

Name : \_\_\_\_\_ (      )      Class : 3E1



# Greenridge Secondary School

## End-of-Year Examination 2006

Subject : Pure Chemistry (5068)  
Secondary Three Express  
Paper 2

Date : 12 Oct 2006

Duration : 1 h 45 mins

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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.

#### **Section A**

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

#### **Section B**

Answer **BOTH B11 and B12** and **Either B13 or B14** from this section.

Write your answers in the spaces provided on 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 12.

Parent's Signature  
\_\_\_\_\_

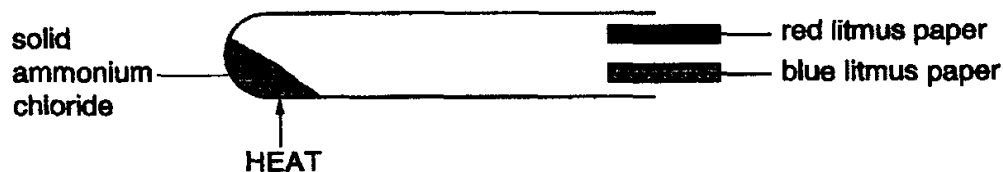
| FOR EXAMINER'S USE |            |
|--------------------|------------|
| Section A          | /50        |
| <b>B11</b>         | /10        |
| <b>B12</b>         | /10        |
| <b>B__</b>         | /10        |
| <b>Total</b>       | <b>/80</b> |

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

### Section A [50 marks]

Answer ALL questions in the spaces provided.

- A1** A student heated some solid ammonium chloride,  $\text{NH}_4\text{Cl}$ , in a test-tube as shown below. Ammonia and one other gas were formed. He tested the gases coming out of the tube with litmus paper.



Observation:

- (1) The red litmus quickly turned blue.
- (2) A few seconds later, both pieces of litmus paper turned red.

Explain the above observations.

[3]

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- A2** Select, from the following list, one method by which each of the following may be separated from the stated mixture.

[4]

You may use a method once, more than once, or not at all.

**chromatography**  
**crystallisation**  
**distillation**

**distillation**  
**filtration**  
**oxidation**

**fractional distillation**  
**reduction**  
**sublimation**

- (a) red dye from a mixture of red and blue dyes in solution, \_\_\_\_\_
- (b) nitrogen from liquefied air \_\_\_\_\_
- (c) ammonium chloride from a mixture of ammonium chloride and sodium chloride \_\_\_\_\_
- (d) petrol from crude oil \_\_\_\_\_

**A3** Using the substances listed below, answer the following questions.

|               |                |                        |
|---------------|----------------|------------------------|
| <b>helium</b> | <b>argon</b>   | <b>ozone</b>           |
| <b>lead</b>   | <b>air</b>     | <b>oxygen</b>          |
| <b>steel</b>  | <b>sulphur</b> | <b>sodium chloride</b> |

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

(a) Which is an element whose atom has a duplet electron arrangement? [1]

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(b) Which is an element, which exists as a diatomic molecule? [1]

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(c) Which is an element, which conducts electricity in solid state? [1]

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(d) Which is a mixture of element and compounds? [1]

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(e) Which is a mixture of metal and non-metal? [1]

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**A4** One of the isotopes of an element M has a proton (atomic) number of 20 and a nucleon (mass) number of 41.

(a) What is meant by the term isotopes? [1]

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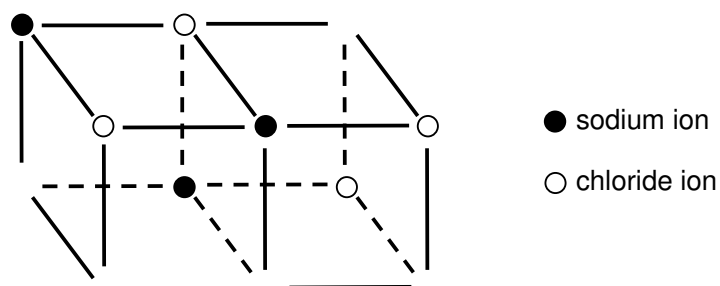
(b) Complete the table about the ion of  ${}_{20}^{41}\text{M}$ . [2]

|                      |  |
|----------------------|--|
| number of protons    |  |
| number of neutrons   |  |
| number of electrons  |  |
| electronic structure |  |

(c) To which Group of the Periodic Table does element M belong? [1]

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**A5** The incomplete diagram below represents the arrangement of the ions in crystals of sodium chloride.



(a) Complete the diagram by adding the missing ions. [2]

(b) How does this crystal structure explain the fact that sodium chloride conduct an electric current when in the molten state but **not** in the solid state? [3]

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**A6** Zinc sulphate can be produced by the reaction between zinc granules and dilute sulphuric acid. In an experiment, 1.3g of zinc granules and 200 cm<sup>3</sup> of 0.2 mol/dm<sup>3</sup> sulphuric acid are allowed to react.

