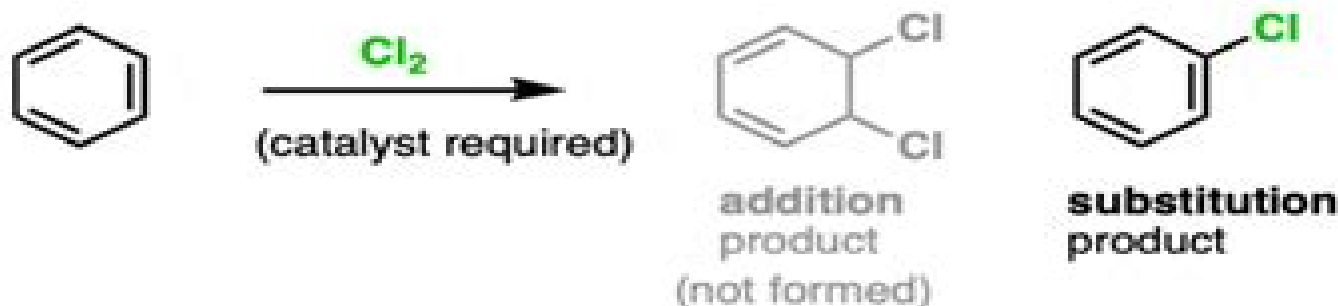


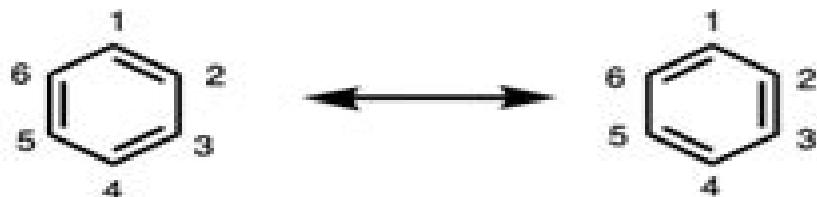
Summary: Aromaticity

Aromaticity is the term given to describe the unusual **stability** of benzene and related molecules. Not related to smells! 😊

- Benzene does not easily undergo **addition** like normal alkenes
- When benzene does undergo reaction, it tends to undergo **substitution** reactions
(and even then, often requires heating and addition of a catalyst)

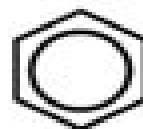


- The measured **resonance energy** of benzene is extremely high (36 kcal/mol) compared to conjugated alkenes like 1,3-cyclohexadiene (2 kcal/mol)
- Unlike dienes, which have alternating bond lengths, **all C-C bond lengths in benzene are identical** (1.40 Å)



Equivalent resonance structures
(not an equilibrium!)

Either structure for benzene is correct
and they can be used interchangeably



Hybrid of these two forms
sometimes drawn like this
to show that the pi-electrons
are "**delocalized**"

- The property of aromaticity is not unique to benzene

Aromatic Chemistry

Edgar Heilbronner, Foil A. Miller



Aromatic Chemistry:

Aromatic Chemistry John D. Hepworth, David R. Waring, Michael J. Waring, 2002 This book provides an up to date and comprehensive account of aromatic chemistry A series of chapters describes the synthesis and reactions of the major functional derivatives of benzene and the more common polycyclic systems The concept of aromaticity and the mechanism of aromatic substitution are discussed as is the use of metals in the synthesis of aromatic compounds Throughout emphasis is placed on mechanisms Worked problems and questions are provided to aid understanding In addition to providing material required by an undergraduate studying chemistry Aromatic Chemistry is also ideal for industrial chemists seeking to update their knowledge of this important aspect of chemistry Ideal for the needs of undergraduate chemistry students Tutorial Chemistry Texts is a major new series consisting of short single topic or modular texts concentrating on the fundamental areas of chemistry taught in undergraduate science courses Each book provides a concise account of the basic principles underlying a given subject embodying an independent learning philosophy and including worked examples

Industrial Aromatic Chemistry Heinz-Gerhard Franck, Jürgen W. Stadelhofer, 2012-12-06 Aromatic organic hydrocarbons and heterocycles represent a bulk of about one third of all industrially produced organic basic materials Aromatic compounds such as benzene phenol naphthalene anthracene and their homologues are derived from raw materials coal crude oil and biogenic resources by thermal and catalytic refining processes This book introduces the chemistry of aromatics with a brief discussion of the aromatic character and a survey of historical aspects particularly the development of the organic dye industry during the 19th century The main emphasis of the book is to give a clear prospect of industrial processes for the production and the derivatisation of aromatics with consistent flow diagrams Economical aspects of by and side products are especially regarded For the most important aromatics an analysis of the international market included their derivatives polymers pesticides dyes pigments and drugs Professional scientists managers and students in chemistry and chemical engineering will find a wealth of information for their career and daily work

