A/R III A

OXFORD LOCAL EXAMINATIONS
GENERAL CERTIFICATE OF EDUCATION
Summer Examination, 1951
Advanced Level
CHEMISTRY, PAPER III A

MONDAY, JULY 2. TIME ALLOWED—3 HOURS

[Write the number of the paper, R III A, on the left at the head of each sheet of your answers in the space provided.

If you are taking Chemistry at Scholarship Level you must not work this paper but you must work Chemistry III S.

Answer SIX questions, selecting at least ONE but not more than TWO from EACH of the sections B and C.

Mathematical tables are provided.]

SECTION A

1. Explain fully what is meant by the term *reduction*.

Give **one** example in **each** case of the reducing action of the following: (*a*) hydrogen sulphide; (*b*) hydrogen iodide; (*c*) oxalic acid; (*d*) stannous chloride. Write equations for the reactions.

Name **one** substance which can act both as an oxidizing and a reducing agent, and give **one** example of each type of action.

2. Describe the laboratory preparation of dry ammonia, giving a diagram of the apparatus used.

How does a solution of ammonia react with (*a*) ferric chloride; (*b*) mercurous chloride; (*c*) copper sulphate; (*d*) sodium chloride and carbon dioxide?

How would you detect a trace of an ammonium salt in tap water?

3. What is the chief ore of zinc? How is the metal extracted from this ore?

Describe how you would prepare specimens of the following from metallic zinc: (*a*) the sulphate; (*b*) the carbonate; (*c*) the oxide; (*d*) a solution of sodium zincate.

State **two** tests by which you could distinguish between zinc oxide and magnesium oxide.

4. Describe how you would obtain chemically a specimen of the first-named substance, free from the second substance, from each of the following mixtures, stating clearly the reactions upon which your separation is based: (*a*) hydrogen sulphide and hydrogen; (*b*) nitric oxide and nitrous oxide; (*c*) hydrogen chloride and carbon dioxide; (*d*) hydrogen bromide and bromine vapour.

Section B

5. One of the oxides of a metal **M** contains 70 per cent. of the metal. 1·5 gm. of **M** when dissolved in dilute sulphuric acid liberated 646 c.c. of hydrogen at 16° C. and 747 mm. pressure.

What is the probable atomic weight of **M**? By what method could you confirm this value?

What is the formula of the oxide indicated above and the equation for the reaction between **M** and dilute sulphuric acid?

(11·2 litres of hydrogen at S.T.P. weigh 1 gm.)

6. Excluding catalysis, give an account of the various factors which increase the speed of chemical reactions.

Illustrate the commercial importance of catalysis by describing **one** inorganic and **one** organic process in which the essential catalytic agent is a metal.

7. How does the freezing-point of an aqueous solution of a non-electrolyte depend upon (*a*) the concentration of the solute, (*b*) the molecular weight of the solute?

Given a pure solvent and a solution of a solid in the solvent, describe exactly how you would find the difference between the freezing-points accurately.

If m gm. of urea are dissolved in w gm. of water and the freezing-point of the solution is $-d°$ C., what is the molecular weight of urea, given that the depression constant for 100 gm. of water is K° C.?

Section C

8. An organic compound **B**, molecular formula C_3H_6O, does not reduce ammoniacal silver oxide. Name **B** and write its structural formula.

Describe how **B** is usually prepared in the laboratory, and state **one** other method by which it can be made.

How does **B** react with (*a*) sodium hydrogen sulphite; (*b*) phosphorus pentachloride; (*c*) a strong oxidizing agent; (*d*) iodine in the presence of an alkali; (*e*) hydroxylamine?

9. Illustrate the difference between (*a*) an alkyl and an acyl group, (*b*) an ether and an ester.

State **two** methods of making diethyl ether and describe how you would prepare a pure specimen of it by **one** method.

What esters have the formula $C_3H_6O_2$? Briefly describe how you could distinguish between them chemically.

10. Describe concisely the production of pure benzene from coal tar.

How, and under what conditions, does benzene react with (*a*) chlorine; (*b*) nitric acid; (*c*) sulphuric acid?

Write the structural formulae of benzene and of normal hexane (C_6H_{14}).

To what extent do these formulae account for the different chemical properties of these hydrocarbons?