

**introduCtion  
to**

**ORGANIC  
LABORATORY  
TECHNIQUES**

*a contemporary approach*

**PAVIA • LAMPMAN • KRIZ**

# **INTRODUCTION TO ORGANIC LABORATORY TECHNIQUES**

*a contemporary approach*

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# PREFACE

At the time we first undertook the rather lengthy project of writing and adapting material for an organic laboratory textbook, we thought that a rather novel approach could have favorable results with students taking courses in organic chemistry. We speculated that a book less oriented toward purely chemical topics and more oriented toward a biological approach to chemistry would be successful. Our own experience suggests that this new approach can indeed be successful.

Enthusiasm for organic chemistry laboratory, on the part of the student, has been rather easy to generate. In the process of creating this enthusiasm, we have not varied significantly the content of a typical organic chemistry laboratory course. Our text presents all of the important laboratory techniques—all types of filtration, crystallization, extraction, distillation, and chromatography, as well as spectroscopy. Also included are many of the important reaction types—esterification, Grignard reaction, aromatic substitution, nucleophilic substitution, reduction, oxidation, and condensation. In short, we have not altered the content of a standard laboratory course in terms of the rigorous practical experience which it is expected to provide. What has been done differently is the effort to choose experiments which include as much material of topical interest as possible. Experiments which deal with the isolation of natural products occur early in the text. These experiments not only introduce the student to topics of an interesting nature, but they also permit the inclusion of a variety of important techniques early in the instructional program.

We have included topics which touch upon items of consumer, biological, and historical interest, as well as purely chemical interest. In choosing the topics for our text, we have attempted to recognize that many students taking an organic laboratory course are biology, pre-medical, pre-dental, and pre-pharmacy majors. Chemistry majors are often greatly outnumbered in most courses of this type. Much of the material in the text is designed to interest these students and to avoid "turning them off" to chemistry. Nevertheless, it is also designed to give the chemistry major all the practical experience needed to begin more advanced study.

Although this text is comparatively larger than other texts which seek to discuss the same area of chemistry, we feel that our text is actually three texts in one. First, there are the experiments. Essentially all of these experiments have been laboratory tested with our own students. Many of the ideas and experiments are totally new, while others are greatly reworked versions of experiments which have been used by many previous generations of students. In general, the experiments can be performed without a need for specialized equipment beyond the typical glassware kit. The experiments are each as fully self-contained as possible. Little is assumed about the student's prior knowledge of organic chemistry before attempting the experiment. Mechanisms of reactions, as well as their stoichiometry are discussed. The experiments have been designed to be used in almost any order, adding to the potential flexibility of the book. Many of the experiments have been selected to be consistent with our philosophy that they can be used as a vehicle for introducing the student to related areas of interest beyond those covered in a normal one-year lecture course.

Second, there are the techniques. We have sought to separate discussions of technique from the experiments themselves. This has been done to permit the substitution of new experiments into a laboratory course without the need for totally rewriting technique discussions. An instructor using this textbook has much greater flexibility in adding his own favorite experiments into the course. These chapters have been written carefully to include thorough discussions of each technique that might be encountered in a laboratory experience. We feel that the technique sections contain material of sufficient detail that the student is prepared even for independent research. Although it may appear that techniques are not included within the experiments, a careful examination of the text will show that not only are the techniques included, but that they are also quite extensively treated.

Third, there are the essays which precede many of the experiments. These essays might be useful as supplements to a lecture text, since they deal with subjects that most lecture texts ignore. The essays form a sort of "course within a course," and are particularly useful as a supplement for lecture courses in organic chemistry for science majors. With these essays, leading references have been included to permit students to pursue the subjects further if they so desire.

Our own experience with preliminary versions of this text has demonstrated that our approach is successful. We have observed that student interest improved greatly over what it had been during times when our course followed more traditional approaches. We believe that our approach can be successful in most institutions.

A very large number of people have helped us in the preparation of this book. While it may seem space-consuming, we feel that their contribution merits mentioning their names as we thank them for their efforts. We greatly appreciate the assistance in manuscript preparation

provided by Gertrude Becker, Ann Drake, Dian Kriz, Mary Kriz, Neva-Jean Pavia, Dorothy Scott, and Judy Vinzant Widener.

Many students (and one faculty wife) were involved in the development and testing of experiments considered for inclusion in this book. We wish to thank Jennifer Andrews, Sandy Banks, Roger Blackman, Dave Bosell, Wayne Bratz, Brent Coleman, Sue Dufresne, Otto Hanssen, Larry Heimark, Connie Heimbuch, Tim Hoyt, Bruce Johnson, Ken Kelley, Linda Larson, Neva-Jean Pavia, Dana Perry, Kristi Pielstick, Joyce Rideout, Alan Schultz, Terry Smedley, Greg Smith, Carl Tuenge, Mark Watson, Rex Widener, Dan Wilson, and Sophia Zervas. These people all deserve a great deal of credit for their dedication and willingness to participate in this project with us. Special thanks must be given to the students who enrolled in our organic laboratory classes over the past three years and who patiently endured our on-the-spot modifications in experimental procedures.