Aromatic and Heteroatomic Chemistry Volume 7 Hans SUSCHITZKY, 1979 Annotation Specialist Periodical Reports provide systematic and detailed review coverage of progress in the major areas of chemical research Written by experts in their specialist fields the series creates a unique service for the active research chemist supplying regular critical in depth accounts of progress in particular areas of chemistry For over 80 years the Royal Society of Chemistry and its predecessor the Chemical Society have been publishing reports charting developments in chemistry which originally took the form of Annual Reports However by 1967 the whole spectrum of chemistry could no longer be contained within one volume and the series Specialist Periodical Reports was born The Annual Reports themselves still existed but were divided into two and subsequently three volumes covering Inorganic Organic and Physical Chemistry For more general coverage of the highlights in chemistry they remain a must Since that time the SPR series has altered according to the fluctuating degree of activity in various fields of chemistry Some titles have

remained unchanged while others have altered their emphasis along with their titles some have been combined under a new name whereas others have had to be discontinued

Aromatic Chemistry Malcolm Sainsbury, 1992-08-27 All the basic principles of this important topic are clearly presented here in an account which takes as examples many compounds of industrial and biological significance Consideration is given to the structure reactions and properties of benzene and classes of aromatic compounds derived from it and topics such as thermodynamic versus kinetic control and pericyclic reactions are introduced The text also covers polycyclic arenes and the small and large ring systems which are embraced by the wider definition of aromaticity

A Philatelic Ramble Through Chemistry Edgar Heilbronner, Foil A. Miller, 2004-03 This is not a history of chemistry which uses stamps instead of the usual illustrations but a collection of short essays and comments on such chemistry as can be found on postage stamps and other philatelic items In other words the choice of topics is dictated by the philatelic material available with the necessary consequence that important parts of chemical history will be missing for the simple reason that they have not found their way onto postage stamps Thus the reader may find detailed comments on lesser known chemists such as Wilhelm August Lampadius who has been honoured with two stamps by the German Post Office but hardly anything on such luminaries as Robert Bunsen who have not been deemed worthy of a commemorative issue

Aromatic and Heteroaromatic Chemistry , 1989-03-31 Specialist Periodical Reports provide systematic and detailed review coverage of progress in the major areas of chemical research Written by experts in their specialist fields the series creates a unique service for the active research chemist supplying regular critical in depth accounts of progress in particular areas of chemistry For over 80 years the Royal Society of Chemistry and its predecessor the Chemical Society have been publishing reports charting developments in chemistry which originally took the form of Annual Reports However by 1967 the whole spectrum of chemistry could no longer be contained within one volume and the series Specialist Periodical Reports was born The Annual Reports themselves still existed but were divided into two and subsequently three volumes covering Inorganic Organic and Physical Chemistry For more general coverage of the highlights in chemistry they remain a must Since that time the SPR series has altered according to the fluctuating degree of activity in various fields of chemistry Some titles have remained unchanged while others have altered their emphasis along with their titles some have been combined under a new name whereas others have had to be discontinued

Pharmaceutical Chemistry Chris Rostron, Jill Barber, 2021 Taking medication is a common occurrence for many people whether it is to soothe an aching head regulate blood sugars or to treat life threatening conditions In the UK alone over 900 million prescriptions are dispensed every year Overseeing all of this are pharmacists experts in medicines and their use Pharmaceutical Chemistry provides a wide ranging overview of organic chemistry as applied to the study and practice of pharmacy Drugs are simply chemicals so to fully understand their manufacture formulation and the way they work in our bodies a knowledge of organic compounds and their reactions is essential By reading this book students will begin to understand how a drug molecule is made the process that

turns it into a medicine the role the pharmacist has when dispensing that medicine and what happens in the body when it is taken Most importantly the text shows how each of these aspects are integrated helping you to see the bigger picture Pharmaceutical Chemistry is available for students and institutions to purchase in a variety of formats and is supported by online resources The ebook offers a mobile experience and convenient access www.oxfordtextbooks.co.uk/ebooks The online resources include For students Self assessment questions to help the reader to check and reinforce understanding of the material introduced in each chapter Bonus material to accompany chapters 3 7 and 11 Answers to self check questions from the book For registered adopters of the book Figures from the book available to download

