A COURSE OF PRACTICAL CHEMISTRY FOR AGRICULTURAL STUDENTS; VOL. I

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649159543

A course of practical chemistry for agricultural students; Vol. I by L. F. Newman & H. A. D. Neville

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

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VOLUME I

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CAMBRIDGE
AT THE UNIVERSITY PRESS
1920

CAMBRIDGE UNIVERSITY PRESS
C. F. CLAY, MANAGER
LONDON : FETTER LANE, E.C. 4

LONDON : H. K. LEWIS AND CO., LTD.,
136 GOWER STREET, W.C. 1
LONDON : WILLIAM WESLEY AND SON,
28 ESSEX STREET, STRAND, W.C. 2
NEW YORK : G. P. PUTNAM'S SONS
BOMBAY
CALCUTTA } MACMILLAN AND CO., LTD.
MADRAS
TORONTO : J. M. DENT AND SONS, LTD.
TOKYO : MARUZEN-KABUSHIKI-KAISHA

PREFACE

THE following exercises in Practical Agricultural Chemistry are designed primarily for the use of students taking the course for the Degree in Agricultural Science at Cambridge University. Volume I is intended to cover the first year's course on the Chemistry and Physics of the Soil, while Volume II covers the second year's course on the Chemistry of Foods. The latter volume is divided into two parts: Part I dealing with such exercises in Pure Organic Chemistry as are essential for agricultural students, and is entirely qualitative, while Part II deals with quantitative estimations and technical analyses of food stuffs. This division has been considered desirable, as students who have already taken a course in Organic Chemistry will find it unnecessary to work through Part I of Volume II. Volume III deals with the special advanced Chemistry of Insecticides and Fungicides, Food preservatives, etc. It is hoped that this division into convenient booklets will make them useful to teachers. The exercises are designed to illustrate most of the essential points in Agricultural Chemistry and to require the minimum of apparatus.

A Course of Practical Work was compiled by Professor T. B. Wood some years ago for the use of his classes, and this forms the foundation of a portion of the present exercises. The sincere thanks of the authors are due to Professor Wood and the Syndics of the University Press for their permission to utilise that material.

In addition to the directions for practical work, a series of notes has been added to each day's work to explain just those points which considerable experience in teaching in a laboratory has shown to be those on which the student usually needs assistance from the demonstrator to explain the reason and reactions of the experiments as they are being carried out.

It is fully recognised that many of the experiments and accompanying notes could have been elaborated with advantage, but the necessity of restricting apparatus to the limits which it is possible to supply for the use of large classes, and the fact that the notes are only intended as laboratory guides, and not to supersede lectures, have determined the present scope of the volumes.

L. F. N.
H. A. D. N.

December, 1919.

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I

THE AIR

1. Burn a small bit of phosphorus in a bell jar standing in a dish of water and observe the following points:

(*a*) The phosphorus burns very brightly at first, then more feebly and finally goes out.

(*b*) As the phosphorus burns, white fumes are formed which gradually disappear.

(*c*) As the bell jar cools the gas inside decreases considerably in volume. (See note *a*.)

2. Prepare some oxygen by gently heating in a round-bottomed flask, fitted with a delivery tube, a small quantity of a mixture of potassium chlorate and manganese dioxide. (See note *b*.) Collect over water three cylinders of the oxygen which is given off. Place the end of the delivery tube under the bell jar in which the phosphorus was burned and pass in enough oxygen to make up the original volume.

(*a*) Into one of the cylinders of oxygen plunge a splinter of wood which has a glowing spark at the end. The wood at once bursts into flame. This is a common test for oxygen.

(*b*) Burn a bit of phosphorus in the second cylinder and note the great brightness with which it burns.

(*c*) Repeat with the third cylinder using charcoal instead of phosphorus.

(*d*) Burn another piece of phosphorus in the bell jar of nitrogen to which oxygen has been added and note that it burns just as it did in the original air. (See note *c*.)

3. Take a long tube, sealed at one end and fitted with a good rubber bung at the other end. Mark off this tube into five equal parts with either rubber rings or thin strips of gummed label. Remove the bung and introduce into the tube a piece of phosphorus about the size of a pea. Replace the bung. Ignite the phosphorus in the sealed end of the tube by *gently* warming in the bunsen flame. By tilting, run the burning phosphorus down the whole length of the tube. When the phosphorus ceases to burn, place the corked end of the tube under water and remove the cork. Water will pass up into the tube and when the gases have thoroughly cooled, will stand in the tube up to the level of the first division. (See notes *d* and *e*.)

4. Fit a test-tube with a cork and leading tube and arrange for collecting gas over water as in Expt. 2. Introduce into the tube a small quantity of mercuric oxide and heat strongly. Collect a test-tube of the gas evolved (allowing the first bubbles, which are mainly air, to escape) and test with a glowing splinter as in Expt. 2. The gas is oxygen. Notice at the same time that small globules of mercury collect on the cooler parts of the walls of the test-tube.