O Level

Chemistry

Session: 1974 June
Type: Question paper
Code: 542

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CHEMISTRY 542/1

ORDINARY LEVEL

THEORY

(Two hours and a half)

Answer Question 1 *and any* **four** *other questions.*

Candidates are advised to spend not more than 60 *minutes in answering Question* 1.

Unless otherwise stated, equations must be given wherever possible and diagrams where they are helpful.

Names, not symbols, should be used in descriptive work for all reacting chemicals and for the products formed.

Mathematical tables and squared paper are available.

Archives & Heritage

Essential working must be shown.

In this paper, *relative atomic mass* may be read as *atomic weight* and *relative molecular mass* as *molecular weight*.

[H = 1·0; C = 12·0; N = 14·0; O = 16·0; S = 32·0; Cl = 35·5; Zn = 65·4. One mole of a gas occupies 22·4 litres at s.t.p. The Faraday constant = 96 500 C/mol.]

1 (*a*) Write the equation for **one** reaction in **each** case in which

(i) a non-metallic **element** is reduced,

(ii) a **compound** is oxidised by nitric acid,

(iii) a **compound** is oxidised by chlorine. [3 *marks*]

(*b*) Give the names **or** formulae of

(i) the products formed when sodium nitrate is heated,

(ii) a suitable catalyst for the decomposition of hydrogen peroxide,

(iii) a compound that is decomposed by exposure to sunlight,

(iv) a compound formed by oxidation of ethanol with acidified potassium dichromate. [4 *marks*]

(*c*) Calculate

(i) the **volume** of oxygen used up,

(ii) the **mass** of carbon dioxide formed,

when 22·4 litres of ethene (ethylene, C_2H_4) are burnt in an excess of oxygen (both volumes at s.t.p.). [3 *marks*]

(*d*) Describe briefly **one** experiment you have seen to illustrate the *diffusion* of a gas or vapour. [3 *marks*]

(*e*) Describe **one** chemical test in **each** case which you could use to distinguish between

(i) a solution containing Pb^{2+} ions and a solution containing Ca^{2+} ions, [3 *marks*]

(ii) a solution containing Na^{+} ions and a solution containing NH_4^{+} ions. [3 *marks*]

(No marks will be given for tests in which solutions are evaporated to dryness.)

(*f*) Explain what you understand by *photosynthesis* in a plant. [3 *marks*]

(*g*) Making use **only** of substances chosen from the list below

water	sodium carbonate
concentrated sulphuric acid	sodium chloride
zinc	copper
zinc sulphide	calcium carbonate

give equations and conditions for the reactions by which you could obtain

(i) hydrogen,

(ii) hydrogen sulphide,

(iii) hydrogen chloride,

(iv) a carbonate of zinc. [4 × 3 *marks*]

(You are **not** required to describe the purification **or** collection of these substances.)

(*h*) Given that the number of atoms in one mole (i.e. 12 g) of carbon is 6×10^{23}, write down

(i) the number of molecules in 1·4 g of nitrogen gas,

(ii) the number of electrons required to convert 3·2 g of sulphur to sulphide ion (S^{2-}),

(iii) the number of sodium ions in 250 cm^3 of 1·0 M sodium chloride solution. [3 × 2 *marks*]

2 (*a*) Making use of calcium carbonate, hydrochloric acid and charcoal, describe, with the help of a diagram, the preparation and collection of carbon monoxide. [7 *marks*]

(*b*) A volatile liquid **X** is a compound of carbon and sulphur only. 0·2 mole of **X** contains 2·4 g of carbon and 12·8 g of sulphur. Calculate the relative molecular mass and formula of compound **X**. [4 *marks*]

X burns in oxygen to form a mixture of two gases both of which are completely absorbed by sodium hydroxide solution.

(i) Give the formulae of the two gases formed.

(ii) Give the formulae of the compounds formed in solution when these gases react with sodium hydroxide. [4 *marks*]

3 Use your chemical knowledge and the information below to answer questions (*a*) to (*i*) about the substances named in the table.