Chemistry for Pharmacy Students Professor Satyajit D. Sarker, Lutfun Nahar, 2013-05-28 This book has succeeded in covering the basic chemistry essentials required by the pharmaceutical science student the undergraduate reader be they chemist biologist or pharmacist will find this an interesting and valuable read Journal of Chemical Biology May 2009 Chemistry for Pharmacy Students is a student friendly introduction to the key areas of chemistry required by all pharmacy and pharmaceutical science students The book provides a comprehensive overview of the various areas of general organic and natural products chemistry in relation to drug molecules Clearly structured to enhance student understanding the book is divided into six clear sections The book opens with an overview of general aspects of chemistry and their importance to modern life with particular emphasis on medicinal applications The text then moves on to a discussion of the concepts of atomic structure and bonding and the fundamentals of stereochemistry and their significance to pharmacy in relation to drug action and toxicity Various aspects of aliphatic aromatic and heterocyclic chemistry and their pharmaceutical importance are then covered with final chapters looking at organic reactions and their applications to drug discovery and development and natural products chemistry accessible introduction to the key areas of chemistry required for all pharmacy degree courses student friendly and written at a level suitable for non chemistry students includes learning objectives at the beginning of each chapter focuses on the physical properties and actions of drug molecules

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Chemistry of Engine Combustion Deposits Lawrence B. Ebert, 2012-12-06 On March 30 1981 a symposium entitled Chemistry of Engine Combustion Deposits was held at the 181st American Chemical Society National Meeting in Atlanta

Georgia under the sponsorship of the Petroleum Division This book is an out growth of that symposium including papers from all of the At 1 anta presentors as we 11 as from others who were i nvi ted to contribute Research on engine deposits has not been as glamorous as in the rel ated fossil fuel areas of petrol eum coal or oil shale and publications in the field have been largely confined to combustion and automotive engineering journals One objec tive of this book is to bring a large body of work on the chemistry of deposits into more general accessibility We hope to make people more familiar with what deposits are with what problems they cause and with what present workers are doing to solve these problems The creation of the book has involved many people Patricia M Vann of Plenum Publishing Corporation gave guidance in planning We thank Claire Bromley Ellen Gabriel and Halina Markowski for the preparation of many of the Exxon contribu tions Finally we thank Joseph C Scanlon for his useful advice and encouragement

Arene Chemistry Jacques Mortier, 2015-11-30 Organized to enable students and synthetic chemists to understand and expand on aromatic reactions covered in foundation courses the book offers a thorough and accessible mechanistic explanation of aromatic reactions involving arene compounds Surveys methods used for preparing arene compounds and their transformations Connects reactivity and methodology with mechanism Helps readers apply aromatic reactions in a practical context by designing syntheses Provides essential information about techniques used to determine reaction mechanisms

PHARMACEUTICAL ORGANIC CHEMISTRY

-II Mr. Jiten mishra, Dr. Roopam devaliya, Dr. S. Kambhoja, Dr. sandhyarani panda, Mrs. Sarita singh ahirwar, This book is designed to provide a basic introduction to some of the most significant topics in organic chemistry with an emphasis on the chemistry of polynuclear hydrocarbons cycloalkanes phenols aromatic amines aromatic acids fats and oils and benzene and its derivatives From the basic structure and reactivity of benzene to the study of complex organic compounds the material is arranged to lead readers through a logical progression of themes Every course aims to provide students a thorough theoretical grasp as well as useful insights into the chemical behaviors and practical uses of these substances Important reactions analytical techniques and the practical relevance of the compounds under discussion are all given particular attention This book tries to make difficult subjects approachable and interesting for experts teachers and students alike via thorough explanations and pertinent examples I hope that anybody looking to learn more about organic chemistry will find this book to be a useful resource and that it will stimulate further research and investigation in this exciting area

Classics in Hydrocarbon Chemistry Henning Hopf, 2000-06-15 The two basic building units carbon and hydrogen can be combined in a million different ways to give a plethora of fascinating organic compounds Henning Hopf presents not only the most remarkable structures and properties of hydrocarbon compounds but shows in a clear presentation and with great didactic skill how molecules like dodecahedrane superphane or annulenes challenge the synthetic skills of every organic chemist To make the information more accessible especially to the novice the author carefully analyzes the synthetic problem explains each synthetic step and gives hints on alternative methods and potential pitfalls Numerous references to useful reviews and

the original literature make this book an indispensable source of further information Special emphasis is placed on the skillful use of graphics and schemes Synthetic retro analyses reaction sequences and crucial steps are presented in blue boxed sections within the text Graduate students and researchers alike will find this book a gold mine of useful information essential for their daily work Every organic chemist will want to have a copy on his or her desk With a foreword by W von Eggers Doering