A very special word of thanks and appreciation must be addressed to Mr. Robert LaRiviere, who illustrated the text. We feel that his work greatly enhances our manuscript. Special thanks should also go to Professors Arnold Krubsack and Thomas Cogdell, who reviewed an earlier version of our manuscript, and Professor John Miller, who class-tested many of the experiments. Their comments were very detailed and valuable.

Finally, we must thank our wives, Neva-Jean, Marian, and Dian, who patiently bore with us as we struggled to forge our preliminary ideas into a final manuscript. They suffered through endless hours of being ignored, having to deal with irritable spouses, and having to advise, type, and proofread.

DONALD L. PAVIA  
GARY M. LAMPMAN  
GEORGE S. KRIZ, JR.

To Neva-Jean, Marian, and Dian

# INDEX

Entries are alphabetized by disregarding prefixes.

- Acetamides, 418
  - preparation, 669
- p*-Acetamidobenzenesulfonyl chloride, 312
- Acetaminophen, structure and discussion, 31
- Acetanilide, preparation, 34
  - structure and discussion, 31
- Acetophenone, reductive amination, 477
- Acetyl chloride test, 417, 419
- Acetylcholine, action, 47
- Acetylsalicylic acid, *see* Aspirin.
- Acids, removal by extraction, 529
  - See also* Carboxylic acids.
- Activation energy, 194
- Active site, 460
- Acylglycerol, 104
- Adsorbent interactions, 581
- Air condenser, 546
- Air drying, 514
- Albumins, properties of, 445
- Alcohols, derivatives, 422, 620
  - identification, 419
  - tables of unknowns, 666
- Aldehydes, derivatives, 408, 668
  - identification, 403
  - tables of unknowns, 659
- Aldol condensations, essay, 346
  - experiment, 351
- Aldolases, essay, 346
- Alkaloid, definition, 47, 54
- Alkyl chlorides, rate of hydrolysis, 200
- Alkyl halides, reactivities, 178
- Alumina, types of, 581
- Alumina G, 600
- Amides, 411
  - preparation, 668
- Amines, derivatives, 418, 669
  - identification, 414
  - tables of unknowns, 664
- Amino acids, biosynthesis, 473
  - essay, 456
  - paper chromatography, 462
  - R<sub>f</sub>* values, 463
  - structures, 463
  - tests, 462
- p*-Aminobenzoic acid, action, 310
  - infrared spectrum, 327
  - preparation, 323
- Analgesics, composition, 33
  - essay, 31
  - thin layer chromatography, 40
- Anesthetics, essay, 328
  - preparations, 332
  - structures, 330
- Anilides, 411
  - preparation, 668
- Aniline, acetylation, 34
  - infrared spectrum, 231
  - nitration, 236
  - preparation, 228
  - sulfonation, 232
- Anisole, infrared spectrum, 680
- Anomers, 429
- Apparatus, identification key, 21
- Arabinose, 428
- Aromaticity tests, 402
- Aspirator, 503
- Aspirator trap, 504
- Aspirin, buffered, 26
  - combination tablets, 27, 33
  - essay, 25
  - preparation, 27
  - structure, 25
  - tablets, 26
- Azeotropes, composition, 565, 566
  - maximum boiling, 565
  - minimum boiling, 563
- Banana oil, 94
- Barbiturates, essay, 337
  - types, 338
- Barfoed's test, 438, 440
- Barometer, 574
- Bases, removal by extraction, 529
- Basic hydrolysis of esters tests, 424
- Beilstein test, 394
- Benedict's test, 438, 439, 450, 452
- Benzaldehyde, condensation, 292, 301
  - infrared spectrum, 295
- Benzamide, infrared spectrum, 684
- Benzamides, 418
  - preparation, 669
- Benzene, nitration, 224



