JUNIOR LYCEUM ANNUAL EXAMINATIONS 2002

Educational Assessment Unit - Education Division

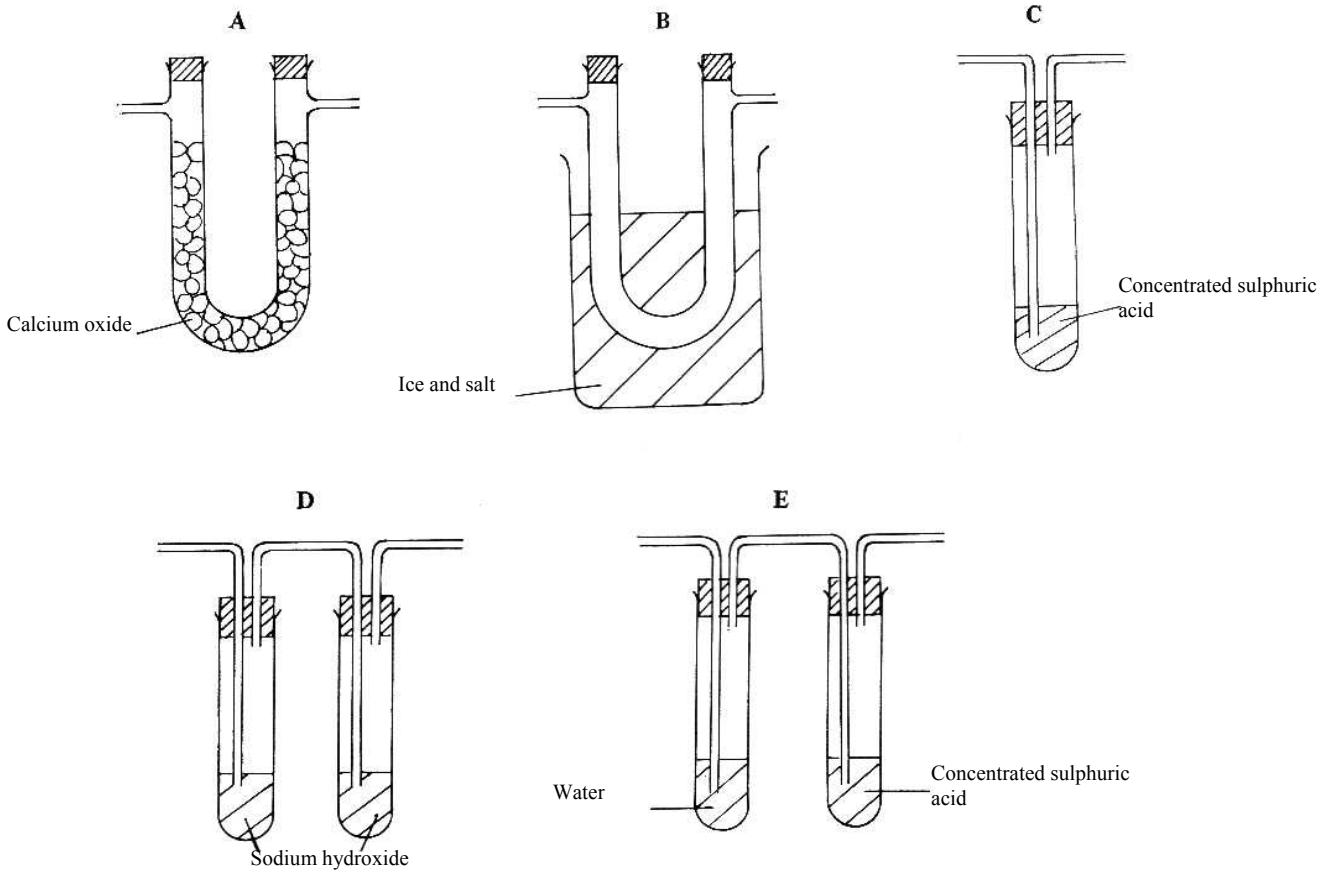
FORM 5 **CHEMISTRY** **TIME: 1hr 45 mins**

Name: _____ Class: _____

Useful Data: A copy of the Periodic Table is provided with this paper.
Relative atomic masses may be taken as Ca = 40

Section A: Answer **All** questions in this Section, using the spaces provided.
This section carries 60 marks.

1. The diagrams below show different types of apparatus that can be used for drying and/or purification of gases.



Select, from A to E, the apparatus which would be most suitable for:

a) removing hydrogen chloride and water vapour from a stream of chlorine _____
b) removing water vapour from ammonia gas _____
c) drying hydrogen _____
d) obtaining nitrogen dioxide from a mixture of this gas with oxygen _____
e) obtaining carbon monoxide from a mixture of carbon dioxide and carbon monoxide _____

(5 marks)

2. a) Complete the table below which gives information about two **ions**.

ion	number of protons	number of neutrons	number of electrons	mass number
Be^{2+}		5	2	
F^-	9	10		

(4 marks)

b) Draw 'dot and cross' diagrams, showing **all** electron shells, to show the electronic structure of the berylium ion and the fluoride ion. (4 marks)

3. This question is about acids, alkalis and salts.

a) (i) Give the **name** and **formula** of a dibasic acid.

name _____ formula _____

(ii) Give the name **or** formula of the ion which is responsible for the acid properties _____ (3 marks)

b) (i) Give the **name** and **formula** of an alkali.

name _____ formula _____

(ii) Which ion is present in all aqueous alkalis?