(a) Calculate the number of moles of zinc in 1.3g. [2]

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(b) Calculate the number of moles of sulphuric acid in 200 cm<sup>3</sup>. [2]

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(c) Give the equation, including state symbols, for the reaction. [2]

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(d) Explain why the reaction stops. [2]

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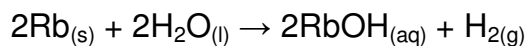


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- A7** (a) Give the **formula** of the ion which is produced in aqueous solution by
- (i) an acid \_\_\_\_\_ [1]
- (ii) an alkali. \_\_\_\_\_ [1]
- (b) Insoluble salts can be prepared by ionic precipitation.
- (i) Name a salt which is best prepared by ionic precipitation. [1]
- \_\_\_\_\_
- (ii) Name **two** reactants can be used to the salt named in c(i). [2]
- \_\_\_\_\_ and \_\_\_\_\_

- A8** One stage in the manufacture of sulphuric acid is the oxidation of sulphur dioxide to sulphur trioxide. For this stage
- (a) Write the equation for this reaction. [1]
- \_\_\_\_\_
- (b) State the essential reaction conditions. [2]
- \_\_\_\_\_
- \_\_\_\_\_

- A9** The Periodic Table is arranged in groups. Rubidium, Rb, is in Group I of the Periodic Table.
- (a) It reacts with water according to the equation below.

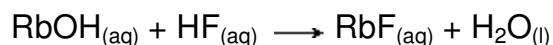


Predict what you would see when a small piece of rubidium is added to cold water. [2]

\_\_\_\_\_

\_\_\_\_\_

- (b) One way to make rubidium fluoride is to react the rubidium hydroxide with hydrofluoric acid. The resulting salt can then be purified by crystallization.



- (i) Draw a 'dot and cross' diagram to show the bonding in rubidium fluoride. *You only need to show the outer (valence) electrons.* [2]

- (ii) Explain why the boiling point of potassium fluoride is very high ( $1410^{\circ}\text{C}$ ) while the boiling point of fluorine is very low ( $-188^{\circ}\text{C}$ ). **[4]**

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- A10** (a) What is the chemical name for rust? **[1]**

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- (b) Explain why aluminium is more expensive than iron although aluminium is the most abundant metal in the Earth's crust. **[1]**

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- (c) Give three factors in which the availability of a metal depends mainly on. **[3]**

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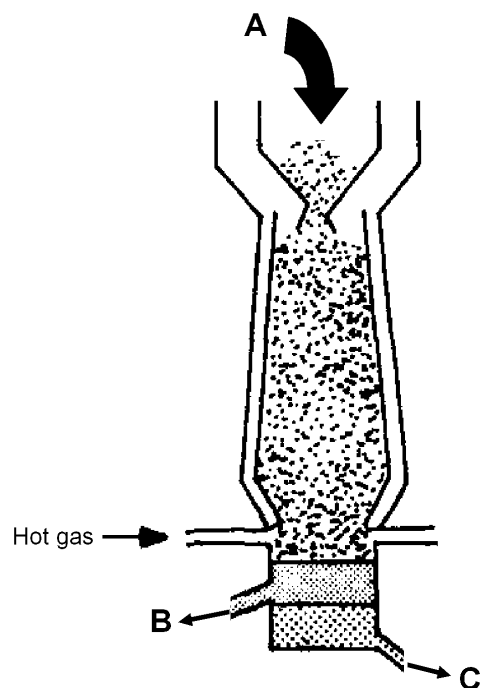
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**Section B [30 marks]**

Answer **BOTH B11 and B12** and **Either B13 or B14** from this section.  
Write your answers in the spaces provided.

**B11** The diagram below shows a blast furnace.



(a) Name the raw materials fed at A. [3]

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(b) Name the products at

(i) B \_\_\_\_\_

(ii) C \_\_\_\_\_

[2]

(c) Write the equations to show the reactions that take place in the furnace. [5]