- Benzil, condensation, 351  
   infrared spectrum, 304  
   preparation, 303  
   rearrangement, 305  
 Benzoic acid, infrared spectrum, 307  
   preparation, 305  
 Benzocaine, infrared spectrum, 333  
   nmr spectrum, 334  
   preparation, 332  
 Benzoic acid, infrared spectrum, 223  
   preparation, 214  
 Benzoin, coenzyme synthesis, 301  
   infrared spectrum, 294  
   oxidation, 303  
   preparation, by cyanide, 292  
     by thiamine, 301  
 Benzoin condensation, 292  
 Benzonitrile, infrared spectrum, 681  
 Benzophenone, photoreduction, 363  
   ultraviolet spectrum, 367  
 Benzpinacol, preparation, 363  
 Benzyl acetate, nmr spectrum, 689  
*N*-Benzylamides, 425  
 Bial's test, 436, 437  
 Bile acids, 67  
 Bilirubin, 72  
 Biphenyl, 216  
 Biuret test, 470  
 Boileezer, 493  
 Boiling chip, 493  
 Boiling points, 537  
   determination, 538  
   effect of pressure on, 537  
 Borneol, elimination-rearrangement, 209  
   infrared spectrum, 166  
   nmr spectrum, 167  
   oxidation, 159  
 Bromine in carbon tetrachloride test, 400  
 Bromine in water test, 412  
 Bromo derivatives, preparation, 669  
 Buchner funnel, 21, 502  
 Bumping, 494  
*n*-Butyl bromide, preparation, 181  
*n*-Butylamine, infrared spectrum, 681  
 5-*n*-Butylbarbituric acid, infrared spectrum, 345  
   preparation, 340  
  
 Caffeine, essay, 54  
   in beverages, 56  
   isolation from coffee, 62  
   isolation from tea, 58  
   salicylate derivative, 60  
   sublimation, 65  
 Camphene, infrared spectrum, 213  
   preparation, 209  
 Camphor, infrared spectrum, 166  
   nmr spectrum, 167  
   preparation, 159  
   reduction, 159  
 Caraway oil, 171  
 Carbohydrates, essay, 426  
   identification, 434  
 Carbon disulfide, infrared spectrum, 653  
 Carbon tetrachloride, infrared spectrum, 652  
 Carboxylic acids, derivatives, 410, 668  
  
 Carboxylic acids (*Continued*)  
   identification, 409  
   tables of unknowns, 661  
 $\beta$ -Carotene, chromatography, 78  
   isolation, 78  
   structure, 77  
   visible spectrum, 83  
 Carotenoids, in vision, 77  
 Carvone, infrared spectrum, 176  
   isolation, 171  
   nmr spectrum, 177  
 Casein, composition, 445  
   isolation from milk, 448  
 Celite, 502  
 Channeling, 591  
 Charcoal, activated, 513  
 Chemical shift, 687  
 Chemiluminescence, definition, 370  
   experiment, 374  
 Chloroform, infrared spectrum, 653  
 Cholesterol, biochemical origin, 148  
   bromination, 71  
   isolation, 70  
   structure, 66  
 Chromatography, *see* Column, Gas, Paper,  
   and Thin Layer Chromatographies.  
 Chromic acid test, 405, 420  
 Cinnamaldehyde, infrared spectrum, 157  
   nmr spectrum, 157  
   Wittig condensation, 378  
 Claisen head, 20, 546  
 Classification tests, *see specific functional*  
   *group*.  
 Cleaning solution, preparation, 18  
   safety precautions, 18  
 Cocaine, 328  
 Coenzyme, 300, 461  
 Cofactor, 460  
 Coffee, caffeine in, 62  
   decaffeination, 56  
 Cold baths, 496  
 Cold-finger condenser, 493  
 Column chromatography, adsorbent quan-  
   tity, 589  
   adsorbents, 580, 586  
   apparatus, 82, 584  
   column size, 589  
   elution sequence for compounds, 588  
   elution techniques, 595  
   monitoring, 597  
   packing the column, 591  
   principles, 583  
   sample application, 594  
   solvents, 587  
   typical problems, 590  
 Crystallization, 505  
   common solvents, 509  
   mixed solvents, 514  
   solvent pairs, 515  
   solvent selection, 508  
   stepwise method, 509, 515  
   summary of steps, 515  
   theory, 507  
 Crystals, drying methods, 514  
 Cuminaldehyde, 154  
 Cyano groups, detection, 396  
 Cyanohydrins, essay, 289  
 Cyclohexanol, dehydration, 206  
   infrared spectrum, 208

