QUALITATIVE ORGANIC ANALYSIS

Qualitative Organic Analysis

B. Haynes

B.S.C. DIP.ED. F.R.I.C.

*Head of Department of Chemistry,
College of Technology, Kingston upon Thames*

SECOND EDITION

Macmillan Education

© B. Haynes 1966

MACMILLAN AND COMPANY LIMITED
incorporating Cleaver-Hume Press Limited
Little Essex Street London WC 2
also Bombay Calcutta Madras Melbourne

MACMILLAN AND COMPANY LIMITED
70 Bond Street Toronto 2

ST MARTIN'S PRESS INC
175 Fifth Avenue New York NY 10010

First published 1961
Reprinted 1962
Second edition 1966

Medium 8vo, 240 pages,
31 tables

ISBN 978-0-333-09376-4

ISBN 978-1-349-00621-2 (eBook)

DOI 10.1007/978-1-349-00621-2

Preface to Second Edition

THIS book is a development of a short scheme of qualitative organic analysis written originally for technical college students preparing for the Ordinary and Higher National Certificates in Chemistry, the Graduate Membership examination of the Royal Institute of Chemistry and University Degrees in Chemistry. Experience has shown that the book fully meets the requirements of these courses with regard to qualitative organic analysis, and the call for a second edition has enabled the author to introduce minor improvements and the publishers to reset the type.

The most important characteristic of the scheme is the use of one comprehensive set of preliminary tests for all compounds. This provides an immediate check on the results of the elements test, and furnishes sufficient additional information at the preliminary stage to enable the subsequent classification to be made in a reasoned manner. The time-consuming application of inappropriate classification tests, which too often arises from the use of analysis schemes depending on a very brief preliminary examination, is thus avoided. In addition, the comprehensive preliminary tests provide a valuable basic training in the behaviour of diverse organic substances towards common reagents, and gives practice in close observation, in deduction and in the correlation of information.

For convenience, classes of compounds are arranged in the same order in the chapters dealing with classification and preparation of derivatives as well as in the tables of melting points.

Any course of qualitative organic analysis should be supplemented by lectures on the basic chemistry involved therein, and for this reason and for brevity, detailed explanations of the reactions used in this scheme have not been given.

The tables of melting points have been compiled from numerous works of reference and original papers and care has been taken to ensure that they are fully sufficient for student needs.

The author thanks his colleague, Mr E. C. Brick, for valuable suggestions and for assistance in correcting the proofs. The constructive criticisms made by numerous students, both full-time and part-time are gratefully acknowledged.

January 1966

B. HAYNES

Contents

PREFACE	5
1 INTRODUCTION	9
2 PRELIMINARY EXAMINATION	15
1. Appearance 17	
2. Odour 18	
3. Action of heat 18	
4. Action of soda-lime 19	
5. Elements tests 21	
6. Mobility of halogen tests 25	
7. Barium chloride test 27	
8. Solubility 27	
9. Action of hot concentrated sulphuric acid 31	
10. Action of 30% aqueous sodium hydroxide 32	
11. Ferric chloride tests 34	
12. Tests for reducing properties 36	
13. Tests for unsaturation 38	
3 CLASSIFICATION	41
Section I	
Metallic derivatives 44	
Section II	45
Carbohydrates and related compounds 46. Aldehydes and ketones, acetals 47; polyfunctional carbonyl compounds 49. Quinones 51. Carboxylic acids 52. Phenols and enols 56. Esters (of carboxylic acids) and anhydrides, lactones 58. Alcohols 60. Ethers 64. Hydrocarbons 65.	
Section III	66
Amines and amino-compounds (amino-acids, etc.) 66. Amine salts 78.	
Section IV	79
Ammonium salts, aldehyde-ammonias, amides, imides, nitriles 79. Acyl derivatives of bases (<i>N</i> -substituted amides) 83. Hydrazines, semicarbazide, hydroxylamine, their salts and carbonyl derivatives 85. Condensation products of aldehydes with ammonia or amines 87.	

Qualitative Organic Analysis

Section V	87
Nitro-, nitroso-, azoxy-, azo- and hydrazo-compounds.	
Section VI	93
Compounds containing halogen (but not nitrogen or sulphur).	
Alkyl halides 93. Aryl halides 93. Halogen-substituted aliphatic acids, aldehydes, ketones, ethers, alcohols and esters 94. Aliphatic polyhalides 95. Acid halides 96.	
Section VII	96
Compounds containing nitrogen and halogen (but not sulphur).	
Section VIII	97
Compounds containing sulphur (with or without nitrogen and /or halogen).	
Ammonium salts of sulphonic acids 98. Sulphonic acids, sulphonamides 98. Amino-sulphonic acids 100. Sulphates of bases 101. Thioureas and thioamides 101. Sulphonyl halides 102. <i>N</i> -Halosulphonamides 103. Aldehyde and ketone bisulphite compounds 103. Thiols 103. Thioethers 104. Thio-acids 104. Esters of sulphonic acids 105.	
4 SEPARATION OF MIXTURES OF ORGANIC COMPOUNDS	107
5 IDENTIFICATION (The preparation of derivatives)	117
6 MELTING POINT TABLES	155
7 PREPARATION OF REAGENTS	219
INDEX	225