Cambridge Assessment

O Level

Chemistry

Session: 1957 June
Type: Question paper
Code: 23

CHEMISTRY 56

ORDINARY LEVEL

THEORETICAL PAPER

(Two hours and a half)

Answer the whole of Part I and any **four** *questions in Part II.*

Candidates are advised to spend not more than 50 minutes in answering Part I.

PART I

Answer this part on the sheet attached and hand it in with the rest of your answers.

PART II

Answer **four** *questions from this part.*

Unless otherwise stated, diagrams and equations must be given wherever possible. When fully labelled diagrams are given, descriptions of apparatus are not required.

Mathematical tables are provided.

1. Give a brief account of the commercial preparation of sulphuric acid. [No diagram is required.]

Give equations and experimental conditions for **one** reaction in each case by which (*a*) a solution of sulphur dioxide can be oxidised to sulphuric acid, (*b*) sulphuric acid can be reduced to sulphur dioxide.

Describe briefly **one** chemical test in each case to show that the change had taken place.

2. How is the electrolysis of brine (sodium chloride solution) carried out on a large scale?

Describe briefly how you could prepare from the products of the electrolysis, (*a*) hydrochloric acid, (*b*) solid sodium hydroxide, (*c*) a solution of sodium hypochlorite.

CHEMISTRY

ORDINARY LEVEL

JULY, 1957

PART I

INDEX NUMBER...../..... NAME .....

[H = 1; C = 12; N = 14; O = 16; Na = 23; S = 32; Cl = 35·5; Cu = 63·5. 1 gm. molecular weight of any gas occupies 22·4 litres at N.T.P.]

1. Explain concisely the meaning of each of the following:

atom, ...

.....

normal salt, ...

.....

molecule, ...

.....

acid, ...

.....

hydrated salt, ...

.....

2. Complete the following table:

Substance	Colour	Formula	Usual physical state (gas, liquid, or solid)
Ammonia			
Nitric acid			
Lead carbonate			
Copper sulphate			
Ammonium sulphate			

3. Write equations **only** for the following reactions:

(*a*) calcium carbonate and dilute hydrochloric acid,

.....

(*b*) sodium hydroxide and ferric chloride,

.....

(*c*) sodium and water,

.....

(*d*) copper oxide and dilute nitric acid.

.....

.....

4. What is the valency of

(*a*) sulphur in sulphur dioxide, ...

(*b*) nitrogen in ammonia, ...

(*c*) aluminium in aluminium oxide, ...

(*d*) sodium in sodium chloride? .....

5. State (*a*) Boyle's law, (*b*) Charles' law.

(*a*) .....

.....

(*b*) .....

.....

6. How many grams of sulphuric acid, sodium carbonate and sodium hydroxide respectively are contained in

(*a*) 1 litre of normal sulphuric acid solution, ...

(*b*) 1 litre of normal sodium carbonate solution, ...

(*c*) 1 litre of 0·5 normal sodium hydroxide solution? .....

7. What is the volume occupied by

(*a*) 7 gm. of nitrogen at N.T.P.; .....

(*b*) 16 gm. of oxygen at N.T.P.; .....

(*c*) 8 gm. of sulphur dioxide at N.T.P.? .....

8. Define the terms (*a*) equivalent weight, (*b*) atomic weight of an element.

(*a*) .....

.....

(*b*) .....

.....

State the relationship between them.

.....

9. A metallic chloride contains 79·8% of chlorine. The specific heat of the metal is 0·23. Calculate the equivalent weight and the exact atomic weight of the metal.

.....

.....

10. What is the formula of a salt containing 37·24% copper, 41·64% chlorine and 21·12% water?

.....

.....

[60 marks]

3. How would you prepare and collect a pure specimen of nitrogen dioxide in the laboratory?

Describe the changes that take place when nitrogen dioxide reacts with (*a*) water, (*b*) hydrogen sulphide, (*c*) hot copper.

4. State (*a*) the law of definite proportions (constant composition), (*b*) the law of multiple proportions.

A metal forms two oxides. The higher oxide contains 79·8% of the metal. 0·429 gm. of the lower oxide formed 0·477 gm. of the higher oxide when oxidised. Calculate the two equivalent weights of the metal, and show how the values agree with the law of multiple proportions.

5. Describe briefly how (*a*) producer gas, (*b*) water gas, are prepared. What are the principal constituents of each gas? Assuming that the reactions by which these gases are prepared go to completion, calculate (i) the weight of copper oxide which would be reduced to copper by 10 litres of water gas measured at N.T.P., (ii) the composition by volume of producer gas, if air contains four-fifths nitrogen and one-fifth oxygen by volume.

6. How would you prepare in a reasonably pure condition

(*a*) zinc oxide from a solution of zinc sulphate;

(*b*) copper from a solution of copper sulphate (not by electrolysis);

(*c*) lead sulphate from lead oxide (litharge);

(*d*) calcium sulphate from calcium chloride solution?

7. Describe briefly how iron is extracted from iron ore. [No diagram is required.]

How would you prepare (*a*) anhydrous ferric chloride, (*b*) ferric oxide, (*c*) crystalline ferrous sulphate, from iron filings?

[100 marks]

CHEMISTRY 57

ORDINARY LEVEL

PRACTICAL TEST

(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 calculations** *must be done on the paper actually given in; if a slide rule is used, a statement to this effect must be made.*

Mathematical tables are provided.

