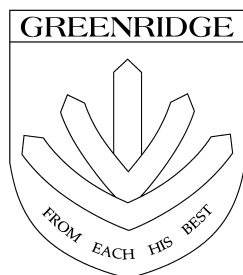


Name : \_\_\_\_\_ (      )

Class : 4E1



# GreenRidge Secondary School

Mid-Year Examination 2002

**Subject : Chemistry (5068)**  
**Secondary Four Express**  
**Paper 2**

**Date : 14 May 2002**

**Time : 1 hour 45 minutes**

## **INSTRUCTIONS TO CANDIDATES**

Write your name and index number in the spaces at the top of this page and on any 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, fasten any separate foolscap paper used securely to the question paper.

## **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 the last page.

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

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

**Section A [50 marks]**

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

A1. The following is a list of formulae of organic compounds.



Which of the above formulae fit the following descriptions?

a. any **one** compound which dissolves in water to form an acidic solution [1]

\_\_\_\_\_

b. **two** compounds which are **not** hydrocarbons [1]

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

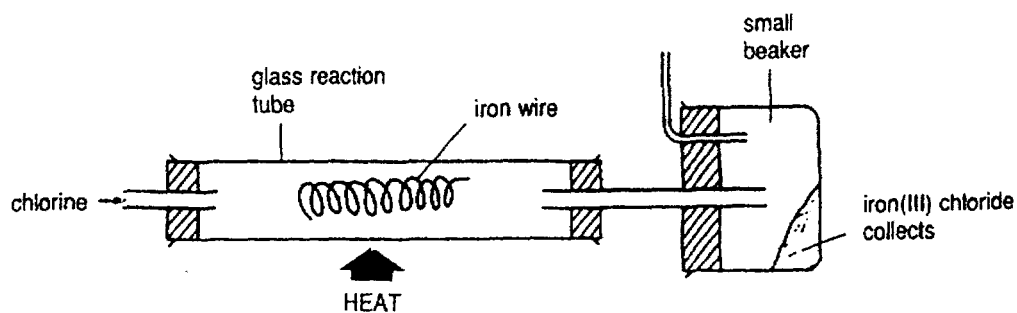
e. **two** compounds which undergo addition reactions with steam [1]

\_\_\_\_\_

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

\_\_\_\_\_

A2. An experiment was set up to show iron reacting with chlorine to form iron(III) chloride.



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

\_\_\_\_\_

(b) Explain why this is a redox reaction. [2]

\_\_\_\_\_

\_\_\_\_\_

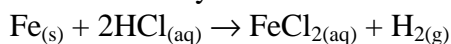
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- (c) Iron(III) chloride undergoes sublimation. What observation in the experiment shows this? [1]

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- (d) Iron reacts with hydrochloric acid according to the equation:



Is chlorine or hydrochloric acid the stronger oxidising agent? Explain your answer. [2]

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A3. Under suitable conditions, the elements chlorine and bromine will combine together to form a compound which may be represented by the formula BrCl.

- (a) Draw the arrangement of electrons in BrCl, *showing the outermost shell electrons only*. [2]

- (b) Given that the compound BrCl is **not** a liquid at room temperature, would you expect it to be a solid or a gas? Explain your answer. [2]

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- (c) Potassium iodide solution can be used as an 'invisible' ink. When it dries on the paper, it cannot be seen. However, if the paper is held over a bottle of chlorine water, the writing appears in violet. Explain, using the equation for the reaction, why the writing appears in violet. [2]

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A4. Barium nitrate is used for producing 'green fire' in fireworks. It is mixed with sulphur and carbon and it supplies the oxygen for them to burn.

(a) How could you show that barium nitrate contains nitrate ions? [3]

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(b) Name the products from the complete combustion of carbon and sulphur. [2]

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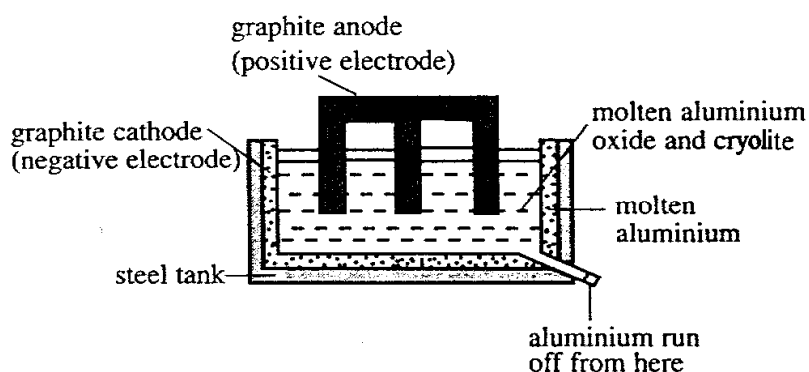
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(c) Name the product from the incomplete combustion of carbon. [1]

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A5. This diagram shows an electrolysis tank used industrially to produce aluminium from aluminium oxide. Pure aluminium oxide melts at 2045°C.