- Cyclohexene, infrared spectrum, 208  
preparation, 206
- DDT, 354
- DNA, structure, 57
- DSS, 658
- Decane, infrared spectrum, 677
- Decolorization, 513
- Decomposition point, 523
- Derivatives, definition, 59  
methods of preparation, 668  
*See also specific functional group.*
- Desiccator, 514
- Detergents, essay, 113  
preparation, 116, 121
- Diatomaceous earth, 502
- Diazotization, 244
- Dibenzyl ketone, condensation, 351
- o*-Dichlorobenzene, infrared spectrum, 678
- Diels-Alder reaction, 359  
essay, 353
- Diethyl *n*-butylmalonate, condensation with  
urea, 340  
infrared spectrum, 344
- Diethyl malonate, alkylation, 340
- N,N*-Diethyl-*m*-toluamide, infrared spec-  
trum, 133  
preparation, 129
- 3,5-Dinitrobenzoates, 413, 422, 425  
preparation, 670
- 2,4-Dinitrophenylhydrazine test, 404
- 2,4-Dinitrophenylhydrazones, 408  
preparation, 668
- 1,4-Diphenyl-1,3-butadiene, preparation, 378
- Distillation  
fractional, 552  
apparatus for, 554  
methods for, 562  
phase diagrams, 540, 555  
reduced pressure, 544  
simple, 540  
apparatus for, 543  
methods for, 542  
solids, apparatus for, 212  
steam, 567  
apparatus for, 571, 572  
methods for, 567  
theory of, 540, 555  
vacuum, 544  
apparatus for, 545  
methods for, 545  
vacuum fractional, apparatus for, 174
- Distribution coefficient, 525
- Drugs, identification, 38  
thin layer chromatography, 40
- Dry Ice, 497
- Drying agents, 534
- Dye mixtures, chromatography, 268
- Dyeing, mechanisms, 250  
procedures, 257
- Dyes, azo, 243  
essay, 241  
food colors, 264  
methods of dyeing, 257  
natural, 242  
synthetic, 243  
triphenylmethane, 243  
types, 252
- Ebulliator, 20, 546
- Elemental analysis, 393
- Emulsions, 533
- Enamine, 349
- Energy diagrams, 194
- Energy transfer, 367
- Enzymes, 460
- Essential oils  
allspice oil, 151  
caraway oil, 171  
cinnamon oil, 156  
clove oil, 151  
cumin oil, 154  
isolation, 150  
spearmint oil, 171
- Esters, derivatives, 425, 670  
essay, 91  
identification, 422  
tables of unknowns, 667
- Ethanol, essay, 84  
preparation, 87
- Eugenol, infrared spectrum, 152  
nmr spectrum, 153
- Eutectic, 518
- Evaporation to dryness, 494
- Extraction, 525  
theory, 526  
use in purification, 529
- Fabric types, 251
- Fabrics, dyeing, 257
- Fats and oils, composition, 106  
essay, 104  
gas chromatography, 108  
saponification, 119
- Fatty acids, 105
- Fermentation, 84
- Ferric chloride test, 28, 407, 412
- Ferric hydroxamate test, 423
- Ferrous hydroxide test, 396
- Fiber types, 251
- Filter aid, 502
- Filter flask, 21, 502
- Filter paper, cone, 498  
fluted, 499  
porosity, 501  
retentivity, 501  
speed, 501  
types, 501
- Filtration, gravity, 497  
in crystallization, 510  
methods, 497  
vacuum, 501
- Fireflies, essay, 370
- Fires, 4
- First aid, 7
- Flames, heating with, 7
- Flavors, artificial, 93  
composition, 91
- Fluorescence, 364
- Folic acid, 310
- Food colors, approved list, 266  
chromatography, 268  
essay, 264
- Fractional distillation, 552
- Fractionating columns, 20, 561  
types of packings, 561
- Fragrances, composition, 91

- Fructose, 430  
 Funnels, methods of preheating, 511
- Galactose, 428  
 Gallic acid, 59  
 Gas chromatograph, 614  
 Gas chromatography, apparatus, 615  
   calculation of peak areas, 624  
   carrier gas, 618  
   columns, 616  
   detector, 620  
   principles, 618  
   qualitative use, 622  
   quantitative analysis, 624  
   retention time, 622  
   sample collection, 623  
   stationary phase, 616, 617  
   support material, 616, 618  
 Gasoline, composition, 134  
   gas chromatography, 140  
 Glassware, apparatus assembly, 22  
   cleaning, 17  
   drying, 18  
   frozen joints, 19  
   identification key, 20, 21  
   lubricating ground-glass joints, 19  
 Glucose, 428  
 Glyceride, 104  
 Glycogen, 433  
 Glycosidic linkages, 430  
 Gravity filtration, 497  
 Grignard reaction, apparatus, 217  
   experiments, 214  
   starting, 218
- Half-life, 202  
 Halides, detection, 394  
   elemental analysis, 398  
 Heating methods, Bunsen burner, 488  
   flames, 488  
   heating mantle, 490  
   hot plate, 491  
   oil bath, 489  
   reflux, 491  
   steam bath, 488  
 $\alpha$ -Helix, 458  
 Heme, 32  
 Hinsberg test, 414  
 Hirsch funnel, 21, 502  
 Hormones, adrenal, 69  
   insect, 357  
   polypeptide, 461  
   sex, 68  
 Hydrazides, 425  
 Hydroxamic acid test, 423  
 Hygroscopic, 514
- Ice bath, 496  
 Ice-salt bath, 497  
 Identification of unknowns, 382  
 Ignition test, 402  
 Infrared spectroscopy, aromatic C-H out-of-plane bending, 679
- Infrared spectroscopy (*Continued*)  
   base values, 675  
   carbonyl compounds, 682  
   correlation table, 674  
   effects of conjugation, 683  
   effects of ring size, 683  
   index of spectra, 699  
   interpretation, 673-676  
   KBr pellets, 649  
   modes of vibration, 672  
   Nujol mulls, 652  
   salt plates, 647  
   sample preparation, 647  
   solution cell, 651  
   solution spectra, 650  
   solvent spectra, 652  
   spectrum calibration, 654  
   survey of functional groups, 676-685  
   theory, 670  
   uses, 671  
 Insect attractants, 125  
 Insect repellents, 125  
   preparation, 129  
 Insecticides, essay, 353  
 Intersystem crossing, 364  
 Iodoform test, 406  
 Isoamyl acetate, infrared spectrum, 96  
   preparation, 94  
 Isoamyl alcohol, esterification, 94  
 Isoborneol, elimination-rearrangement, 209  
   infrared spectrum, 166  
   nmr spectrum, 167  
   preparation, 159  
 Isolation experiments, definition, 14  
 Isoprene rule, 145
- KBr pellet preparation, 649  
 Ketones, derivatives, 408, 668  
   identification, 403  
   tables of unknowns, 660  
 Kinetic equations, 195  
 Kinetics, essay, 193
- Lactose, 432  
   isolation from milk, 448  
   mutarotation, 453  
 Leuckart reaction, 477  
 Ligroin, 487  
 Limiting reagent, 10  
 Limonene, infrared spectrum, 176  
   nmr spectrum, 177  
 Lucas test, 420  
 Luminol, preparation, 374  
 Lycopene, chromatography, 78  
   isolation, 78  
   structure, 78  
   visible spectrum, 83
- Magnetic stirrer, 494  
 Maltose, 85  
 Manometer, bleed valve, 579  
   closed-end, 577  
   connection, 579

