CHEMISTRY

SCHEME OF EXAMINATION

There will be three papers, Papers 1, 2 and 3 all of which must be taken. Papers 1 and 2 will be a composite paper to be taken at one sitting.

PAPER 1: Will consist of fifty multiple choice objective questions drawn from Section A of the syllabus. Candidates will be required to answer all the questions within 1 hour for 50 marks.

PAPER 2: Will be a 2-hour essay paper covering the entire syllabus and carrying a maximum of 100 marks. The paper will be in two sections: Sections A and B.

- Section A: Will consist of ten short structured questions drawn from the common portion of the syllabus (ie Section A of the syllabus). Candidates will be required to answer all the questions for 25 marks.
- Section B: Will consist of two questions from the common portion of the syllabus (ie Section A of the syllabus) and two other questions from the section of the syllabus which is perculiar to the country of the candidate (ie **either** Section B **or** C of the syllabus). Candidates will be required to answer any three of the questions. Each question shall carry 25 marks.

PAPER 3: This shall be a 2-hour practical test for school candidates or1 hour 30 minutes alternative to practical work test for private candidates. Each version of the paper shall contain three compulsory questions and carry 50 marks.

The questions shall be on the following aspects of the syllabus:

- one question on quantitative analysis;
- one question on qualitative analysis;
- the third question shall test candidates' familiarity with the practical activities suggested in the syllabus.

SAMPLE QUESTIONS

PAPER 1

(OBJECTIVE TEST)

1. Isotopes of the same element have the same number of
   A. protons, neutrons and electrons.
   B. protons and neutrons but different number of electrons.
   C. protons and electrons but different number of neutrons.
   D. neutrons and electrons but different number of protons.

2. Which type of chemical bond is formed by the transfer of electrons?
   A. Covalent
   B. Dative
   C. Ionic
   D. Metallic

3. The concentration of an aqueous solution is 5mg dm^{-3}. Determine is the concentration in parts per million (ppm).
   A. 500 ppm
   B. 50 ppm
   C. 10 ppm
   D. 5 ppm

4. Consider the following species: H, H^+, H^-. What is the number of electrons in **each** of the species respectively?
   A. 1, 0, 2
   B. 0, 1, 2
   C. 2, 1, 0
   D. 1, 2, 0

5. Two electrons can occupy the same orbital if they have different
   A. angular momentum quantum numbers.
   B. magnetic quantum numbers.
   C. principal quantum numbers.
   D. spin quantum numbers.

6. What mass of NaOH is required to make 250 cm^3 of 0.10 mol dm^{-3} solution? [Na = 23, O = 16, H = 1]
   A. 1 g
   B. 4 g
   C. 8 g
   D. 16 g

7. Which of the following substances is **not** a hydrocarbon?
   A. Benzene
   B. Butane
   C. Ethyne
   D. Ethanamide

8. A substance which ionizes completely into hydroxonium ions is a
   A. strong acid.
   B. strong base.
   C. weak acid.
   D. weak base.

9. Which of the following solutions is able to resist changes in *pH* when small amounts of an acid or a base is added?
   A. Buffer solution
   B. Neutral solution
   C. Saturated solution
   D. Supersaturated solution

10. Protein is a polymer formed from the linkage of
   A. amino acid molecules.
   B. fatty acid molecules.
   C. glucose units.
   D. monosaccharides.

PAPER 2

(ESSAY)

SECTION A

1. Identify the solid remaining when **each** of the following is heated.

   (a) lithium trioxonitrate (V);
   (b) potassium trioxonitrate (V);
   (c) calcium trioxonitrate (V);

[3 marks]

2. (a) When calcium oxide and coke are heated in a electric furnace, the products are carbon (ii) oxide and calcium carbide (CaC_2), write the equation for this reaction.

[2 marks]

(b) Addition of water to calcium carbide leads to the formation of calcium hydroxide and ethyne. Write the equation for the production of ethyne. [2 marks]

3. Calculate the percentage by mass of silicon tetrachloride. [2 marks]

4. Ammonia, NH_3, and phosphine, Ph_3, are the hydrides of the first two elements in group 5.

(a) Draw a dot and cross diagram for the ammonia molecule. [2 marks]

(b) Sketch and explain the shape of the ammonia molecule. [3 marks]

5. The first ionization energy of chlorine is $+1260KJmol^{-1}$.

(a) Define the term *first ionization energy*. [2 marks]

(b) State and explain the general trend in the values of the first ionization energy for the elements across the period, sodium to argon in the periodic table. [3 marks]

6. Compound **A** consisting of carbon and hydrogen only. The compound was found to contain 80% carbon by mass.

(a) Calculate the empirical formula of compound **A** using the data above. [3 marks]

(b) The relative molecular mass of compound **A** was found to be 30. Use this information to deduce the molecular formula of compound **A**.
[H = 1.00 C = 12.00] [3 marks]

7. State **two** factors other than a change in temperature or the use of a catalyst that influence the rate of a chemical reaction. [2 marks]

SECTION B

1. (a) Two elements represented by the letters **Q** and **R** have atomic numbers 9 and 12 respectively.

