

CONTENTS

I. EXAMINATION OF THE PURITY OF THE SUBSTANCE..	1
Recrystallisation 1 — Determination of the melting point 1	
Determination of the boiling point 9 — Fractional distillation 10 — Determination of the refractive index 12 — Determination of the density 12 — Chromatography 13 — Ion exchange 16.	
II. The ELEMENTS	18
1. Carbon 18 — 2. Hydrogen 19 (Estimation of active hydrogen 19) — 3. Oxygen 22 (Estimation of active oxygen 23) — 4. Nitrogen 24 (Dumas' method for estimation of nitrogen 28, Kjeldahl's method for estimation of nitrogen 29) — 5. The halogens 34 (Detection of fluorine 35, of chlorine, bromine and iodine 36, Estimation of fluorine, 37, of chlorine, bro- mine and iodine, the Stepanov-Bacon method 37, of iodine, the Baubigny-Chavanne method 43, of chlorine and bromine, the Grote-Krekeler method 44) — 6. Sulphur 44 (Detection 44, Estimation, the Grote-Krekeler method 45) — 7. Phosphorus 48. — 8. Arsenic 50 — 9. Other elements 51.	
III. PRELIMINARY EXAMINATION AND GENERAL TESTS ..	53
1. Appearance 53 — 2. Smell 55 — 3. Taste 55 — 4. Solubility 56. — 5. Acid/base reaction 57. — 6. Solubility in bases 58 — 7. Hydrolysis with bases 59 — 8. Solubility in acids 60 — 9. Behaviour on burning 60 — 10. Absorption spectra 61.	
IV. DETECTION AND ESTIMATION OF FUNCTIONAL GROUPS	62
1. The hydroxyl group	62
A. ALIPHATICALLY-BOUND HYDROXYL	63
(1) Non-specific reactions 63 — (2) Primary alcohols 66 — (3) Secondary alcohols 68 — (4) Tertiary alcohols 69 — (5) Polyhydric alcohols 70 — (6) Other aliphatic hydroxyl compounds 71.	
B. AROMATICALLY-BOUND HYDROXYL	72
(1) Non-specific reactions and monohydric phenols 72 — Dihydric phenols 75 — (3) Trihydric phenols 77.	
C. HYDROXYL IN HETEROCYCLIC COMPOUNDS	78

D. PREPARATION OF DERIVATIVES FOR CHARACTERISING HYDROXY COMPOUNDS	78
(1) Chromatographic methods 78 — (2) <i>m</i> -Nitrophenylurethanes 84 — (3) Acetates 87 — (4) Benzoates 89 — (5) <i>p</i> -Nitrobenzoates 90 — (6) 3,5-Dinitrobenzoates 91 — (7) β -Cyano- β,β -Diphenylpropionates 95 — (8) <i>p</i> -Bromophenacyl alkyl xanthates 95 — (9) Pseudo-saccharin ethers 96 — (10) <i>S</i> -Alkylthiuronium picrates 97 — (11) 2,4-Dinitrobenzenesulphenates 98 — (12) Acid esters of phthalic acid 99 — (13) Oxidation products 100 — (14) Bromination products 101 — (15) Aryloxyacetic acids 101 — (16) Formation of nitrolyl ethers 103 — (17) Formation of 2,4-dinitrophenyl ethers 104.	
E. METHODS FOR THE QUANTITATIVE ESTIMATION OF HYDROXY COMPOUNDS	105
(1) Aliphatically-bound hydroxyl 105 (a. Acylation 105 — Estimation via b. the Potassium alkyl xanthates 110 — c. the <i>S</i> -Alkylthiuronium picrates 112 — d. the <i>p</i> -Nitrobenzoates 113 — e. the <i>m</i> -Nitrophenylurethanes or phenylurethanes 114 — f. the Acid phthalates 114 — g. Acid pyromellitates 115) — (2) Aromatically-bound hydroxyl 116 (a. Titration of aryloxyacetic acids 116 — b. Acetylation 116. — c. Estimation via the <i>p</i> -nitrobenzoates or the <i>m</i> -nitrophenylurethanes 116 — d. Titration with bromine 116. — e. Estimation via the 2,4-dinitrophenyl ethers 120) — (3) Heterocyclic hydroxy compounds 120 (a. Acetylation 120 — b. Estimation via <i>m</i> -nitrophenylurethanes 120 — c. Kjeldahl-determination of nitrogen 121 — d. Titration with bromine 121).	
2. The carbonyl group	121
A. NON-SPECIFIC REACTIONS	121
Reaction with (1) 2,4-Dinitrophenylhydrazine 121 — (2) <i>p</i> -Carboxyphenylhydrazine 122 — (3) Other substituted hydrazines 123 — (4) Colour reactions 123 (a. Fuchsin-sulphurous acid solution 123 — b. Sodium nitroprusside 124 — c. Diazobenzenesulphonic acid 125).	
B. THE ALDEHYDE GROUP	125
(1) Reduction of an ammoniacal solution of silver nitrate 125 — (2) Reduction of Fehling's solution 126 — (3) Dimedone 126 — (4) 1,2-Bis(<i>p</i> -methoxybenzylamino)ethane 126 — (5) 1,2-Bis-(phenylamino)ethane	