- Manometer (*Continued*)  
  construction, 578  
  filling, 578  
  open-end, 575  
  trap, 579
- Melting point, 517  
  behavior, 517  
  capillary, 520  
  composition diagram, 518  
  corrections, 524  
  decomposition, 523  
  determination, 521  
  discoloration, 523  
  electrical apparatus, 522  
  mixed, 520  
  packing tubes, 520  
  range, 517  
  shrinkage of crystals, 523  
  softening, 523  
  standards, 525  
  sublimation, 524  
  theory, 518
- Mesityl oxide, infrared spectrum, 684
- Methiodides, 418  
  preparation, 669
- Methyl benzoate, infrared spectrum, 684
- Methyl isopropyl ketone, infrared spectrum, 673
- Methyl orange, preparation, 245
- Methyl salicylate, hydrolysis, 101  
  infrared spectrum, 100  
  nmr spectrum, 100  
  preparation, 97
- Micelle, 116  
  casein, 445  
  soap, 116
- Micro boiling point determination, 539
- Micron, 671
- Milk, essay, 443  
  isolation of casein, 448  
  isolation of lactose, 448
- Mixed solvents, 514
- Mixtures, separation, 529
- Mole fraction, 556
- Mole percent, 556
- Molecular rotation, 638
- Molisch test, 436, 437
- Monosaccharides, 426
- Mordant, 255
- Mordanting, procedures, 259
- Mother liquor, 508
- Mucic acid test, 442, 453
- Mutarotation, 430, 450, 453
- Nmr spectroscopy, anisotropy in, 691  
  aromatic rings, 696  
  chemical equivalence, 688  
  chemical shift, 687  
  common splitting patterns, 694  
  correlation chart, 690  
  coupling constant, 694  
  index of spectra, 699  
  integrals, 688  
  magnetic equivalence, 695  
   $n + 1$  rule, 693  
  protons on heteroatoms, 698  
  quantitative use, 191
- Nmr spectroscopy (*Continued*)  
  reference substances, 657  
  ring current, 692  
  sample preparation, 655  
  sample tube, 655  
  shielding, 690  
  solvents, 656  
  spin-spin splitting, 693  
  theory, 685
- Naphthalene, ultraviolet spectrum, 367
- 2-Naphthol, infrared spectrum, 680
- $\alpha$ -Naphthylurethanes, 413  
  preparation, 669
- Natural products, essay, 44
- Nerve impulse transmission, 49
- Neutralization equivalent, 410
- Nicotine, dipicrate derivative, 51  
  essay, 46  
  isolation, 50  
  structure, 46
- Ninhydrin test, 462, 467
- Nitro groups, detection, 396
- p*-Nitroaniline, preparation, 236
- Nitrobenzene, infrared spectrum, 227  
  preparation, 224  
  reduction, 228
- Nitrogen, elemental analysis, 398
- 5-Nitrophthalhydrazide, preparation, 374  
  reduction, 374
- Nitrous acid test, 416  
  for amino acids, 472
- Nonanal, infrared spectrum, 682
- Norit, 513
- Notebook, format, advance preparation, 9  
  calculations, 14  
  laboratory records, 14  
  general, 9  
  sample pages, 11, 12
- Novocaine, *see* Procaine.
- Nuclear magnetic resonance, *see* Nmr Spectroscopy.
- Nucleophilic substitution, competing nucleophiles, 187  
  kinetic study, 200  
  preparation of alkyl halides, 181, 203  
  reactivities of alkyl halides, 178
- Nujol, infrared spectrum, 653  
  mull, 652
- Nylon, preparation, 281
- Octane ratings, 138
- Odor, stereochemical theory, 168
- Oil bath, 489
- Oiling out, 509
- Oligosaccharides, 430
- Optical activity, 636
- Optical purity, 640
- Osazone formation, 440
- Oven drying, 514
- Oximes, 408
- PABA, *see* *p*-Aminobenzoic acid.
- Paper chromatography, 268, 462, 613  
  amino acids, 462  
  food colors, 268