Substance	Formula	Melting point, in °C	Boiling point, in °C
Acetic acid	CH_3COOH	16·6	118
Argon	Ar	−189	−186
Benzene	C_6H_6	5·5	80
Calcium chloride	$CaCl_2$	772	over 1600
Lead	Pb	327	1613
Methanol	CH_3OH	−97·7	64·5
Sodium	Na	98	880
Sodium carbonate	Na_2CO_3	852	decomposes at a very high temperature
Sulphur dioxide	SO_2	−72·7	−10

(*a*) Which substances are liquids at a temperature of 50 °C? [3 *marks*]

(*b*) Which substance is a liquid over the smallest range of temperature? [1 *mark*]

(*c*) Which **two** substances conduct electricity at a temperature of 20 °C? [2 *marks*]

(*d*) Which **two** substances conduct electricity readily at a temperature of 900 °C but not at 20 °C? [2 *marks*]

(*e*) Which is the least reactive substance in the table? [1 *mark*]

(*f*) Which **two** compounds are covalent when pure but dissolve in water to give solutions that conduct electricity? [2 *marks*]

(*g*) Which substance dissolves in water to give a solution that will not conduct electricity? [1 *mark*]

(*h*) Which **two** substances are soluble in water and give a white precipitate when their solutions are mixed? [1 *mark*]

(*i*) Which substances would you expect to burn in excess of oxygen to give carbon dioxide and water? [2 *marks*]

4 Make use of the information in the table below to answer the following questions about strontium and bismuth. **Either** write equations for **or** name the products of any definite chemical reactions to which you refer.

Element	Strontium	Bismuth
Symbol	Sr	Bi
Relative atomic mass	88	209
Valency	2	3
Position in the activity series (electrochemical series)	Between sodium and calcium	Between lead and copper

(*a*) Write formulae for the oxides of strontium and bismuth and state how these oxides would differ

(i) when treated with water,

(ii) when heated in hydrogen. [6 *marks*]

(*b*) How would you expect the elements strontium and bismuth to differ in their behaviour when added to cold water? [3 *marks*]

(*c*) Write formulae for the chlorides of strontium and bismuth. [1 *mark*]

(*d*) Name the substances you would expect to be liberated at platinum cathodes (negative electrodes) when solutions of

(i) strontium chloride,

(ii) bismuth chloride,

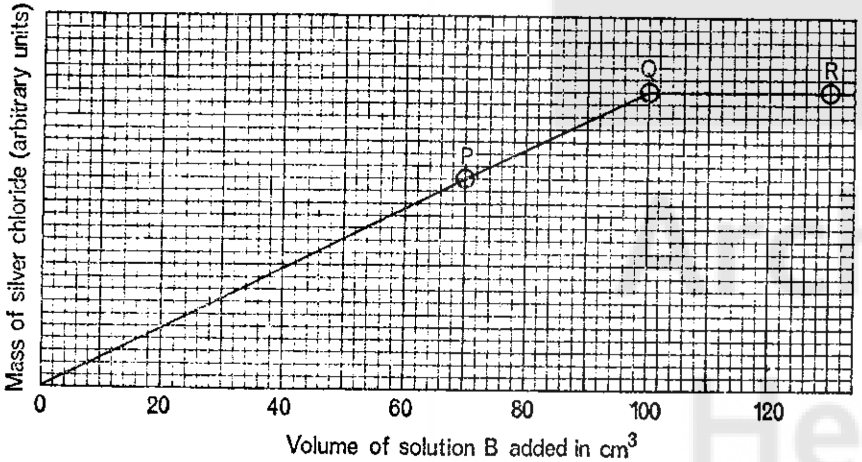
are electrolysed separately. [2 *marks*]

(*e*) What masses of the products in (*d*) would be liberated by the passage of 96 500 C (coulombs) of electricity? [3 *marks*]

5 Solution *A* contains one mole per litre of the chloride of a metal *M*.

Solution *B* contains one mole per litre of silver nitrate ($AgNO_3$).

In a series of experiments, different volumes of solution B were added to 50 cm^3 portions of solution A and the mass of silver chloride precipitated in each experiment was determined. The results of the experiments are shown in the following graph.