- 126 — (6) 2-Diphenylacetyl-indane-1,3-dion-1-hydrazine
127.
- C. SUBSTANCES WITH A METHYLENE GROUP ADJACENT TO A CARBONYL GROUP 127
- (1) Condensation with *p*-nitrosodimethylaniline 127 —
(2) Coupling with arenediazonium ions 128 — (3) Reaction with isoaniyl nitrite 128.
- D. DIKETONES 129
- (1) α -Diketones 129 (Reaction with a. *o*-Phenylenediamine 129 — b. Phenylhydrazine and substituted phenylhydrazines 130 — c. Hydroxylamine 131 — d. Sodium hydroxide 131 — e. Bismuth oxide 131) — (2) β -Diketones 132 (Reaction with a. *o*-Phenylenediamine 132 — b. Cupric acetate 133 — c. Titanous chloride 133 d. Substituted phenylhydrazines 133) — (3) γ -Diketones 134 (a. Reaction with 2,4-dinitrophenylhydrazine 134 — b. Pyrrole reaction 134) — (4) Quinones 134 (Reaction with a. Hydriodic acid 134 — b. Titanous chloride 134 — c. Formation of quinhydrones 135 — Reaction with d. Hydroxylamine 135 — e. Phenylhydrazine 135).
- E. KETO ACIDS 136
- (1) α -Keto acids 136 — (2) β -Keto acids 137 — (3) γ -Keto acids 138.
- F. PREPARATION OF DERIVATIVES FOR CHARACTERISING CARBONYL COMPOUNDS 139
- (1) 2,4-Dinitrophenylhydrazones 139 — (2) *p*-Carboxyphenylhydrazones 143 — (3) Phenylhydrazones and *p*-nitrophenylhydrazones 144 — (4) Semicarbazones 144 — (5) Oximes 146 — (6) Dimedone-derivatives 147 —
Derivatives with (7) 1,2-Bis(*p*-methoxybenzylamino)-ethane 148 — (8) 1,2-Bis(phenylamino)-ethane 150 — (9) 2-Diphenylacetyl-indane-1,3-dion-1-hydrazine 150 = (10) Substituted pyrroles 152 — (11) Summary of the course of the condensation reactions of *p* arboxyphenylhydrazine with different types of carbonyl compounds 152.
- G. METHODS FOR THE QUANTITATIVE ESTIMATION OF CARBONYL COMPOUNDS 156
- Estimation via (1) *p*-Carboxyphenylhydrazones 156 — (2) 2,4-Dinitrophenylhydrazones 160 — (3) Semicarbazones 164 — (4) with Sodium hydrogensulphite 165 —

(5) via Oximes 166 — (6) with Sodium borohydride 170 — (7) **Estimation** of 8-diketones by reaction with bases 172' — (8) Estimation of quinones 173.