(a) What is usually added to the aluminium oxide during electrolysis? [1]

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(b) Explain why the substance mentioned in (a) is added to the aluminium oxide. [1]

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(c) Construct *ionic equations* for the reactions which take place at the electrodes. [2]

At the Cathode :

At the Anode :

- (d) Explain why this process is very expensive compared to extraction of iron in the blast furnace. [2]

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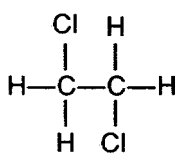
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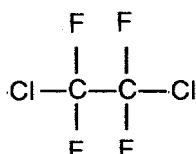
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- (e) Give the equation, *including state symbols*, representing the reduction reaction of haematite in the blast furnace. [1]

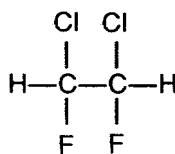
A6. Scientists believe that CFCs produce chlorine atoms which damage the ozone layer.



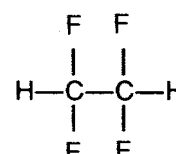
**A**



**B**



**C**



**D**

- (a) Which of the molecules A, B, C or D is a CFC? Explain your reasoning. [2]

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- (b) Explain why damage to the ozone layer can cause harm to humans. [1]

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Chlorine atoms react with ozone, but chloride ions do not. Chlorine atoms in the atmosphere may be able to be converted to ions by charged rods hanging from helium balloons.

- (c) (i) Complete the table to show the number of each type of sub-atomic particles present in an atom and ion of  $^{35}_{17}\text{Cl}$ . [3]

Particle	Neutrons	Protons	Electrons
Chlorine atom, $^{35}_{17}\text{Cl}$			
Chloride ion, $^{35}_{17}\text{Cl}^-$			

- (ii) Suggest why the atom is more reactive than the ion. [1]

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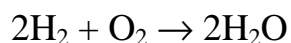
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- A7. (a) The table below shows the bond energies, measured in kilojoules per mole.

Bond	Bond Energy, in kJ/mol
O–O	150
O=O	496
O–H	460
H–H	436

Use the information given above to answer the questions below for the following reaction.



- (i) Calculate the energy change in breaking the bonds in 2 moles of  $\text{H}_2$  in the above reaction. [1]
- (ii) Calculate the energy change in breaking the bonds in 1 mole of  $\text{O}_2$  in the above reaction. [1]
- (iii) What is the energy change in making the bonds in 2 moles of  $\text{H}_2\text{O}$  in the above reaction? [1]
- (iv) Calculate the  $\Delta\text{H}$  value of this reaction. [1]
- (b) Explain in terms of bond breaking and bond making, why the overall energy change is negative or positive as in (a)(iv). [2]

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- A8. (a) Concentrated sulphuric acid will dehydrate methanoic acid (HCOOH). Suggest what gas is given off, and describe how you would show the presence of this gas. [2]

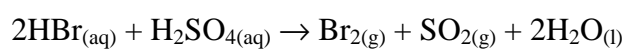
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- (b) When concentrated sulphuric acid reacts with hydrogen bromide, the following reaction takes place.



- (i) What would you observe if you carry out this experiment? [1]

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- (ii) What chemical property of concentrated sulphuric acid does this reaction suggest? [1]

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- (c) Give **two** uses of sulphuric acid. [2]

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**Section B [30 marks]**

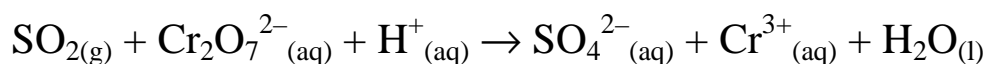
Answer **three** questions

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

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

**B9.** A sample of air taken from the air around a power station that uses fossil fuels was found to contain many pollutants.