(*a*) Explain why the graph has the shape shown. [4 *marks*]

(*b*) What fraction of one mole of the chloride of M is present in 50 cm^3 of solution A? [1 *mark*]

(*c*) What fraction of one mole of silver nitrate is present in 100 cm^3 of solution B? [1 *mark*]

(*d*) How many moles of silver nitrate are needed to react completely with one mole of the chloride of M? [1 *mark*]

(*e*) Write the formula for the chloride of M and the equation for the reaction between the chloride and silver nitrate. [2 *marks*]

(*f*) The relative molecular mass of the chloride of M is 111·0. What is the relative atomic mass of M? [2 *marks*]

(*g*) Give the formulae of the ions (other than those formed from water) present in solution in the liquids corresponding to the points P, Q and R on the graph. [4 *marks*]

6 In the U.S.A., ethene (ethylene) is manufactured by heating ethane to temperatures between 800 °C and 900 °C:

$$C_2H_6 \rightarrow C_2H_4 + H_2.$$

The process is called the *cracking* of ethane.

In the cracking of the hydrocarbon C_3H_8, several reactions occur, one of which is represented by the equation

$$C_3H_8 \rightarrow C_3H_6 + H_2.$$

(*a*) Give the names of the hydrocarbons C_3H_8 and C_3H_6. [2 *marks*]

(*b*) Give the names and the general formulae of the homologous series to which C_3H_8 and C_3H_6 belong. [4 *marks*]

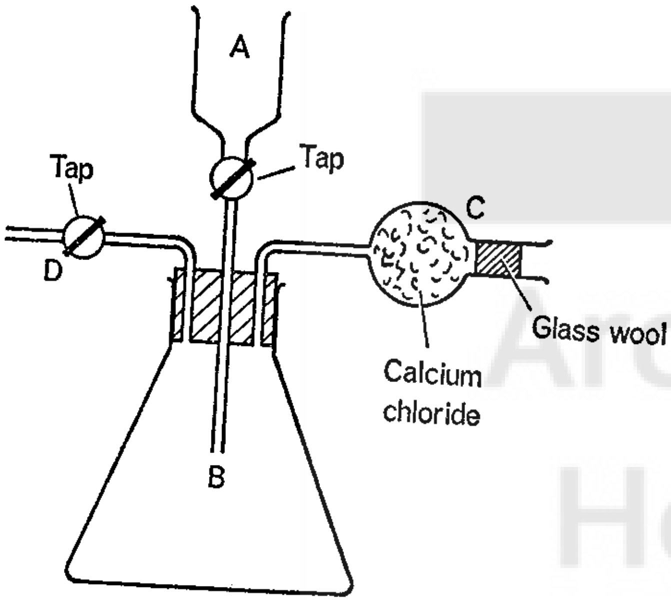
(*c*) Give the structural formulae for C_3H_8 and C_3H_6, using lines to represent covalent bonds between atoms. [2 *marks*]

(*d*) When C_3H_8 is cracked, another reaction occurs in which a mixture of equal volumes of two other gaseous hydrocarbons is formed. Give the formulae of these two hydrocarbons. [2 *marks*]

(*e*) Give **two** possible industrial uses of the hydrogen formed as a by-product of the manufacture of ethene. [2 *marks*]

(*f*) Explain how ethane and ethene differ in their reactions with chlorine. [3 *marks*]

7 The apparatus below can be used to determine the mass of carbon dioxide evolved when a carbonate reacts with an excess of acid.



A known mass of the carbonate is placed in flask *B*, dilute hydrochloric acid is placed in funnel *A* and the whole apparatus is weighed. The acid is then added to the carbonate and when the reaction is over, air is blown through tube *D* and the whole apparatus re-weighed.

(*a*) What is the purpose of the calcium chloride in *C*? [1 *mark*]

(*b*) Should tap *D* be open or closed while the reaction is going on? Give a reason for your answer. [2 *marks*]

(*c*) Explain why air is blown through tube *D*. [3 *marks*]

(*d*) A basic carbonate of zinc has the formula

$$ZnCO_3.Zn(OH)_2.$$

Write equations for the reactions you would expect when this compound is

(i) treated with an excess of dilute hydrochloric acid, [2 *marks*]

(ii) heated to constant mass. [2 *marks*]

(*e*) What would you expect to observe in experiment (*d*)(ii)? [1 *mark*]

(*f*) Calculate

(i) the relative molecular mass of the compound

$ZnCO_3.Zn(OH)_2$, [1 *mark*]

(ii) the mass of carbon dioxide evolved when 10 g of the basic carbonate is treated with an excess of dilute hydrochloric acid. [3 *marks*]

8 Use the information in the table to answer parts (*a*), (*b*) and (*c*).

Element	Carbon	Oxygen	Fluorine	Sodium	Sulphur
Symbol	C	O	F	Na	S
Atomic number	6	8	9	11	16
Mass number	12	16	19	23	32

(*a*) Draw simple diagrams to show the structures of the atoms of **two** of the elements in the table. [2 × 3 *marks*]

(*b*) Give the formulae of

(i) **two** covalent compounds, [2 *marks*]

(ii) **two** ionic compounds, [2 *marks*]

formed only from the elements in the table.