- Partial pressure, 558  
Partition coefficient, 525  
Penicillin, 309  
t-Pentyl chloride, preparation, 181  
Peptide, 457  
Percentage yield, 15  
Petroleum, essay, 134  
Petroleum ether, 487  
Phenacetin, preparation, 36  
    structure and discussion, 32  
p-Phenetidine, acetylation, 36  
Phenols, derivatives, 413, 669  
    identification, 411  
    tables of unknowns, 663  
Phenylacetone, nmr spectrum, 687  
 $\alpha$ -Phenylethylamine, preparation, 477  
    resolution, 481  
Phenylmagnesium bromide, preparation, 214  
Phenylpropanes, essay, 144  
Phenylurethanes, 422  
    preparation, 670  
Pheromones, definition, 93  
    essay, 125  
Phosphorescence, 364  
Photochemistry, 363, 370  
Picrates, 51, 418  
    preparation, 669  
Plant metabolism, 149  
Plastics, essay, 273  
Polarimeter, 637  
    operation, 639  
Polarimeter cell, 638  
Polarimetry, 635  
Polarized light, 635  
Polyesters, preparation, 281  
Polymers, addition, 275  
    condensation, 277  
    essay, 273  
    preparation, 281  
    types, 274  
Polysaccharides, 432  
Polystyrene, infrared spectrum, 655  
    preparation, 281  
Polyurethan, preparation, 281  
Potassium permanganate test, 401  
Preparative experiments, definition, 10  
Procaine, preparation, 332  
Procaine hydrochloride, infrared spectrum, 336  
Product purification, by extraction, 529  
Propargyl alcohol, infrared spectrum, 679  
Prostaglandins, 26  
Protective group, 233, 238, 312, 324  
Proteins, amphoteric properties, 468  
    coagulation, 469  
    composition, 463  
    denaturation, 460  
    essay, 456  
     $\alpha$ -helix, 458  
    hydrolysis, 465  
    pleated sheet, 458  
    precipitation by metal ions, 469  
    primary structure, 458  
    quaternary structure, 460  
    secondary structure, 458  
    tertiary structure, 458  
    tests, 462  
Purification of solids, 505  
Quenching, 368  
 $R_f$  value, 609, 614  
Raoult's law, immiscible liquids, 568  
    miscible liquids, 558  
Rate constant, 196  
Rate-determining step, 193  
Rates of chemical reactions, essay, 193  
Reaction order, first order, 197  
    pseudo first order, 199  
    second order, 198  
    zero order, 197  
Rearrangement, benzoic acid, 305  
Reducing sugar tests, 438  
Reducing sugars, 430  
Reductive amination, 474  
Reflux, 491  
Reflux apparatus, 492  
Reflux ring, 492, 544  
Refractive index, 641  
    temperature corrections, 646  
Refractometer, apparatus, 643  
    cleaning, 645  
    operation, 644  
Refractometry, 641  
Resolution, 481  
Retention time, 622  
Retinal, 75  
Rhodopsin, 74  
Safety, eye, 4  
    general, 4-8  
    organic solvents, 6  
Salicylic acid, acetylation, 27  
    esterification, 98  
    preparation, 101  
Salt plates, 648  
Samples, containers, 16  
    labeling, 16  
Saponification, 109, 114  
Scratching, to induce crystallization, 511  
Sealed tube, 109  
Seed crystals, 513  
Seliwanoff's test, 436, 438  
Semicarbazones, 408  
    preparation, 668  
Separation methods, 529  
Separation scheme, 13, 531  
Separatory funnel, 20, 530  
Silica gel, 581  
Silica gel G, 600  
Silver nitrate test, 179, 394, 409  
Simple distillation, 542  
    apparatus, 543  
Slurry, 502, 593, 601  
Soap, cleaning action, 115  
    essay, 113  
    preparation, 114, 119  
Sodium 2,2-dimethyl-2-silapentane-5-sulfonate, 658  
Sodium fusion tests, 397  
Sodium iodide test, 178, 395  
Sodium lauryl sulfate, preparation, 121