3. Carbohydrates	174
A. DETECTION OF CARBOHYDRATES	174
(1) Reaction with α -naphthol and concentrated sulphuric acid 174 — (2) with Anthrone and concentrated sulphuric acid 174 — (3) Reduction of complex cupric ions 175 (a. Fehling's solution 175 — b. Barfoed's reagent 176 — c. Soldaini's reagent 176) — (4) Specific reactions for ketoses 176 (a. Selivanoff's reaction 176 — b. Reaction with aminoguanidine 177 — c. Anthrone reaction 177) — (5) Non-reducing carbohydrates 178.	
B. CHARACTERISATION OF INDIVIDUAL CARBOHYDRATES	178
(1) Determination of the specific rotation 178 — (2) Reaction with phenylhydrazine 179 — (3) Osotriazoles 181 — (4) Benzimidazole derivatives 182 — (5) Acylation products 184 (a. Acetyl derivatives 184 — b. Benzoyl derivatives 184 — c. Toluene-p-sulphonates 185) — (6) Ethers 185 — (7) Partition chromatography 186.	
C. ESTIMATION OF CARBOHYDRATES	188
a. Bertrand's method 189 — b. Lehmann and Maquenne's method 190 — c. Complexometric estimation 190 — d. Blom and Rosted's method 192 — e. The Hagedorn-Jensen method 192 — f. Willstatter and Schudel's method 193 — g. Estimation via osazones or phenylhydrazones 194 — h. Periodo-argentimetric estimation 194.	
4. Carboxylic acids	196
A. CARBOXYLIC ACIDS	196
(1) Reaction towards litmus 196 — (2) Reaction with sodium carbonate 197 (3) Preparation of salts 197.	
B. ANHYDRIDES OF CARBOXYLIC ACIDS	198
(1) Reaction towards litmus and sodium carbonate 198 — (2) Recrystallisation from water 198 — (3) Reaction with resorcinol 198 — (4) Reaction with phenylhydrazine 199.	
C. ACYL HALIDES	199

D. HYDROXY ACIDS	199
(1) α -Hydroxy acids 200 — (2) β -Hydroxy acids 201 —	
(3) γ - and δ -Hydroxy acids 201 — (4) Aromatic hydroxy	
acids 201.	
E. LACTONES	202
F. PREPARATION OF DERIVATIVES OF CARBOXYLIC	
ACIDS	203
(1) Formation of salts 203 (S-Benzylthiuronium salts	
203) — (2) Esters 207 — (3) Acid chlorides 212 — (4)	
Amides 213 — (5) Anilides and p-toluidides 215 — (6)	
Hydrazides and acylarylthiosemicarbazides 216 — Der-	
ivatives of (7) Acid anhydrides 216 — (8) Hydroxy	
acids 217 — (9) Partition chromatography 218.	
G. ESTIMATION OF CARBOXYLIC ACIDS	219
(1) Titration 219 — Estimation via (2) Salts of the acid	
224 — (3) p-Bromophenacyl esters 228 — (4) Amides	
or anilides 228 — (5) Estimation of aromatic hydroxy	
acids by titration with bromine 228 — (6) Estimation	
of acid anhydrides 229.	
5. Esters	230
A. GENERAL REMARKS	230
(a. The hydroxamic acid test 231 — b. Test for esters of	
aldehyde hydrates 232 — c. Separation of ester mixtures	
232).	
B. IDENTIFICATION OF THE ACID	233
Esters of (1) Inorganic acids 233 — (2) Hydrogen hali-	
des 233 — (3) Organic acids 233 (Characterisation as	
a. Amide or anilide 233 — b. Benzylamide 233 — c.	
N-(β -Morpholinoethyl) amide 234. — d. Anilide or p-to-	
luidide 235 — e. S-Benzylthiuronium salt 236 — f. p-Bro-	
mophenacyl ester 236 — g. Isolation of the acid 237).	
C. IDENTIFICATION OF THE ALCOHOL	237
(a. As 3,5-dinitrobenzoate 237 — b. Isolation of the	
alcohol 238).	
D. ESTIMATION OF ESTERS	240
(a. By saponification 240 — b. via derivatives 244).	