Organic Chemistry Jonathan Clayden, Nick Greeves, Stuart Warren, 2012-03-15 A first and second year undergraduate organic chemistry textbook specifically geared to British and European courses and those offered in better schools in North America this text emphasises throughout clarity and understanding

An Introduction to the Chemistry of Benzenoid Compounds Muriel Tomlinson, 2016-07-29 An Introduction to the Chemistry of Benzenoid Compounds is an introductory text to some chemical aspects of benzenoid compounds This book is composed of 13 chapters that specifically cover the sources properties and reactions of these compounds The opening chapters describe the structural aspects of benzenoid compounds including their homologues isomers and aromaticity The subsequent chapters deal with the disubstitution and addition reactions of the benzene nucleus Considerable chapters are devoted to the synthesis of benzenoid derivatives such as aromatic halides nitro compounds carbonyl compounds acids and amines phenols alcohols and naphthalene The final chapter introduces the chemistry of anthracene phenanthrene and polycyclic aromatic hydrocarbons This book is of value to organic chemistry students

Chemistry for Pharmacy Students Lutfun Nahar, Professor Satyajit D. Sarker, 2019-08-26 Introduces the key areas of chemistry required for all pharmacy degree courses and focuses on the properties and actions of drug molecules This new edition provides a clear and comprehensive overview of the various areas of general organic and natural products chemistry in relation to drug molecules Structured to enhance student understanding it places great emphasis on the applications of key theoretical aspects of chemistry required by all pharmacy and pharmaceutical science students This second edition particularly caters for the chemistry requirements in any Integrated Pharmacy Curricula where science in general is meant to be taught not in isolation but together with and as a part of other practice and clinical elements of the course Chemistry for Pharmacy Students General Organic and Natural Product Chemistry 2nd Edition is divided into eight chapters It opens with an overview of the general aspects of chemistry and their importance to modern life with emphasis on medicinal applications The text then moves on to discuss the concepts of atomic structure and bonding and the fundamentals of stereochemistry and their significance to pharmacy in relation to drug action and toxicity Various aspects of organic functional groups organic reactions heterocyclic chemistry nucleic acids and their pharmaceutical importance are then covered in subsequent chapters with the final chapter dealing with drug discovery and development and natural product chemistry Provides a student friendly introduction to the main areas of chemistry required by pharmacy degree courses Written at a level suitable for non chemistry students in pharmacy but also relevant to those in life sciences food science and the health sciences Includes learning objectives at the beginning of each chapter Focuses on

the physical properties and actions of drug molecules Chemistry for Pharmacy Students General Organic and Natural Product Chemistry 2nd Edition is an essential book for pharmacy undergraduate students and a helpful resource for those studying other subject areas within pharmaceutical sciences biomedical sciences cosmetic science food sciences and health and life sciences **Theilheimer's Synthetic Methods of Organic Chemistry** G. Tozer-Hotchkiss,2013-08-23 This

systematic survey of the mainstream organic chemistry literature published six monthly provides a key research tool Highlights include 3 Examples abstracted to illustrate important new generally applicable synthetic methods 3 Abstracts summarizing the experimental procedure as well as indicating the scope and limitations of the method and important mechanistic features 3 Abstracts collated and organised into logical sections affording a useful browsing tool 3 Comprehensive indexing and cross referencing providing an invaluable research tool 3 More than 1000 graphical abstracts per year complemented by thousands of additional references which comprise supplementary information citations to previous abstracts a review of reviews and informed commentary on latest trends 3 Available as ActiveBooks fully text searchable online versions Each volume provides the organic chemist with an indispensable educational tool both for researching and browsing recent literature highlights in a way that is entirely complementary with searching electronic reaction databases Extensive indexing and cross referencing allows the series to grow volume by volume into an important reference work that deserves to be an integral part of any scientific library Specifically volume 82 comprises 3 500 graphical abstracts covering the mainstream organic chemistry literature to November 2012 3 A summary of reviews covering the six month period to May 2013 collated into easily accessible sections 3 An informed commentary on research trends during the six month period to June 2013 **Advances in Heterocyclic Chemistry** ,1978-05-31 Advances in Heterocyclic Chemistry