(i) Write the election configuration of **R**.
(ii) To what group does **Q** belong in the periodic table.

(iii) Write the formula of the compound formed when **Q** combines with **R**.
(iv) Explain briefly, why **Q** is a good oxidizing agent.

(v) State whether **R** would be expected to form acidic or basic oxide. [25 marks]

(b) (i) State **two** assumptions of the kinetic theory of gases.
(ii) When some solids are heated, they change directly into the gaseous state. What name is given to this phenomenon?
(iii) List two substances which exhibit the phenomenon mentioned in (ii).
(iv) Write an expression to show the mathematical relationship between the rate of diffusion of a gas and its vapour.

[25 marks]

2. An aqueous solution has a *pH* of 4.0.

(a) (i) What is the *hydrogen ion concentration* of the solution?
(ii) What effect will it have on litmus paper?
(iii) Which of the following salt solutions would have the same effect on litmus? Give a reason for your answer.
$NH_4Cl_{(aq)}$; $NaCl_{(aq)}$; $CH_3(OONa_{(aq)}$.

(b) (i) Differentiate between a *fine chemical* and a *heavy chemical*.
(ii) Name **two** sources of air pollution.
(iii) Suggest **one** way of reducing air pollution in cities.

[25 marks]

3. (a) (i) Explain briefly the *fermentation process*.
(ii) Write a balanced equation for the fermentation of glucose.
(iii) What substance must be added to glucose solution to ferment it?
(iv) Explain briefly why tightly corked glass filled to the brim with palm wine shatters on standing.

(b) State **one** industrial application of **each** of the following methods of separation:
(i) crystallization;
(ii) fractional distillation.

(c) Explain the following terms:
(i) *saponification*;
(ii) *esterification*.

(d) Write a balanced equation to illustrate **each** of the terms in (c).

(e) (i) What is *hydrocarbon compound*?
(ii) Name **two** principal sources of hydrocarbons.

[25 marks]

PAPER 3

(PRACTICAL)

1. **A** is a solution of HCl of unknown concentration.
   B contains 1.00g of NaOH in 250cm^3 of solution.

   (a) Put **A** into the burette and titrate it against 20.0cm^3 or 25.0cm^3 portions of **B** using methyl orange as indicator.
   Tabulate your burette readings and calculate the average volume of **A** used.
   The equation for the reaction involved in the titration is
   $NaOH + HCl \rightarrow NaCl + H_2O$

   (b) From your results and the information provided above, calculate the

   (i) concentration of **A** in $moldm^{-3}$;

   (ii) concentration of **A** in gdm^{-3}.

   [H=1.0;O=16; Na=23;Cl=35.5]

2. **C** is a solution of a simple salt. Carry out the following exercises on **C**.
   Record your observations and identify any gases evolved.
   State the conclusions you draw from the result of **each** test.
   Put about 2cm^3 each of **C** in **three** separate test tubes.

   (a) To the first portion of C add $NaOH_{(aq)}$ in drops and then in excess.

   (b) To the second portion of C add a few drops of $AgNO_{3(aq)}$ followed by excess $HNO_{3(aq)}$.

   (c) To the third portion of C add about 2cm^3 of $KI_{(aq)}$.

3. State the apparatus that could be used to

   (i) separate liquids whose boiling points are within a range of five degrees;
   (ii) change vapour into liquid during distillation;
   (iii) separate a mixture of starch and water.

PAPER 3

(ALTERNATIVE TO PRACTICAL WORK TEST)

1. The following table gives the burette readings when 25.00cm^3 portions of 0.100$moldm^{-3}$ solutions of $NaHCO_3$ were titrated against dilute HNO_3.

Burette readings/ cm^3	1	2	3
Final volume	22.30	41.50	29.50
Intial volume	1.40	21.40	9.60
Titre			

(a) Copy and complete the table.

(b) Calculate the average titre.

(c) Determine the concentration of the acid in $moldm^{-3}$.

2. **X** was a solution of a simple salt. The tests recorded in the table below were performed as indicated.
Copy and complete the table.

Test	Observation	Inference
(a) X + NaOH (aq) in drops then in excess	---------- ----------	Cu^{2+} Present
(b) X + NH_3 (aq) in drops then in excess	---------- ---------- ----------	---------- ---------- ----------
(c) X + $BaCl_2$ (aq) then followed by ----------	White precipitate insoluble	---------- ----------

3. State what is observed when **each** of the following compounds is heated strongly:
(i) $ZnCO_3$

(ii) NH_4Cl

(iii) $Pb(NO_3)_2$