6. Alkoxy compounds	244
A. PHENOLIC ETHERS	244
Reaction with (1) Anhydrous aluminium chloride 245	
— (2) Hydriodic acid 245 — (3) Chlorosulphonic acid	
246 — (4) Bromination products 247 — (5) Picrates	
248 — (6) Reaction for methylenedioxybenzenes 249.	
B. ACYCLIC ETHERS	249
(1) Formation of oxonium compounds 249 — Reaction	
with (2) Hydriodic acid 250 — (3) Concentrated sul-	
phuric acid 250 — (4) 3,5-Dinitrobenzoyl chloride 250.	
C. CYCLIC ETHERS (ALKYLENE OXIDES)	251
Reaction with (1) Sodium chloride solution 251 — (2)	
Hydrochloric acid 251 — (3) Alkylmagnesium halide	
or sodiuni hydrogensulphite 252.	
D. ACETALS	252
E. ESTIMATION OF ALKOXYL COMPOUNDS	253
(1) Zeisel's methoxyl determination 253 — Estimation	
via (2) Sulplionamides 260 — (3) Picrates 260 — Esti-	
mation of (4) Ethers 261 — (5) 1,2-Alkylene oxides 261	
— (6) Acetals 264.	
7. Amines	264
A. DISTINCTION BETWEEN PRIMARY, SECONDARY	
AND TERTIARY AMINES AND QUATERNARY	
AMMONIUM COMPOUNDS	265
Reaction with (1) Nitrous acid 265 — (2) Toluene- <i>p</i> -	
sulphonyl chloride 268 — (3) Colour reactions 270 (a.	
with Chloroanil 271 — b. with Quinhydrone 272).	
B. PRIMARY AMINES	272
(1) The carbylamine reaction 272 — (2) The mustard	
oil reaction 272 — (3) Smell 273 — (4) Diazotation and	
coupling 273 — (5) Schiff bases 274 — (6) Diamines	
274 (a. <i>o</i> -Diamines 274 — b. <i>m</i> -Diamines 275 — c. <i>p</i> -	
Diamines 276).	
C. SECONDARY AMINES	276
D. TERTIARY AMINES	277
Reaction with (1) Acid potassium ferrocyanide 277 —	
(2) Methyl iodide 277.	

E. QUATERNARY AMMONIUM COMPOUNDS	277
F. PREPARATION OF DERIVATIVES OF AMINES	278
† (1) Salts 278 — (2) Acyl derivatives 281 (a. Acetyl derivatives 281 — b. Benzoyl derivatives 282 — c. Toluene- <i>p</i> -sulphonamides 282 — d. 3-Nitrophthalimides or phthalamic acids 282) — (3) ² 2,4-Dinitroanilines 283 — (4) Bromination products 284 — (5) Conversion into derivatives of urea or thiourea 284 — (6) Conversion into phenols 286.	
G. ESTIMATION OF AMINES	286
(1) Titration of the amine 286 (a. with Perchloric acid 286 — b. with Hydrochloric acid 287 — c. Bromometric estimation 287) — (2) Titration of amine salts 288 (a. Volhard estimation of halogen 288 — b. Titration of amine salts as acids 289 — c. Titration of ammonium picrates in non-aqueous solution 289) — (3) Estimation of nitrogen by the Kjeldahl method 290 — (4) Estimation via derivatives of the amine 291 (a. Dinitrobenzoates 291. — b. Acid ferrocyanides 291 — c. Substituted ureas or thioureas 292 — d. Nitrosamines 292) — (5) Determination of primary aliphatic amino groups by the van Slyke method 292 — (6) Determination of primary aromatic amines by diazotation 295.	
8. Amino acids	296
(1) Reaction of amino acids in aqueous solution 296 — Reaction with (2) Ferric chloride 297 — (3) Cupric acetate 297 — (4) Ninhydrin 297 — (5) Alkali cobalticarbonate 298 — (6) Salts of amino acids 299 (a. S-Benzylthiuronium salts 299 — b. Naphthalene- β -sulphonates 299) — (7) Acylation of amino acids 299 (a. 3,5-Dinitrobenzamides 299 — b. Toluene- <i>p</i> -sulphonamides 299 — c. <i>p</i> -Nitrobenzyl chloroformate 300 — d. Substituted phthalimides 300) — (8) Conversion into derivatives of urea 301 — (9) Chromatographic and electrophoretic methods 302 (a. Paper chromatography 302 — b. Gaschromatography 303 — c. Thin layer chromatography 304 — d. Electrophoresis 304) — (10) Estimation of amino acids 305 (a. Forinol titration 305 — Titration of b. the Carboxyl group 307 — c. the Amino group 308 d. Substituted phthalimides 309 — e. Aminosulphonic acids 310).	

