the reaction of excess copper(II) oxide and dilute sulphuric acid, followed by filtration and crystallization. However, sodium sulphate crystals **cannot** be prepared by the reaction of excess sodium hydroxide and dilute sulphuric acid, followed by filtration and crystallization. [2]

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- b. When an excess of dilute sulphuric acid is added to lead(II) oxide, the reaction stops before all the lead(II) oxide has completely reacted. [2]

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- c. When testing for a chloride, the solution should be acidified with dilute nitric acid before either aqueous silver nitrate and aqueous lead(II) nitrate is added. [2]

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- d. When ethene is added to aqueous bromine, it decolourises the reddish-brown bromine solution rapidly. However, when ethane is added to aqueous bromine, it decolourises bromine very slowly even in the presence of sunlight. Explain the above observations. [2]

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3. Hydrogen can be manufactured from methane and steam in the following reaction.



When one mole of  $\text{CH}_4$  reacts, the energy change is 210kJ.

- a. What type of energy change occurs when bonds are broken? [1]

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b. What type of energy change occurs when bonds are formed? [1]

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c. Which is the larger of the energy changes taking place in the reaction above, bond breaking or bond forming? Explain your answer. [2]

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d. How much heat is required to produce 2g of H<sub>2</sub>? [1]

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e. Name a major source of methane. [1]

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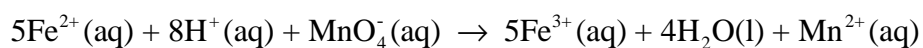
4. 25 cm<sup>3</sup> of an alkali, XOH, reacted with 30 cm<sup>3</sup> of dilute hydrochloric acid. The acid concentration was 3.10 g/dm<sup>3</sup> and the alkali concentration was 4.08 g/dm<sup>3</sup>. Calculate  
a. the molarity of the acid, [1]

b. the molarity of the alkali, [2]

c. the relative molecular mass of the alkali, [2]

d. the relative atomic mass of X and hence deduce the identity of X. [2]

5. Aqueous iron(II) ions react with acidified aqueous potassium manganate(VII) according to the equation below.



a. What is the reducing agent in this reaction? Explain your answer. [2]

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b. Describe briefly how aqueous potassium iodide can be used to test for an oxidising agent. [2]

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6. Fluorine can form either covalent or ionic bonds.

a. Draw a 'dot-and-cross' diagram (*showing all electron shells*) to show the bonding in  
(i) sodium fluoride, NaF, [1]

(ii) fluorine, F<sub>2</sub>. [1]

- b. Explain why sodium fluoride has a higher melting point than fluorine. [2]
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- 
- 
- 
- 
7. a. What is meant by 'catalyst'? [1]
- 
- 
- 
- b. Name a catalyst used for each of the following conversions. [1]
- (i) nitrogen to ammonia [1]
- 
- (ii) hydrogen peroxide to oxygen [1]
- 
- (iii) sulphur dioxide to sulphur trioxide [1]
- 
- (iv) an alkene to an alcohol [1]
- 
- (v) an alkene to an alkane [1]
- 
8. Sulphuric acid is manufactured industrially by the Contact Process. The first stage involves reacting sulphur with air to form sulphur dioxide.
- a. Write a balanced equation for the above reaction. [1]
- 
- b. The second stage involves the reaction of sulphur dioxide with oxygen to produce sulphur trioxide. What are the **two conditions** needed for the formation of sulphur trioxide. [2]
- 
- 
- c. Write a balanced equation for the formation of sulphur trioxide. [1]
-

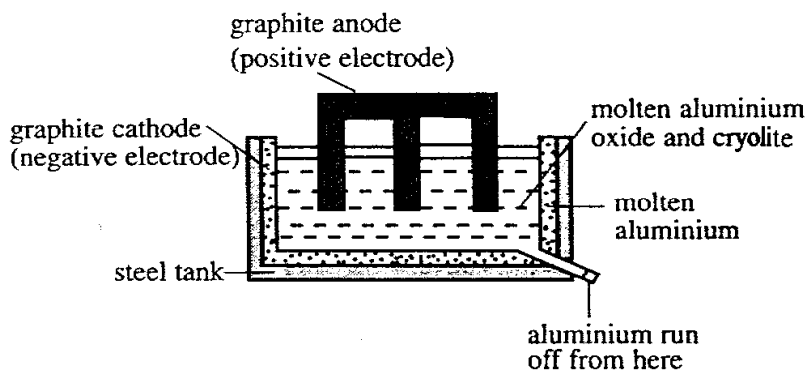
**Section B (30 marks)**

Answer **THREE** questions from this Section.

Each question is allocated **TEN** marks

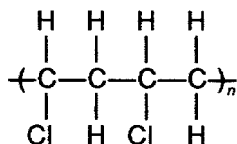
1. This diagram shows an electrolysis tank used industrially to produce aluminium from aluminium oxide.

