

# JUNIOR LYCEUMS FINAL EXAMINATIONS 2000

Educational Assessment Unit - Education Division

**FORM 5**

**CHEMISTRY**

**TIME : 1hr 45min**

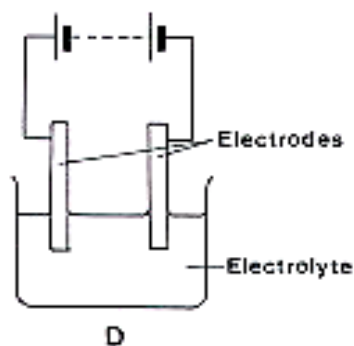
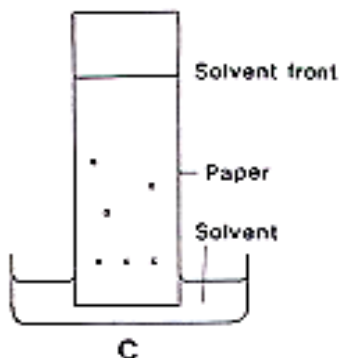
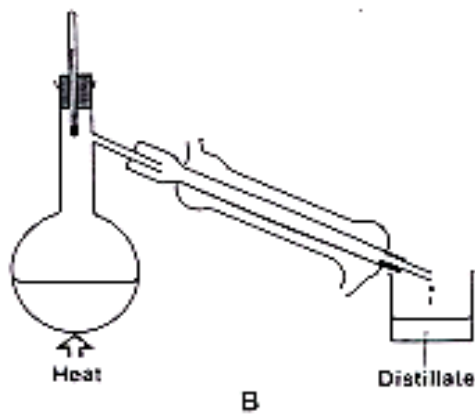
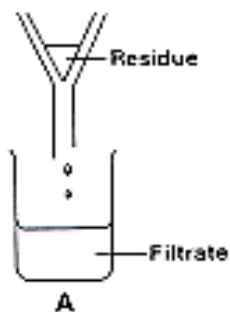
Name: \_\_\_\_\_

Class: \_\_\_\_\_

Useful Data: A copy of the Periodic Table is provided with this paper.  
One mole of any gas occupies  $22.4\text{dm}^3$  at standard temperature and pressure.  
Relative Atomic Masses may be taken as: Carbon C = 12,  
Chlorine Cl = 35.5, Hydrogen H = 1, Silver Ag = 108.

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

1. The following diagrams show four processes.



a) Name the processes A, B, C, and D.

A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

b) Give the letter of the process which would be most suitable for:

(i) obtaining pure water from sea water \_\_\_\_\_

(ii) separating the dyes in black ink \_\_\_\_\_

(iii) obtaining copper metal from copper sulphate solution \_\_\_\_\_

(iv) separating a mixture of lead chloride and water \_\_\_\_\_

(8 marks)

2. Choose from  $\text{NH}_3$   $\text{CO}_2$   $\text{NO}$   $\text{H}_2$   $\text{O}_2$   
These gases may be used once, more than once, or not at all.

(a) Which of these gases –

(i) turns brown on exposure to air \_\_\_\_\_

(ii) can NOT be collected over water \_\_\_\_\_

(iii) supports the combustion of petrol \_\_\_\_\_

(iv) produces white fumes when placed near hydrogen chloride \_\_\_\_\_

(v) can be made by the reaction of dilute hydrochloric acid with calcium carbonate.

\_\_\_\_\_ (5 marks)

(b) Describe a test by which you could identify

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

(ii) Sulphur dioxide \_\_\_\_\_ (3 marks)

\_\_\_\_\_

3. (a) A solution of sodium hydroxide is added to a solution of copper (II) chloride.

(i) What would be SEEN? \_\_\_\_\_ (1 mark)

(ii) Give a balanced equation for this reaction.

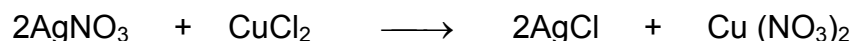
\_\_\_\_\_ (2 marks)

(b) Solutions of silver nitrate and copper (II) chloride are first weighed separately, then they are added together.

(i) What would be SEEN on mixing these solutions?

\_\_\_\_\_ (1 mark)

(ii) The equation for the reaction is



Write the *ionic* equation for this reaction, omitting spectator ions.

\_\_\_\_\_ (2 marks)

(c) If  $50\text{cm}^3$  of  $2.0\text{M}$  ( $2\text{ mol dm}^{-3}$ ) copper chloride solution was used.  
Calculate (i) the number of moles of copper chloride in solution.

(ii) the mass of silver chloride formed.

(4 marks)

4. (a) When graphite is burned completely in oxygen, a gas is produced which turns calcium hydroxide solution milky.

(i) Write an equation for the burning of graphite.

\_\_\_\_\_ (1 mark)

(ii) Name the gas produced \_\_\_\_\_ (1 mark)

(iii) What is the common name for calcium hydroxide solution?

\_\_\_\_\_ (1 mark)

(iv) Write a balanced equation for the reaction of the gas with calcium hydroxide solution.

\_\_\_\_\_ (2 marks)

(b) If  $3\text{g}$  of graphite is burned completely in oxygen, what volume of the gas you have named in (a)(i) will be produced at standard temperature and pressure?

(2 marks)

(c)  $3\text{g}$  of graphite and  $3\text{g}$  of diamond burned separately and completely in oxygen to produce the same volume of the same gas. Explain the reason for this.