9. Amides	310
A. UNSUBSTITUTED AMIDES	310
(1) Hydrolysis of amides 310 — (2) Reaction of amides with nitrous acid 311 — (3) The biuret reaction 311 — (4) Formation of xanthy derivatives 312 — (5) Hofmann degradation of amides 313 — (6) Hydrapides 314.	
B. SUBSTITUTED AMIDES	314
(1) N-Alkylsubstituted amides 314 — (2) N-Arylsubstituted amides 315 — (3) Acylsubstituted amides 316.	
C. IMIDES	316
Reaction with (1) Aqueous sodium hydroxide 316 — (2) Ammonia 317 — (3) Xanthy derivatives 317 — (4) Hofmann degradation of imides 317 — (5) Preparation of N-alkyl- or arylimides 317.	
D. UREA AND UREIDES	319
(1) Conversion into diphenylurea 319 — (2) Conversion of urethanes and isocyanates into sulphamic acids 319 — (3) Formation of xanthy derivatives 320 — (4) The cobalt-amine reaction 320 — (5) <i>p</i> -Nitrobenzyl derivatives 321 — (6) Reaction of guanidines 322 — (7) Hydrolysis 322.	
E. ESTIMATION OF AMIDES	322
(1) Hydrolysis and estimation of the ammonia evolved 322 — (2) Titration 323 — (3) Phthalimido substituted esters 324 — (4) Iodometric estimation of amidines 326 — (5) Estimation of hydrazides 326.	
10. Nitriles and isocyanides (Carbylamines)	329
A. NITRILES	329
(1) Hydrolysis to the acid and ammonia 329 — (2) Hydrolysis to the amide 329 — (3) Characterisation of nitriles 330 — (4) Conversion into ketones 330.	
B. ISOCYANIDES (CARBYLAMINES)	331
(1) Smell 331 — (2) Hydrolysis 331 — (3) Addition of alkyl iodide 331 — (4) Reaction with mercuric oxide 331 — (5) Addition of bromine 331.	
C. ESTIMATION OF NITRILES AND ISOCYANIDES	332
(1) Nitriles 332 — (2) Isocyanides 332.	