(*c*) Describe, in terms of electrons, the formation of **one** of the covalent compounds and **one** of the ionic compounds in (*b*) from their constituent atoms. [5 *marks*]

CHEMISTRY

542/2 (U.K.)
542/2 (Carib.)

ORDINARY LEVEL

PRACTICAL A

(*Two hours*)

Answer **all** *the questions.*

Read the questions carefully and follow the instructions.

Archives & Heritage

N.B. *In Question 1, all burette readings and the capacity of the pipette must be recorded,* **but no account of experimental procedure is required. All essential working must be shown;** *if a slide rule is used, a statement to this effect must be made.*

Mathematical tables are available.

Candidates using semi-micro methods in Questions 2 and 3 should modify the instructions as appropriate to the size of apparatus and the techniques they are using.

[H = 1·0; O = 16·0; Na = 23·0; S = 32·0.]

1 **BA 1** is a solution containing 4·65 g/litre of sulphuric acid.

BA 2 is a solution containing 5·00 g/litre of a sample of sodium hydroxide having sodium chloride as an impurity.

Put the acid into the burette and titrate 25 cm^3 (or 20 cm^3) portions of **BA 2**, using the indicator provided.

You must state in your results

(*a*) the size of the pipette you actually use,

(*b*) the titration value you intend to use in the calculation.

Calculate

(i) the concentration, in mole/litre, of the sodium hydroxide present in solution **BA 2**,

(ii) the percentage by mass of sodium hydroxide in the sample.

The equation for the reaction may be written

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O.$$

2 **BA 3** is a mixture of the carbonates of two metals.

Put the whole of your sample into a conical flask, add approximately 20 cm^3 of dilute sulphuric acid and wait for the effervescence to subside. Gentle swirling of the flask will hasten the process. You should obtain a clear solution but any slight residue can be ignored.

To this solution, add approximately 50 cm^3 of sodium hydroxide solution, place an empty filter funnel in the neck of the flask and heat just to boiling, taking care to avoid 'bumping'. The funnel should prevent loss of any material if 'bumping' does occur. Leave the contents of the flask for a few minutes, filter while still hot and keep the residue in the filter paper for further experiments.

Cool the filtrate and test separate portions of it as follows

(i) add a few cm^3 of sodium sulphide solution,

(ii) gradually add dilute nitric acid until there is no further change.

Make a solution from the residue by filling the filter paper once with dilute sulphuric acid and collecting the filtrate. Do **not** repeat the extraction. Test separate portions of this filtrate as follows

(*a*) add a few cm^3 of sodium sulphide solution,

(*b*) add a little ammonia solution, followed by an excess.

Describe and, as far as possible, account for all your observations and, using the results of these experiments **and no others**, identify the two metals in **BA 3**. Be careful to indicate which results help you to identify each metal.

3 **BA 4**, **BA 5** and **BA 6** are three different sodium salts. Identify the anion (acid radical) in each.

If you use a solution test, you must state clearly how you prepare the solution of the specimen.

PRACTICAL CHEMISTRY INSTRUCTIONS

PRACTICAL A **B (A)**

ORDINARY LEVEL

PAPER **542/2** (U.K.) **542/2** (CARIB.)

THURSDAY 13 JUNE 1974

In addition to the fittings and substances ordinarily contained in a chemical laboratory and to the substances enumerated below, candidates will require a burette to hold 50 cm^3 and a pipette of either 20 cm^3 or 25 cm^3 capacity.

All candidates at a Centre should have pipettes of the same capacity.

The following are to be provided locally.