\_\_\_\_\_ (2 marks)

5. Consider the chemical processes given below

- A. Haber process
- B. Contact process
- C. Cracking of hydrocarbons
- D. Formation of alkanes from alkenes

Note that there may be more than one answer to the questions below. Identify the process(es) in which-

- a) hydrogen is a reactant \_\_\_\_\_
- b) the catalyst is vanadium (v) oxide \_\_\_\_\_
- c) molecules of high molecular mass are converted to smaller molecules \_\_\_\_\_

(4 marks)

6. In 1894, William Ramsay, showed that the atmosphere contains about 1% of the noble gases, mainly argon.

Potassium and chlorine are typical elements which are next to argon in the Periodic Table. Potassium and chlorine react violently together but neither will react with argon.

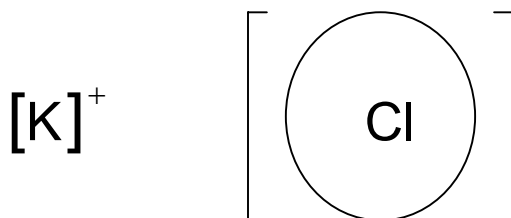
(a) (i) Name the groups of the Periodic Table to which potassium and chlorine belong

\_\_\_\_\_ (2 marks)

(ii) Give the electron configurations of potassium and chlorine

\_\_\_\_\_ (2 marks)

(iii) Complete the diagram below, which shows the arrangement of the outer shell electrons in potassium chloride.



(2 marks)

(b) (i) Give a reason why argon does not react with either of potassium or chlorine.

\_\_\_\_\_  
\_\_\_\_\_ (1 mark)

(ii) Give one use of a noble gas which depends on the property given in your answer to (b) (i)

\_\_\_\_\_ (1 mark)

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

Air is a mixture of gases. When substances burn in air, they react with \_\_\_\_\_.

Water can be synthesised by burning the element \_\_\_\_\_ in air.

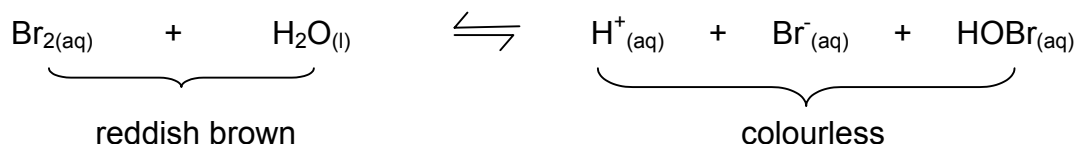
The action of air and water together on iron results in the \_\_\_\_\_ of iron.

Water and carbon dioxide from air react with limestone to give \_\_\_\_\_ hardness.

A process which releases carbon dioxide and water into the air is

\_\_\_\_\_. (5 marks)

8. Bromine dissolves in water forming a reddish brown solution. A dynamic equilibrium which can be represented by the following equation is obtained.



(a) (i) What is meant by the term dynamic equilibrium?

\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(ii) How is this equilibrium represented in the equation?

\_\_\_\_\_ (1 mark)

(b) Addition of an alkali to the equilibrium mixture, would produce a colourless solution.

(i) Which ion, *present in the alkali*, affects the system? \_\_\_\_\_

(ii) Which ion, *present in the equilibrium mixture*, is affected by the alkali?

\_\_\_\_\_. (2 marks)

(c) (i) What colour change would occur when excess dilute hydrochloric acid was added to the colourless alkaline solution produced in (b)?

\_\_\_\_\_ (1 mark)

(ii) Explain, using Le Chatelier's principle, why addition of excess acid gives the change you suggested in (c) (i).

\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

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

9. Butane,  $C_4H_{10}$ , is an example of an alkane. Ethene,  $C_2H_4$ , is an alkene. These hydrocarbons have different structures.
- (i) Draw the structural formula of butane and ethene.  
(ii) Write, underneath each formula, the term which is used to describe the difference in their structure. (4 marks)
  - Ethene quickly decolourises bromine water but butane has no effect on bromine water.
    - Explain the reason for this, using terms which describe these different reactions.
    - Give an equation for **one** of these reactions. (4 marks)
  - Butane is the main component of cylinder gas used in most households in Malta.
    - Name the products formed if butane is completely burned in a plentiful supply of air.
    - Write an equation for this reaction.
    - What is the danger of using a gas appliance in a very small and unventilated room? (6 marks)
  - (i) A hydrocarbon contains 92.31% carbon and 7.69% hydrogen. Calculate the empirical formula for this compound.  
(ii) Given that this hydrocarbon has a relative molecular mass of 26, deduce its molecular formula.  
(iii) Give the name of the homologous series to which this hydrocarbon belongs. (6 marks)
10. The rate of a chemical reaction between a solid and a solution can be increased by increasing the temperature, increasing the concentration of the solution, or using smaller pieces of the solid.
- Briefly explain, *in terms of particle collisions*, how each of these three factors influence the rate of a reaction. (6 marks)
  - Describe, in detail, a **laboratory experiment** that can be carried out in order to show the effect of **one** of these factors on the rate of a reaction. (12 marks)
  - Give the name of a process that is affected by
    - pressure
    - light(2 marks)
11. Explain the following observations, giving equations for the chemical reactions that take place.
- Zinc added to an aqueous solution of copper (II) sulphate removes the blue colour and produces a reddish brown precipitate. (6 marks)
  - When magnesium is added to dilute hydrochloric acid there is vigorous effervescence but there is no effervescence when copper is added to dilute hydrochloric acid. (4 marks)
  - When an electric current is passed through potassium iodide solution, a colourless gas is liberated at the cathode and a reddish brown substance forms around the anode. (6 marks)
  - When chlorine is bubbled through aqueous iron (II) chloride, the colour of the solution changes from green to brown. (4 marks)
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