Pure aluminium oxide melts at 2045°C.



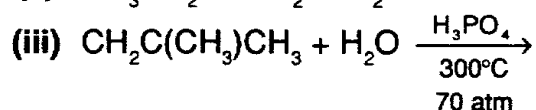
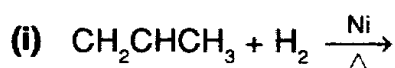
- a. State and explain why the cryolite is added to the aluminium oxide. [1]
- b. Construct ionic equations for the reactions which take place at the electrodes. [2]
- c. Explain why the carbon anodes need replacing regularly. [1]
- d. Electrolysis is also used to purify copper.
- (i) Draw and label a diagram of apparatus which could be used to purify a block of impure copper. [3]
- (ii) Describe what happens at each electrode during the electrolysis. [3]
2. a. When a beaker of ethanol was left exposed to air for several days, the volume of liquid was found to have decreased and the remaining liquid tasted sour. On addition of a spatula of sodium carbonate to the beaker, effervescence was observed and the gas turned limewater chalky. After the reaction was completed, the solution was evaporated to dryness. A white solid was obtained. **Explain** the above observations and **write the equations** where appropriate. [4]

- b. Polyvinylchloride (PVC) is an addition polymer. Part of the PVC polymer is shown below.



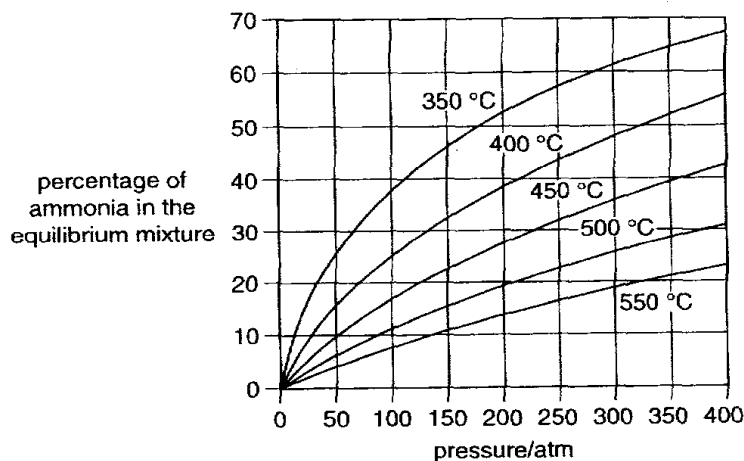
- (i) What is the repeating unit (ie. Monomer)? [1]
- (ii) Draw the full structural formula of the monomer. [1]
- (iii) What is the name of the monomer? [1]

- c. Give the name and full structural formula of the products formed in the following reactions: [3]



3. a. Selenium, Se, is in Group VI of the Periodic Table.
- How many electrons are there in the outer shell of an atom of selenium? [1]
  - Is selenium a metal or a non-metal? [1]
  - Will the oxide(s) of selenium be acidic, basic or amphoteric? [1]
  - Write the formula for an ion you would predict selenium to form. [1]
- b.
- Name two noble gases. [1]
  - Describe one property of the elements of the noble gas group. [1]
  - Describe a use of one of the gases named in b(i). [1]
- c.
- Explain how the lubricating action of graphite depends on its structure. [1]
  - Using your knowledge of its structure, explain why diamond is not used as a lubricant. [2]

4. Ammonia is manufactured in the Haber Process. The following graph shows the amount of ammonia present in the equilibrium mixture under different conditions of temperature and pressure.



- a. Use the graph to deduce the effect of increasing the pressure on the percentage of ammonia in the equilibrium mixture. [1]
- b. An industrial process uses conditions of 450°C and 200 atm.
- Use the graph to find the percentage of ammonia in the equilibrium mixture. [1]
  - Suggest one advantage and one disadvantage of using 450°C rather than 350 °C as the working temperature. [3]

- c. Explain why expensive metals are economical to use as catalysts. [1]
- d. A student has three test-tubes of gas. One tube contains ammonia, one contains hydrogen and one contains nitrogen. Describe tests the student could do to identify the three gases. [2]
- e. Describe briefly how you would prepare crystals of ammonium sulphate, starting with aqueous ammonia. [3]

~ The End ~

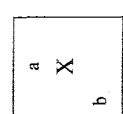
# The Periodic Table of the Elements

Group																			
I	II											III	IV	V	VI	VII	0		
												I 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 Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18		
39 K Potassium 19	40 Ca Calcium 20	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 27	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	91 Y Yttrium 39	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 47	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	127 I Iodine 53	128 Te Tellurium 52	131 Xe Xenon 54				
133 Cs Caesium 55	137 Ba Barium 56	178 La Lanthanum 57	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86				
87 Fr Francium 87	88 Ra Radium 88	227 Ac Actinium 89																	

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	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	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103

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

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



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