(i) \_\_\_\_\_

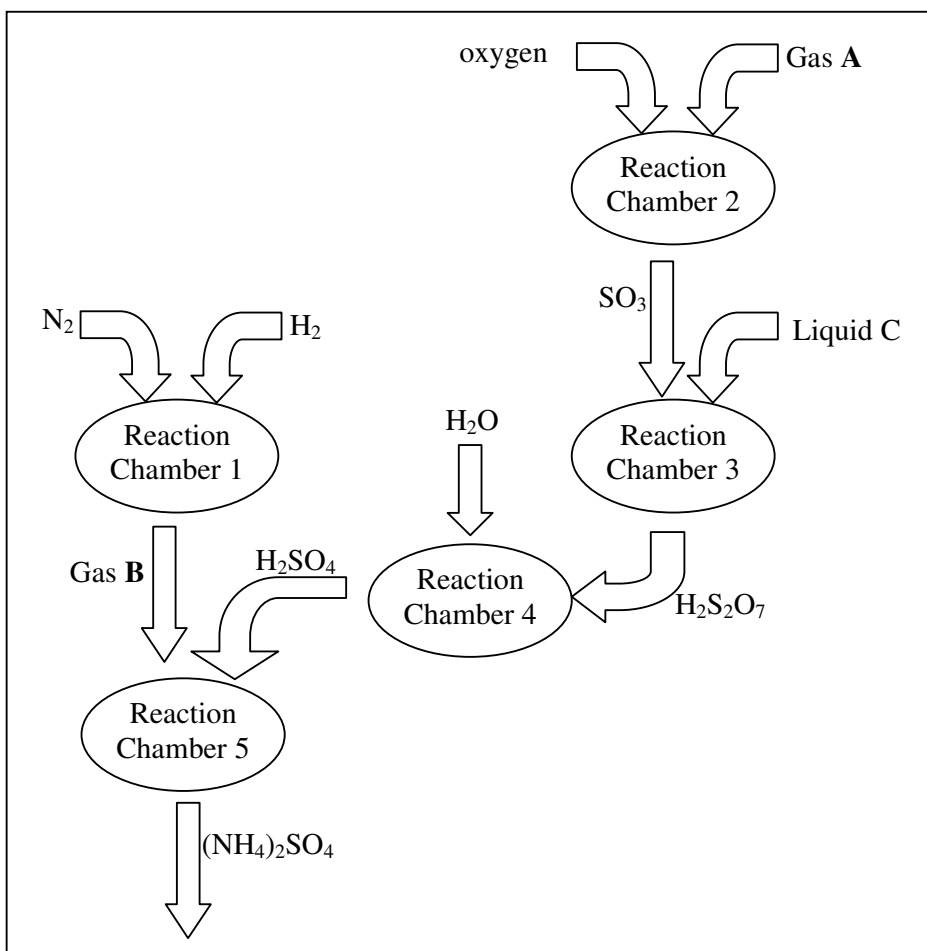
(ii) \_\_\_\_\_

(iii) \_\_\_\_\_

(iv) \_\_\_\_\_

(v) \_\_\_\_\_

**B12** One of the major industrial uses of ammonia is for the manufacture of fertilisers. The diagram below shows some of the stages in the manufacture of ammonium sulphate.



(a) Write the equation, including state symbols, for the formation of ammonia in **Reaction Chamber 1**. [2]

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(b) Name a suitable catalyst for the reaction in **Reaction Chamber 1**. [1]

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(c) Name a suitable catalyst for the reaction in **Reaction Chamber 2**. [1]

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(d) Name of the substances **A**, **B** and **C**. [3]

Gas **A** : \_\_\_\_\_

Gas **B** : \_\_\_\_\_

Liquid **C** : \_\_\_\_\_

- (e) Suggest a method other than liquefaction which you could use in the laboratory to remove ammonia from a mixture with nitrogen and hydrogen. **[1]**

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- (f) Write the equation, including state symbols, for the formation of ammonium sulphate in **Reaction Chamber 5**. **[2]**

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## Either

**B13** Sodium phosphate,  $\text{Na}_3\text{PO}_4$ , is a soluble salt, used as a water softener in washing powders.

It is made by reacting dilute phosphoric acid,  $\text{H}_3\text{PO}_4$ , with an alkali.

(a) Give the formulae of the ions present in sodium phosphate. **[1]**

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(b) (i) Name the alkali which reacts with phosphoric acid to make sodium phosphate. **[1]**

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

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(c) What is the maximum amount of sodium phosphate that can be produced from 49g of phosphoric acid? **[3]**

(d) Sodium carbonate also reacts with phosphoric acid to make sodium phosphate.

(i) Name the gas formed during this reaction. **[1]**

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(ii) Describe the test for this gas. **[2]**

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(e) Calcium phosphate is used to make fertilisers. Deduce the formula of calcium phosphate. **[1]**

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Or

B14

(a) Fluorine, chlorine, bromine and iodine are members of Group VII of the Periodic Table.

(i) For these four elements, complete the table below: [5]  
(The first element has been done for you.)

| Name     | Molecular Formula | Physical state at r.t.p. | electronic configuration |
|----------|-------------------|--------------------------|--------------------------|
| Fluorine | F <sub>2</sub>    | gaseous                  | 2,7                      |
| Chlorine |                   |                          |                          |
| Bromine  |                   |                          |                          |
| Iodine   |                   |                          |                          |

(ii) Use the ideas of electron sharing and electron transfer to explain why sodium chloride exists as the ions Na<sup>+</sup>Cl<sup>-</sup> rather than the covalent molecule Na-Cl. [2]

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(b) An element **X** is in Group VI of the Periodic Table.  
Use this information to state

(i) the number of electrons in the outer shell of an atom of **X**, [1]

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(ii) whether the element **X** is metallic or non-metallic, [1]

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(iii) the formula of a chloride of **X**. [1]

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~ The End ~