1 A solution of hydrochloric acid or sulphuric acid, labelled **BA 1**, and an approximately 0·1 M (0·1 N) solution of sodium hydroxide, labelled **BA 2**. The precise concentration of each solution is immaterial but it is *essential* that 25·0 cm^3 of **BA 2** are equivalent to between 28·0 and 30·0 cm^3 of **BA 1** (or 20·0 cm^3 of **BA 2** equivalent to between 22·4 and 24·0 cm^3 of **BA 1**) using the indicator provided. The Supervisor is asked to perform the titration at the same time as the candidates and to record the result on the report form **which must be returned with the scripts**. Unless this is done and unless the titre is within the stated limit, candidates may be unavoidably penalised.

Allow each candidate 150 cm^3 of each solution. Candidates must assume that **BA 1** and **BA 2** are as described in the question paper. They must **not** be told how the solutions are actually prepared.

2 Methyl orange, screened methyl orange or any other suitable indicator.

3 An intimate mixture containing approximately equal parts by mass of copper(II) carbonate and zinc carbonate, labelled **BA 3**. Allow each candidate approximately 2 g. Candidates will be instructed to use the whole of their sample and should require no more but, in the event of mishap, a further portion may be issued without penalty.

4 Well-powdered samples of sodium chloride, sodium nitrate and sodium sulphite, labelled **BA 4**, **BA 5** and **BA 6** respectively. Allow each candidate a few grammes of each.

5 Apart from apparatus and materials used in testing for gases, anions and cations, candidates should have access to solutions of sulphuric acid (M), nitric acid (2 M), sodium hydroxide (2 M), ammonia (2 M) and sodium sulphide (approximately 1 g in 50 cm^3). Each candidate will require only a few cm^3 of the latter.

6 Each candidate will require a 250 cm^3 conical flask, a beaker of similar capacity (or a second conical flask), a filter funnel, a boiling tube and a supply of filter paper.

7 In all cases, more material may be issued if required, without penalty, but this should not be necessary.

8 N.B. Candidates are **not** allowed the use of qualitative analysis books in the examination.

9 In order to check the suitability of apparatus and material the teacher responsible for preparing the examination is allowed to consult the question paper eight working days before the paper is set. The question paper must then be **replaced in the envelope, re-sealed and kept under lock and key with other question papers until the day of the examination.**

PRACTICAL CHEMISTRY INSTRUCTIONS
PRACTICAL A

B (A)
CARIBBEAN

PAPER 542/2 (U.K.), 542/2, 547/2 (CARIB.)

In addition to the fittings and substances ordinarily contained in a chemical laboratory and to the substances enumerated below, candidates will require a burette to hold 50 cm^3 and a pipette of either 20 cm^3 or 25 cm^3 capacity.

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The following are to be provided locally.

1 A solution of hydrochloric acid or sulphuric acid, labelled **BA 1**, and an approximately 0·1 M (0·1 N) solution of sodium hydroxide, labelled **BA 2**. The precise concentration of each solution is immaterial but it is *essential* that 25·0 cm^3 of **BA 2** are equivalent to between 28·0 and 30·0 cm^3 of **BA 1** (or 20 cm^3 of **BA 2** equivalent to between 22·4 and 24·0 cm^3 of **BA 1**) using the indicator provided. The Supervisor is asked to perform the titration at the same time as the candidates and to record the result on the report form **which must be returned with the scripts.** Unless this is done and unless the titre is within the stated limit, candidates may be unavoidably penalised.

Allow each candidate 150 cm^3 of each solution. Candidates must assume that **BA 1** and **BA 2** are as described in the question paper. They must **not** be told how the solutions are actually prepared.

2 Methyl orange, screened methyl orange or any other suitable indicator.

3 An intimate mixture containing approximately equal parts by mass of copper(II) carbonate and zinc carbonate, labelled **BA 3**. Allow each candidate approximately 2 g. Candidates will be instructed to use the whole of their sample and should require no more but, in the event of mishap, a further portion may be issued without penalty.

4 Well powdered samples of sodium chloride, sodium nitrate and sodium sulphite, labelled **BA 4**, **BA 5** and **BA 6** respectively. Allow each candidate a few grammes of each.

5 Apart from apparatus and materials used in testing for gases, anions and cations, candidates should have access to solutions of sulphuric acid (M), nitric acid (2 M), sodium hydroxide (2 M), ammonia (2 M) and sodium sulphide (approximately 1 g in 50 cm^3). Each candidate will require only a few cm^3 of the latter.