11. Diazo compounds	333
A. ALIPHATIC DIAZO COMPOUNDS	333
B. AROMATIC DIAZO COMPOUNDS	333
C. ESTIMATION OF DIAZO COMPOUNDS	334
12. Azo compounds	334
A. DETECTION OF AZO COMPOUNDS	334
B. ESTIMATION OF AZO COMPOUNDS	336
13. Azoxy compounds	341
A. DETECTION OF AZOXY COMPOUNDS	341
B. ESTIMATION OF AZOXY COMPOUNDS	342
14. Hydrazines	342
A. ALIPHATIC HYDRAZINES	342
(1) Primary hydrazines, RNHNH_2 , 342 — (2) Asymmetrical hydrazines, R_2NNH_2 , 343 — (3) Symmetrical hydrazines, RNHNHR and R_2NNR_2 , 343 — (4) Quaternary hydrazines, $\text{R}_3\overset{+}{\text{N}}\text{NH}_2\text{X}^-$, 344.	
B. AROMATIC HYDRAZINES	344
(1) Primary hydrazines, ArNHNH_2 , 344 (2) Asymmetrical hydrazines, Ar_2NNH_2 , 345 — (3.) Symmetrical hydrazines (hydrazo compounds), ArNHNHAr , 346 — (3.) Symmetrical hydrazines, Ar_2NNAr_2 , 348 — (4) Quaternary hydrazines $\text{Ar}_3\overset{+}{\text{N}}\text{NH}_2\text{X}^-$, 349 — (5) Azines 349.	
C. ESTIMATION OF HYDRAZINES	349
(1) Acidimetric titration 349 — (2) Titration of primary hydrazines with bromine monochloride 350 — (3) Iodometric estimation 350.	
15. Nitro compounds	350
A. ALIPHATIC NITRO COMPOUNDS	350
(1) The nitrolic acid and pseudo-nitrol tests 351 — (2) Colour reaction with ferric chloride 352 — (3) Tertiary aliphatic nitro compounds 352.	
B. AROMATIC NITRO COMPOUNDS	353
Reduction to (1) Primary amines 353 — (2) Aryl hydroxylamines 354 — (3) Distinction between mono- and polynitrosubstituted compounds 355 — (4) Characterisation of nitro compounds 356.	

C. ESTIMATION OF NITRO COMPOUNDS	356
(1) Titanous chloride estimation 356 — (2) Estimation of primary and secondary nitro compounds 357 — (3) Kjeldahl estimation 358 — (4) Estimation with tin and methanolic hydrochloric acid 359 — (5) Titration of aromatic nitro compounds in non-aqueous solution 360.	
16. Nitroso- and isonitroso compounds	360
A. NITROSO COMPOUNDS	360
(1) Colour, smell 360 — (2) Colour reaction with N,N'-diphenylbenzidine 361 — Reaction with (3) Hydrogen iodide 361 — (4) Primary aromatic amines 361 — (5) Liebermann's reaction 361 — (6) Reduction to azoxy compounds 362 — Reaction with (7) Hydroxylamine 362 — (8) Concentrated sulphuric acid 362 — (9) Characterisation of nitroso compounds 363.	
B. ISONITROSO COMPOUNDS (OXIMES)	363
(1) Reaction with other carbonyl reagents 363 — (2) Reduction 363 — (3) Liebermann's nitroso reaction 364 — (4) Characterisation of isonitroso compounds 364.	
C. ESTIMATION OF NITROSO AND ISONITROSO COMPOUNDS	364
(1) Titanous chloride estimation 364 — (2) Estimation of keto ximes and <i>uic.</i> dioximes by acetylation 364 — (3) Estimation via derivatives 365.	
17. Substituted hydroxylamines	366
A. O-SUBSTITUTED HYDROXYLAMINES	366
B. N-SUBSTITUTED HYDROXYLAMINES	366
C. ESTIMATION OF, SUBSTITUTED HYDROXYLAMINES .	367
18. Substances containing active oxygen	367
A. IODOSYL AND IODYL COMPOUNDS	367
(1) Iodosyl compounds 367 — (2) Iodyl compounds 368	
B. PEROXIDES AND PER-ACIDS INCLUDING AMINE OXIDES	368
C. QUINONES	369
D. ESTIMATION OF ACTIVE OXYGEN	369
(1) Iodosyl and iodyl compounds 369 — (2) Peroxides and per-acids 370 — (3) Quinones 371.	