_____ (3 marks)

c) A dibasic acid can react with an alkali to give two types of salt, known as a normal salt and an acid salt.

Give the name **or** formula, of one example of each type of salt.

normal salt _____

acid salt _____ (2 marks)

d) Give one use of an acid and an alkali in industry.

_____ (2 marks)

4. A student was given instructions to carry out tests on an unknown substance XY.

a) The table below shows the results that the student obtained. Complete the Inference / Conclusion column. (4 marks)

Instruction / Test	Observation	Inference / Conclusion
1. Prepare a solution of XY and add sodium hydroxide solution.	XY formed a pale green solution which gave a green precipitate with sodium hydroxide.	
2. To a fresh portion of an aqueous solution of XY, add dilute nitric acid followed by a few cm^3 of silver nitrate solution.	A white precipitate was formed on adding silver nitrate.	
3. Working *in a fume cupboard*, bubble some chlorine gas through a fresh solution of XY. Keep the new solution for Test 4.	The pale green solution of XY turned brown.	
4. Add sodium hydroxide solution to a sample of the solution obtained in Test 3.	A brown precipitate was formed.	

b) Give **ionic** equations for the reactions occurring in

(i) Test 1 _____

(ii) Test 2 _____ (2 marks)

c) (i) Why was the student instructed to carry out Test 3 in a fume cupboard?

_____

(ii) Explain why chlorine acted as an oxidising agent in Test 3.

_____ (2 marks)

5. Calcium can be extracted by the electrolysis of **molten** calcium chloride.

a) (i) Write an ionic half equation for the formation of calcium during electrolysis.

_____

(ii) What mass of calcium would be deposited by the passage of 0.4 Faradays of electricity?

(4 marks)

b) Calcium chloride **solution** also undergoes electrolysis at room temperature. Explain why this method cannot be used for the extraction of calcium.

_____

_____ (2 marks)

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6. Complete the following statements by writing the missing word in the spaces provided.

Ethyne is the first member of the _____ series called alkynes. Its properties are very similar to those of ethene. Ethyne has the molecular formula _____. It has a _____ bond between the carbon atoms and therefore it is said to be _____. Ethyne burns with a _____ flame which shows that it has a _____ percentage by mass of carbon. Ethyne rapidly decolourises _____ because it reacts by _____. (8 marks)

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7. When heated, magnesium can react with oxygen and even with nitrogen and carbon dioxide.

(a) Magnesium is ignited and then lowered into a gas jar of oxygen.

(i) How would you show that the gas jar contains oxygen?

_____

(ii) Describe what is **seen** when the magnesium is put in the gas jar.

_____

(iii) Give a balanced equation for the reaction.

_____

(iv) Name this type of reaction. _____ (5 marks)

(b) Magnesium glows if a stream of nitrogen is passed over the heated metal. The product is solid magnesium nitride, Mg_3N_2.

(i) Draw a labelled diagram of the apparatus that could be used to pass the nitrogen gas over magnesium.

(ii) Give a balanced equation for the reaction.

_____

(iii) Magnesium nitride reacts with water to liberate ammonia.
Describe a test to prove that ammonia is given off.

_____ (6 marks)

(c) If burning magnesium is lowered into a gas jar of carbon dioxide, it continues to burn with a spluttering flame. Some white smoke is seen and specks of a black solid form on the sides of the gas jar.

(i) How could you show that the gas jar contains carbon dioxide?

_____

(ii) Carbon dioxide does not support combustion. Suggest what is happening to enable the magnesium to continue burning.

_____

(iii) Suggest what the black solid is. _____ (3 marks)

(d) Give the name of a gas that would **not react** with magnesium.

_____ (1 mark)

Section B: Answer any **TWO** questions from this section on the separate sheets provided. Each question carries 20 marks.

8. The statements below describe the chemistry of carbon and some of its compounds. Write brief notes to show that you understand the meaning of these statements with particular reference to the underlined terms.

   a) carbon has two main **isotopes** $^{12}_{6}C$ and $^{14}_{6}C$ (4 marks)

   b) carbon has two naturally occurring **allotropes** (4 marks)

   c) butane, C_4H_{10}, has two **structural isomers** (6 marks)

   d) methane and ethane are two members of the same **homologous series** (6 marks)

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9. This question refers to the following statement. 'Hydrogen peroxide decomposes very slowly at room temperature according to the equation
   $2H_2O_{2\,(l)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$.
   The decomposition is catalysed by manganese (IV) oxide?

   (a) Describe, in detail, an experiment to show that manganese (IV) oxide does increase the rate of reaction. Your answer should include a labelled diagram of the apparatus, the method and how the results can be interpreted. (14 marks)

   (b) Suggest **three other** factors which might increase the rate of the above reaction. Use the 'collision theory' to explain how each factor affects the rate of reaction.

   (6 marks)

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10. The following are names of reactions that are used in the chemistry laboratory: neutralisation , displacement , precipitation , reversible.

    a) For any TWO of the above processes, describe a simple **laboratory experiment** to illustrate the process.

       Your answers should include.

       (i) the name of the reagents

       (ii) the conditions

       (iii) any observations that would be made

       (iv) an equation for the reaction (16 marks)

    b) Give equations to represent the **other two processes** that were not selected in your answer to (a). (4 marks)