- Sodium metal, handling techniques, 632  
  reactivity, 632  
  storage, 633  
  weighing, 633  
Sodium press, 634  
Solubility rules, 505  
Solubility tests, 388  
Solution cell, infrared spectroscopy, 651  
Solvent evaporation, rapid methods, 495  
  reduced pressure, 496  
Solvents, boiling points, 487  
  densities, 533  
  for crystallization, 509  
  heating methods, 487  
  mixed, 514  
  relative polarities, 507  
  safety, 6, 487  
Spearment oil, 171  
Specific rotation, 638  
Spices, 150  
Spin-spin splitting, 693  
Starch, 85, 433  
  test for, 30, 441  
Starch-iodine test, 441  
Steam bath, 488  
Steam distillation, 567  
  methods, 570  
  theory, 568  
  trap, 571  
Stem corrections, 550  
Steroids, essay, 66  
Streaming, 591  
Styrene, infrared spectrum, 677  
Sublimation, advantages, 630  
  apparatus, 630  
  methods, 629  
  theory, 626  
  vacuum, 629  
Sucrose, 432  
  fermentation, 87  
  hydrolysis, 442  
Suction filtration, 501  
Sugars, identification, 434  
  reducing, 430  
Sulfa drugs, essay, 308  
  preparation, 311  
  testing on bacteria, 320  
  types, 309  
Sulfanilamide, action, 310  
  infrared spectrum, 318  
  preparation, 311  
Sulfanilic acid, diazotization, 245  
  preparation, 232  
Sulfapyridine, infrared spectrum, 319  
  preparation, 311  
Sulfathiazole, infrared spectrum, 320  
  preparation, 311  
Sulfonamide derivatives, 415, 418  
Sulfur, elemental analysis, 398  
Sulfur test for proteins, 470  
  
TMS, 657, 687  
Tables of derivatives, 659  
Tables of unknowns, 659  
Tailing, 598, 610  
Tannin, 58  
  
Terpenes, biochemical origin, 146  
  essay, 144  
Tetracycline, 309  
Tetramethylsilane, 657, 687  
Tetraphenylcyclopentadienone, Diels-Alder  
  reaction, 359  
  infrared spectrum, 352  
  preparation, 351  
Tetraphenyl-1,2-dihydrophthalic anhydride,  
  infrared spectrum, 367  
  preparation, 359  
Tetraphenylphthalic anhydride, infrared  
  spectrum, 362  
  preparation, 359  
Theobromine, 55  
Theophylline, 55  
Theoretical plates, 559  
Thermometer calibration, 524  
Thermometer stem corrections, 550  
Thiamine, essay, 295  
  mechanism of action, 296  
Thiele tube, 21, 521  
Thin layer chromatography, chemical  
  applications, 610  
  coating slides, 602  
  development chambers, 605  
  large plates, 603, 609  
  micropipet preparation, 604  
  pre-prepared plates, 603  
  principles, 599  
   $R_f$  values, 609  
  sample application, 604  
  slide preparation, 600  
  slurry preparation, 601  
  solvent choice, 607  
  visualization methods, 607  
Tollen's test, 406  
*m*-Toluic acid, 130  
*p*-Toluidides, 411  
  preparation, 668  
*p*-Toluidine, oxidation, 323  
Transamination, 474  
Transesterification, 109  
Transition state, 194  
Trap, acidic gases, 131, 184, 189  
  aspirator, 503, 504  
  manometer, 579  
  steam distillation, 571  
  vacuum distillation, 545, 579  
1,1,2-Trichloroethane, nmr spectrum, 693  
Triglyceride, definition, 104  
  transesterification, 111  
Triphenylmethanol, infrared spectrum, 221  
  preparation, 214  
  
Unknown compounds, identification, 382  
Unknowns, tables of, 659  
  *See also specific functional groups.*  
Unsaturation tests, 112, 206, 399  
  
Vacuum distillation, 544  
  apparatus, 545  
  stepwise directions, 548  
Vacuum filtration, 501

- Vapor phase chromatography, *see* Gas chromatography.  
Variable transformer, 490  
Variac, 490  
Vigreux column, 562  
Vinyl acetate, nmr spectrum, 696  
Vision, chemistry, 74  
Vitamin, 300, 461  
Vitamin A, 76
- Wavenumber, 671  
Weight percent recovery, 15
- Wintergreen oil, preparation, 97  
Wittig reaction, 378
- Xanthines, 55  
Xanthoproteic test, 470  
Xylose, 428
- Yield, actual, 15  
    calculation, 15  
    theoretical, 15  
Ylid, definition, 297