6 Each candidate will require a 250 cm^3 conical flask, a beaker of similar capacity (or a second conical flask), a filter funnel, a boiling tube and a supply of filter paper.

7 In all cases, more material may be issued if required, without penalty, but this should not be necessary.

8 **N.B.** Candidates are **not** allowed the use of qualitative analysis books in the examination.

CHEMISTRY

542/3 (U.K.)
542/3, 547/3 (Carib.)

ORDINARY LEVEL

PRACTICAL B

(Two hours)

Answer **all** *the questions.*

Read the questions carefully, and follow the instructions.

N.B. *In Question* 1, *all burette readings and the capacity of the pipette must be recorded, but* **no account of experimental procedure is required. All essential working must be shown;** *if a slide rule is used, a statement to this effect must be made.*

Mathematical tables are available.

Candidates using semi-micro methods in Questions 2 and 3 should modify the instructions as appropriate to the size of apparatus and the techniques they are using.

[H = 1·0; O = 16·0; S = 32·0; Cl = 35·5; K = 39·0]

1 **BB 1** is a solution containing 3·35 g/litre of hydrochloric acid.

BB 2 is a solution containing 6·75 g/litre of a sample of potassium hydroxide having potassium sulphate as an impurity.

Put the acid into the burette and titrate 25 cm^3 (or 20 cm^3) portions of **BB 2**, using the indicator provided.

You must state in your results

(*a*) the size of the pipette you actually use,

(*b*) the titration value you intend to use in the calculation.

Calculate

(i) the concentration, in mole/litre, of the potassium hydroxide present in solution **BB 2**,

(ii) the percentage by mass of potassium hydroxide in the sample.

The equation for the reaction may be written

$$HCl + KOH \rightarrow KCl + H_2O.$$

2 **BB 3** is a mixture of the carbonates of two metals.

Put the whole of your sample in a conical flask, add approximately 20 cm^3 of dilute nitric acid and wait for the effervescence to subside. Gentle swirling of the flask will hasten the process. You should obtain a clear solution but any slight residue can be ignored.

To this solution, add approximately 50 cm^3 of sodium hydroxide solution, place an empty filter funnel in the neck of the flask and heat just to boiling, taking care to avoid 'bumping'. The funnel should prevent any loss of material if 'bumping' does occur. Leave the contents of the flask for a few minutes, filter while still hot and keep the residue in the filter paper for further experiments.

Cool the filtrate and carefully add dilute nitric acid to it until there is no further change. Test separate portions of the resulting solution as follows

(i) add a few cm^3 of potassium iodide solution,

(ii) add an approximately equal volume of dilute sulphuric acid.

Make a solution from the residue by filling the filter paper once with dilute nitric acid and collecting the filtrate. Do **not** repeat the extraction. To the filtrate cautiously add sodium carbonate solution until there is no further change. Describe and, as far as possible, account for all your observations and, using the results of these experiments **and no others**, identify the two metals in **BB 3**. Be careful to indicate which results help you to identify each metal.

3 **BB 4**, **BB 5** and **BB 6** are three different sodium salts. Identify the anion (acid radical) in each.

If you use a solution test you must state clearly how you prepare the solution of the specimen.

PRACTICAL CHEMISTRY INSTRUCTIONS

PRACTICAL B

ORDINARY LEVEL

PAPER **542/3**

B (B) Home

In addition to the fittings and substances ordinarily contained in a chemical laboratory and to the substances enumerated below, candidates will require a burette to hold 50 cm^3 and a pipette of either 20 cm^3 or 25 cm^3 capacity.

All candidates at a Centre should have pipettes of the same capacity.

The following are to be provided locally.

1 A solution of hydrochloric or sulphuric acid, labelled **BB 1** and an approximately 0·1 M (0·1 N) solution of sodium hydroxide, labelled **BB 2**. The precise concentration of each solution is immaterial but it is *essential* that 25·0 cm^3 of **BB 2** are equivalent to between 27·0 and 29·0 cm^3 of **BB 1** (or 20·0 cm^3 of **BB 2** equivalent to between 21·6 and 23·2 cm^3 of **BB 1**) using the indicator provided. The Supervisor is asked to perform the titration at the same time as the candidates and to record the result on the report form **which must be returned with the scripts.** Unless this is done and unless the titre is within the stated limit, candidates may be unavoidably penalised.