Chemical Synthesis C. Chatgililoglu,V. Snieckus,2012-12-06 Chemical Synthesis Gnosis to Prognosis XTUllKtl uv8eoTr ana TT rVWOT OTT npaYVWOT other things being equal that field has the most merit which contributes most heavily to and illuminates most brightly its neighbouring scientific disciplines l One hundred scientists a blend of students industrialists and academics from twenty countries gathered to circumscribe understand and elaborate this topic in the magical setting of Ravello Italy The mandate of this workshop To survey existing knowledge assess current work and discuss the future directions of chemical synthesis as it impinges on three exciting interdisciplinary themes of science in the 1990 s bioactive molecules man made chemical materials and molecular recognition This tempting but inexact menu summoned diverse students and scientists who wished to seriously reflect upon dissect and eject ideas and own experiences into open debate on this topic which is at a crossroad in internal evolution and impact on the life and material sciences The group arrived from many directions and in various forms of transportation matters soon forgotten when it found itself in the village which nurtured Wagner s inspiration and set to work immediately to ponder the question which has received extensive thought prediction and caveat from illustrious chemists over a period of time 2 two of which to the delight of all in presence among

the Lectures **Eilhard Mitscherlich, Prince of Prussian Chemistry** Hans-Werner Schütt, 1997 Eilhard Mitscherlich 1794 1863 holds an important position among the chemists who created the basis of postLavoisier chemistry His discoveries of iso and polymorphism his pioneering work on catalysis and his research on benzene and benzene derivatives the formation of ethers and alcoholic fermentation belong to the truly fundamental achievements of classical chemistry In 1822 at the instigation of his mentor Berzelius Mitscherlich became the successor of Klaproth both as member of the Royal Prussian Academy of Sciences and as full professor at the Friedrich Wilhelm University Despite his long quarrels with Liebig the most influential chemist in Germany Mitscherlich remained the most eminent representative of chemistry in Prussia When he died an epoch of chemistry in Berlin drew to an end

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web 1 060 t variation 10 w 2 040 t variation 10 e 3 345 t variation 8 e 4 352 t variation 12 w 5 003 t variation 6 e answers convert these magnetic bearings to true bearings 6 009 m variation 19 e 7 000 m variation 5 w 8 000 m variation 10 e 9 345 m variation 25 e 10 009 m variation 11 w answers

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web and west of that line east of the true north the country may there tone be divided into eastern and western magnetic regions in the eastern region the bearing of polaris at its western elongation if eastward added to the azimuth gives the desired variation west but if westward the bearing taken from the azimuth gives the variation west

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web grivation is calculated by adding variation and convergence algebraically in this case variation is west and convergence is east opposite directions so the algebraic sum becomes 29 w 69 e 40 e grivation the grivation is then applied to the magnetic heading grivation east magnetic least 345 40 025 g

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web apr 5 2022 variation west magnetic best if the variation annotation features the letter w we must add the variation from the course measured on the chart to give an accurate magnetic bearing to fly here are a couple of quick examples true course measured on the map 195 variation 17 w variation west magnetic best

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web the magnetic pole is currently in the far north of canada and has been for there approximately for 200 year this all means that is you are sitting in the uk a magnetic compass points approxima tely 3 5 degrees to the west of true north this difference is known a variation variation is relatively predictable and is marked on the chart

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web magnetic declination sometimes called magnetic variation is the angle between magnetic north and true north declination is positive east of true north and negative when west magnetic declination changes over time and with location as the compass points with local magnetic fields declination value is needed to obtain true north more

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web around uk coasts variation is around 4 west to 7 west in other parts of the world it can reach more than 50 east or west because the magnetic north pole moves the variation changes from year to year the compass rose on the chart gives the annual change around 7 east per year around the uk

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web dec 13 2010 magnetic declination also called variation is the difference between true north and magnetic north it is either east or west east declination is considered positive and west is negative charts or maps define the

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web 1 by convention declination is positive when magnetic north is east of true north and negative when it is to the west isogonic lines are lines on the earth's surface along which the declination has the same constant value and lines along which the declination is zero are called agonic lines

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web for a magnetic compass the needle will point towards magnetic north rather than true north depending on where you are on the earth's surface this difference may be as much as 30 variation may be to east or west of true north again depending on where you are on the earth's surface variation also changes as time progresses as the magnetic

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web dec 14 2022 here a magnetic reading of 051 is to be converted to true using a variation of 2 e variation is east so m will be least or less than t by 2 t must be 053 in this example variation is unknown the boat may be on a course of 357 true and a

hand held compass reads 001 magnetic the difference between t and m is 4 and m is

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web as variation is directional the rhymes variation east magnetic least and variation west magnetic best can be used as a memory aid to ensure variation is applied correctly navigation variation is an important component when

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web when magnetic north m is west of the true north variation v is west fig 9 5 as it is the case in eastern canada the magnetic course mc of the boat can be calculated from its true course tc measured on the chart by applying the formula mc tc variation west fig 9 5 i e magnetic course true course plus the variation west

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