19. Halogen compounds (other than iodosyl and iodyl compounds)	372
A. CHARACTERISATION OF HALOGEN COMPOUNDS ...	372
(1) S-Alkylthiouronium picrates or styphnates	372 —
(2) S-Alkylthiouronium 3,5-dinitrobenzoates	374 —
(3) Separation of S-alkylthiouronium halides by paper chromatography	374 —
(4) Picrates of β -naphthyl ethers	374 —
(5) Alkoxybenzoic acids	375 —
(6) Ethers of 2,4-dinitrothiophenol	376 —
(7) Acylanilides	376 —
(8) Sulphonamides	377 —
(9) Acylhalides and other coinpounds containing reactive halogen	377 —
(10) Alkylidene halides	378.
B. ESTIMATION OF HALOGEN COMPOUNDS	378
(1) General remarks	378 —
(2) Estimation via derivatives	379.
20. Sulphur containing substances	380
A. THIOLS (MERCAPTANS), THIO ACIDS AND ALKYL XANTHATES	380
(1) Reaction with nitrous acid	380 —
(2) Formation of insoluble salts (mercaptides) with heavy metals	381 —
(3) Oxidation	382 —
(4) Reaction with 2,4-Dinitrochlorobenzene	382 —
(5) m-Nitrobenzazide	383 —
(6) Reactions of xanthates	383.
B. THIOETHERS (SULPHIDES)	384
(1) Oxidation	384 —
(2) Formation of sulphonium salts	384 —
(3) p-Nitrobenzenesulphonylsulphilimines	385 —
(4) Addition compounds with mercuric chloride	387.
C. ISOTHIOCYANATES (MUSTARD OILS)	388
(1) Hydrolysis	388 —
(2) Reaction with Silver nitrate	389 —
(3) Ammonia or primary amines	389 —
(4) p-Carboxyphenylhydrazine	390.
D. THIOAMIDES AND THIOUREAS	390
Reaction with (1) Silver nitrate	390 —
(2) Mercuric oxide	390 —
(3) Xanthyl derivatives	391 —
(4) Acetylation	391.
E. SULPHONIC ACIDS AND SULPHONAMIDES	391
(1) Alkali fusion	391 —
(2) Conversion into sulphonyl chlorides	392 —
(3) Sulphonamides	392 —
(4) Methyl esters	392 —
(5) S-Benzylthiouronium salts	392 —
(6) Xanthyl derivatives of sulphonamides	393.

F. ESTIMATION OF SULPHUR CONTAINING GROUPS ...	393
(1) Thiols, thio acids and xanthate derivatives	393 —
(2) Thioethers (sulphides)	395 —
(3) Isothiocyanates (mustard oils)	397 —
(4) Thioamides and thioureas	399 —
(5) Sulphonic acids and sulphonamides	403.
21. The double bond	404
A. DETECTION OF THE DOUBLE BOND	404
(1) Reduction of potassium permanganate	404 —
(2) Addition of bromine	404 —
(3) Colour reaction with tetranitromethane	405 —
(4) Reaction for conjugated double bonds	406.
B. ESTIMATION OF SUBSTANCES CONTAINING THE DOUBLE BOND	406
(1) Addition of bromine	406 —
(2) Addition of iodine (determination of the iodine number)	408 —
(3) Determination of α,β -unsaturated compounds by reaction with morpholine	410 —
(4) Determination of double bonds with mercuric acetate	411.
22. The triple bond	413
A. DETECTION OF THE TRIPLE BOND	413
(1) Formation of salts	413 —
(2) Addition of water	413 —
(3) Addition of halogens or hydrogen halides	414.
B. ESTIMATION OF SUBSTANCES CONTAINING THE TRIPLE BOND	414
(1) with Nessler's reagent	414 —
(2) with Silver nitrate	415.
23. Hydrocarbons	416
(1) Addition compounds with trinitrobenzene	418 —
(2) Nitration	418 —
(3) Sulphonation	419 —
(4) Oxidation	419 —
(5) Conversion of arenes into aroylbenzoic acids or aroyltetrachlorobenzoic acids	420.
B. ESTIMATION OF HYDROCARBONS	421
Normality of solutions of reagents	423
Author index	430
Subject index	437