Allow each candidate 150 cm^3 of each solution. Candidates **must** assume that **BB 1** and **BB 2** are as described in the question paper. They must **not** be told how the solutions are actually prepared.

2 Methyl orange, screened methyl orange or any other suitable indicator.

3 An intimate mixture containing approximately equal parts by mass of calcium carbonate and lead(II) carbonate, labelled **BB 3**. Allow each candidate approximately 2 g. Candidates will be instructed to use the whole of their sample and should require no more but, in the event of mishap, a further portion may be issued without penalty.

4 Well powdered samples of sodium chloride, sodium sulphate and sodium sulphite, labelled **BB 4**, **BB 5** and **BB 6** respectively. Allow each candidate a few grammes of each.

5 Apart from apparatus and materials used in testing for gases, anions and cations, candidates should have access to solutions of nitric acid (2 M), hydrochloric acid (2 M), sulphuric acid (M), sodium hydroxide (2 M), sodium carbonate (M) and potassium iodide (0·5 M).

6 Each candidate will require a 250 cm^3 conical flask, a beaker of similar capacity (or a second conical flask), a filter funnel, a boiling tube and a supply of filter paper.

7 In all cases, more material may be issued if required, without penalty, but this should not be necessary.

8 N.B. Candidates are **not** allowed the use of qualitative analysis books in the examination.

9 In order to check the suitability of apparatus and material the teacher responsible for preparing the examination is allowed to consult the question paper eight working days before the paper is set. The question paper must then be **replaced in the envelope, re-sealed and kept under lock and key with other question papers until the day of the examination.**

PRACTICAL CHEMISTRY INSTRUCTIONS
PRACTICAL B

B (B)
CARIBBEAN

ORDINARY LEVEL

PAPER 542/3, 547/3 (CARIB.)

TUESDAY 25 JUNE 1974

In addition to the fittings and substances ordinarily contained in a chemical laboratory and to the substances enumerated below, candidates will require a burette to hold 50 cm^3 and a pipette of either 20 cm^3 or 25 cm^3 capacity.

All candidates at a Centre should have pipettes of the same capacity.

The following are to be provided locally.

1 A solution of hydrochloric or sulphuric acid, labelled **BB 1** and an approximately 0·1 M (0·1 N) solution of sodium hydroxide, labelled **BB 2**. The precise concentration of each solution is immaterial but it is *essential* that 25·0 cm^3 of **BB 2** are equivalent to between 27·0 and 29·0 cm^3 of **BB 1** (or 20·0 cm^3 of **BB 2** equivalent to between 21·6 and 23·2 cm^3 of **BB 1**) using the indicator provided. The Supervisor is asked to perform the titration at the same time as the candidates and to record the result on the report form **which must be returned with the scripts.** Unless this is done and unless the titre is within the stated limit, candidates may be unavoidably penalised.

Allow each candidate 150 cm^3 of each solution. Candidates **must** assume that **BB 1** and **BB 2** are as described in the question paper. They must **not** be told how the solutions are actually prepared.

2 Methyl orange, screened methyl orange or any other suitable indicator.

3 An intimate mixture containing approximately equal parts by mass of calcium carbonate and lead(II) carbonate, labelled **BB 3**. Allow each candidate approximately 2 g. Candidates will be instructed to use the whole of their sample and should require no more but, in the event of mishap, a further portion may be issued without penalty.

4 Well powdered samples of sodium chloride, sodium sulphate and sodium sulphite, labelled **BB 4**, **BB 5** and **BB 6** respectively. Allow each candidate a few grammes of each.

5 Apart from apparatus and materials used in testing for gases, anions and cations, candidates should have access to solutions of nitric acid (2 M), hydrochloric acid (2 M), sulphuric acid (M), sodium hydroxide (2 M), sodium carbonate (M) and potassium iodide (0·5 M).

6 Each candidate will require a 250 cm^3 conical flask, a beaker of similar capacity (or a second conical flask), a filter funnel, a boiling tube and a supply of filter paper.

7 In all cases, more material may be issued if required, without penalty, but this should not be necessary.