In Questions 2 *and* 3, *credit will be given for good observations precisely recorded, and for well-drawn inferences.*

1. **B 1** is a solution of sodium bicarbonate. **B 2** is a solution containing 4·00 gm. per litre of hydrochloric acid. Put the solution of acid in the burette and by means of it find the normality and the concentration in gm. per litre of sodium bicarbonate in the solution **B 1**.

Use 20 c.c. or 25 c.c. of the bicarbonate for each titration and the indicator provided.

Tabulate your burette readings, and give the average volume of the acid used.

[H = 1; C = 12; O = 16; Na = 23; Cl = 35·5.]

2. Identify the metallic radical and the two acidic radicals in the mixture **B 3**.

3. (*a*) Heat the substance **B 4** in a test-tube, and identify any gas evolved. Describe all that you observe while heating and then allowing to cool.

(*b*) Dissolve a portion of the residue from experiment (*a*) in dilute hydrochloric acid and then add sodium hydroxide solution **slowly**, with constant shaking, until the solution is alkaline and no further change occurs. Describe all that you observe.

(*c*) Pour a little of the product from experiment (*b*) into a separate test-tube, keeping the remainder in reserve in case you wish to repeat the experiment. To this small portion slowly add dilute sulphuric acid until the solution is acid and no further change occurs. Shake constantly during this operation, and describe all that you observe.

Give some simple explanation for the results observed in the above experiments.

PRACTICAL CHEMISTRY INSTRUCTIONS B

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In addition to the fittings and substances ordinarily contained in a chemical laboratory and to the substances enumerated below, burettes to hold 50 c.c. and pipettes (20 or 25 c.c.) should be provided in sufficient numbers for the candidates, but all candidates at a centre are to use pipettes of the same size.

Neither balances nor tables of atomic weights will be required.

The following substances are to be provided locally:

1. A solution containing approximately 8 gm. of $NaHCO_3$ per litre, labelled "Solution of sodium bicarbonate **B 1**." Allow each candidate 150 c.c.

2. A solution containing approximately 4 gm. of HCl per litre, labelled "Solution of hydrochloric acid **B 2**, 4·00 gm. per litre." Allow each candidate 150 c.c.

3. Methyl orange, or screened methyl orange, or other suitable indicator, is to be provided, but all candidates at the same centre must use the same indicator.

[*Note.* The solutions need not contain exactly 4 gm. and 8 gm. per litre respectively, but their actual concentrations must be

accurately known and must be stated on the envelope of scripts in the space provided. The candidates will assume that the acid contains exactly 4 gm. per litre, and the Examiner will make the necessary correction.]

The Examiners will be obliged if the Chemistry Master will himself perform the titration in the first question and enclose the results with the scripts. Unless this is done at the same time as the candidates' own titrations, candidates may be unavoidably penalized.

4. A mixture of powdered lead nitrate and lead carbonate, labelled **B 3**. The lead nitrate should be well powdered to avoid decrepitation on heating.

5. Zinc carbonate powder labelled **B 4**.

6. The bench reagents, dilute sodium hydroxide and dilute sulphuric acid, should be between $2N$ and $3N$.

Substances **B 3** and **B 4** can conveniently be given out on squares of stiff paper, or watch glasses, with appropriate labels.

Allow each candidate about a teaspoonful of each substance.

[More material may be issued, if required, without penalty, but this should not be necessary.]

7. Small pieces of litmus paper should be provided for Question 3.

CHEMISTRY 58

ORDINARY LEVEL

ALTERNATIVE-TO-PRACTICAL TEST

(*One hour and a half*)

Answer the whole of Question 1 *and any* **two** *other questions.*

Throughout this paper, marks will be given mainly for details which show that you have carried out experiments in the laboratory.

Mathematical Tables are provided.

1. (*a*) What weight of sodium carbonate is required to make 1 litre of $N/2$ solution?

(*b*) If 25 c.c. of this solution neutralized 20 c.c. of a solution of hydrochloric acid, what weight of pure HCl does 1 litre of the solution contain?

[H = 1; C = 12; O = 16; Na = 23; Cl = 35·5]

(*c*) What are the colours of the following substances: copper carbonate; baking soda; lead dioxide; ferrous sulphate crystals; ferrous sulphide?

(*d*) *X*, *Y* and *Z* are gases, each of which is soluble in water. The solutions of *X* and *Y* give a red colour with litmus, the solution of *Z* bleaches litmus. When *X* and *Y* are bubbled successively into the same quantity of water, a yellow substance is deposited which, if collected and dried, burns in air to form the gas *X* again. When *Y* and *Z* are mixed, the same yellow substance is formed, together with a steamy acid gas *W*. When *W* is mixed with ammonia gas it forms a white smoke. Identify *X*, *Y*, *Z* and *W*, and explain the changes involved.

2. Of what substance is the "fur" in a kettle, in a district in which the water is hard, principally composed? Describe **two** tests by which you could identify this substance in a sample of fur from a kettle.

If you had a specimen of the water which had been boiled in the kettle, and some of the unboiled water, describe how you would compare the hardness of the two.

3. You are given a mixture of copper nitrate and sodium nitrate. Both salts dissolve in water. Describe how you would prepare from the mixture (*a*) copper carbonate, (*b*) crystals of sodium nitrate.

4. Draw and label diagrams of the apparatus you would use (*a*) to prepare and collect reasonably pure chlorine, (*b*) to collect a sample of dissolved air from tap water.

How does the air removed from water differ from ordinary air?