- (a) What is a pollutant? [1]
- (b) State a pollutant, other than sulphur dioxide, in the sample which causes acid rain. Explain how the pollutant enters the air and how the amount can be reduced. [3]
- (c) Why do the levels of these pollutants in the atmosphere increase in winter time? [1]
- (d) A sample of the polluted air can be treated for sulphur dioxide by bubbling it through acidified potassium dichromate (VI) solution. The ionic equation is given below



- (i) Balance the above ionic equation. [1]
- (ii) What is the property exhibited by sulphur dioxide in its reaction with acidified potassium dichromate(VI) solution? Explain your answer. [2]
- (iii) A solution contains 0.100 mol/dm<sup>3</sup> of dichromate (VI) ions. Given a 2.00dm<sup>3</sup> sample of polluted air which contains 3.4% by volume of sulphur dioxide measured at room temperature and pressure, calculate the minimum volume of this solution required to remove sulphur dioxide. [2]

**B10.** (a) Copy and complete the table below which lists the colours and the physical states, at room temperature and pressure, of the halogens. [2]

Name of Halogen	Physical State	Colour
Chlorine		
Bromine		
iodine	solid	black

- (b) Astatine is another halogen with greater relative atomic mass than the iodine. Predict the colour and state of astatine at room temperature. [1]
- (c) Iodine is present in part of the organic compound thyroxine, C<sub>15</sub>H<sub>11</sub>I<sub>4</sub>NO<sub>4</sub>, which is found in the thyroid gland (in humans). Calculate the total number of protons found in one molecule of thyroxine. [1]
- (d) Iodine can be reacted with iron to form iron(II) iodide.
- (i) As iodine vapour passes through heated iron wool, a red glow is seen. Suggest why this glow occurs. [1]
- (ii) How can you form iodine vapour from crystals of iodine? [1]
- (iii) How can you show that the iron(II) iodide contains iodide ions? [2]
- (iv) State whether iron(II) iodide is coloured or not. Explain your reasoning. [2]

- B11.** (a) Both urea ( $\text{CON}_2\text{H}_4$ ) and ammonium sulphate ( $(\text{NH}_4)_2\text{SO}_4$ ) are manufactured for use as fertilisers. Urea is made by heating a dry mixture of ammonia and carbon dioxide to  $200^\circ\text{C}$  in a pressurized, silver lined reactor. The mixture of urea and water formed is cooled to  $15^\circ\text{C}$  and crystals of urea are separated.
- (i) Construct the equation for the formation of urea by this method. [1]
  - (ii) Suggest **one** reason why the reactor is lined with silver [1]
  - (iii) Suggest why the mixture is cooled to  $15^\circ\text{C}$ . [1]
  - (iv) Suggest how crystals of urea may be separated from the mixture. [1]
- (b) (i) How can ammonium sulphate be manufactured from ammonia? [1]
- (ii) Give the equation for the reaction used. [1]
- (c) (i) Calculate the percentage by mass of nitrogen in urea. [1]
- (ii) Why would this value be of interest to a farmer? [1]
  - (iii) Suggest **two** other factors which a farmer would consider before choosing a fertiliser. [2]
- B12.** (a) A solution of sodium chloride has a concentration of  $0.15 \text{ mol/dm}^3$ . Calculate
- (i) the concentration in  $\text{g/dm}^3$ , [1]
  - (ii) the number of grams of NaCl in  $20 \text{ cm}^3$  of the solution. [1]
- (b)  $0.16 \text{ g}$  of NaOH is dissolved in water to make up a volume of  $50 \text{ cm}^3$ . Calculate the concentration in
- (i)  $\text{g/dm}^3$ , [1]
  - (ii)  $\text{mol/dm}^3$ . [1]
- (c) What mass of lead(II) chloride will be obtained from  $1.0 \text{ dm}^3$  of  $1.0 \text{ mol/dm}^3$   $\text{Pb}(\text{NO}_3)_2$  solution if  $50 \text{ cm}^3$  of  $0.15 \text{ mol/dm}^3$  NaCl solution are added? [2]  
(Assume that all the lead(II) chloride formed is precipitated out.)
- (d) Tablets containing magnesium oxide can be used to relieve stomach pains caused by excess hydrochloric acid. If the stomach contains the equivalent of  $100 \text{ cm}^3$  of excess hydrochloric acid of concentration  $3 \text{ mol/dm}^3$ , how many tablets each containing  $3 \text{ g}$  of magnesium oxide should be taken? [2]
- (e) Arsenic(V) acid,  $\text{H}_3\text{AsO}_4$ , is a tribasic acid.  $25.0 \text{ cm}^3$  of a solution of the acid requires  $35.7 \text{ cm}^3$  of a solution of sodium hydroxide of concentration  $0.100 \text{ mol/dm}^3$  for neutralisation. What is the concentration of the acid (in  $\text{mol/dm}^3$ )? [2]

~ The End ~