# CONTENTS

Foreword to the Student and Words of Advice .....	1
Laboratory Safety .....	4
Advance Preparation and Laboratory Records .....	8
Laboratory Glassware .....	17

## PART ONE THE EXPERIMENTS

Essay: Aspirin .....	25
<i>Experiment 1 Acetylsalicylic Acid</i> .....	27
Essay: Analgesics .....	31
<i>Experiment 2 Acetanilide</i> .....	34
<i>Experiment 3 Phenacetin</i> .....	36
Essay: Identification of Drugs .....	38
<i>Experiment 4 TLC Analysis of Analgesic Drugs</i> .....	40
Essay: Natural Products .....	44
Essay: Nicotine .....	46
<i>Experiment 5 Nicotine from Tobacco</i> .....	50
Essay: Caffein .....	54
<i>Experiment 6 Isolation of Caffein from Tea</i> .....	58
<i>Experiment 7 Isolation of Caffein from Coffee</i> .....	62
Essay: Steroids .....	66
<i>Experiment 8 Cholesterol from Gallstones</i> .....	70
Essay: The Chemistry of Vision .....	74
<i>Experiment 9 Lycopene and <math>\beta</math>-Carotene</i> .....	78
Essay: Ethanol and Fermentation Chemistry .....	84
<i>Experiment 10 Ethanol from Sucrose</i> .....	87
Essay: Esters—Flavors and Fragrances .....	91
<i>Experiment 11 Isoamyl Acetate (Banana Oil)</i> .....	94
<i>Experiment 12 Methyl Salicylate (Oil of Wintergreen)</i> .....	97
<i>Experiment 13 The Hydrolysis of Methyl Salicylate</i> .....	101



Essay: Fats and Oils .....	104
<i>Experiment 14 Gas Chromatographic Analysis of the</i>	
<i>Fatty Acid Composition of Fats and Oils .....</i>	108
Essay: Soaps and Detergents .....	113
<i>Experiment 15 Preparation of Soap .....</i>	119
<i>Experiment 16 Preparation of a Detergent .....</i>	121
Essay: Pheromones: Insect Attractants and Repellents .....	125
<i>Experiment 17 N,N-Diethyl-m-toluamide: The Insect</i>	
<i>Repellent "Off" .....</i>	129
Essay: Petroleum .....	134
<i>Experiment 18 Gas Chromatographic Analysis of Gasolines ..</i>	140
Essay: Terpenes and Phenylpropanes .....	144
<i>Experiment 19 Essential Oils from Spices .....</i>	150
<i>Experiment 19A Oils of Clove or Allspice .....</i>	151
<i>Experiment 19B Oil of Cumin .....</i>	154
<i>Experiment 19C Oil of Cinnamon .....</i>	156
<i>Experiment 20 An Oxidation-Reduction Scheme: Borneol,</i>	
<i>Camphor, Isoborneol .....</i>	159
Essay: The Stereochemical Theory of Odor .....	168
<i>Experiment 21 Spearmint and Caraway Oil: (-) and (+) -</i>	
<i>Carvones .....</i>	171
<i>Experiment 22 Reactivities of Some Alkyl Halides .....</i>	178
<i>Experiment 23 Synthesis of n-Butyl Bromide and t-Pentyl</i>	
<i>Chloride .....</i>	181
<i>Procedure 23A n-Butyl Bromide .....</i>	183
<i>Procedure 23B t-Pentyl Chloride .....</i>	185
<i>Experiment 24 Nucleophilic Substitution Reactions:</i>	
<i>Competing Nucleophiles .....</i>	187
Essay: The Rates of Chemical Reactions .....	193
<i>Experiment 25 The Hydrolysis of Some Alkyl Chlorides .....</i>	200
<i>Experiment 26 Cyclohexene .....</i>	206
<i>Experiment 27 Camphene from Borneol or Isoborneol .....</i>	209
<i>Experiment 28 Triphenylmethanol and Benzoic Acid .....</i>	214
<i>Procedure 28A Triphenylmethanol .....</i>	220
<i>Procedure 28B Benzoic Acid .....</i>	222
<i>Experiment 29 Nitrobenzene .....</i>	224
<i>Experiment 30 Aniline .....</i>	228
<i>Experiment 31 Sulfanilic Acid .....</i>	232
<i>Experiment 32 p-Nitroaniline .....</i>	236
Essay: Synthetic Dyes .....	241
<i>Experiment 33 Methyl Orange .....</i>	245
Essay: Dyes and Fabrics .....	250
<i>Experiment 34 Dyes, Fabrics and Dyeing .....</i>	257
Essay: Food Colors .....	264
<i>Experiment 35 Chromatography of Some Dye Mixtures .....</i>	268