

# Main Group Elements

Main group elements

<div> <div><sup>1</sup>H Hydrogen 1.008</div> <div><sup>2</sup>He Helium 4.003</div> </div>																	
s-block		p-block															
1	2											13	14	15	16	17	18
<sup>3</sup> Li Lithium 6.941	<sup>4</sup> Be Beryllium 9.012											<sup>5</sup> B Boron 10.811	<sup>6</sup> C Carbon 12.011	<sup>7</sup> N Nitrogen 14.007	<sup>8</sup> O Oxygen 15.999	<sup>9</sup> F Fluorine 18.998	<sup>10</sup> Ne Neon 20.180
<sup>11</sup> Na Sodium 22.990	<sup>12</sup> Mg Magnesium 24.305											<sup>13</sup> Al Aluminum 26.982	<sup>14</sup> Si Silicon 28.086	<sup>15</sup> P Phosphorus 30.974	<sup>16</sup> S Sulfur 32.06	<sup>17</sup> Cl Chlorine 35.45	<sup>18</sup> Ar Argon 39.948
<sup>19</sup> K Potassium 39.098	<sup>20</sup> Ca Calcium 40.078	<sup>21</sup> Sc Scandium 44.956	<sup>22</sup> Ti Titanium 47.88	<sup>23</sup> V Vanadium 50.942	<sup>24</sup> Cr Chromium 51.996	<sup>25</sup> Mn Manganese 54.938	<sup>26</sup> Fe Iron 55.845	<sup>27</sup> Co Cobalt 58.933	<sup>28</sup> Ni Nickel 58.693	<sup>29</sup> Cu Copper 63.546	<sup>30</sup> Zn Zinc 65.38	<sup>31</sup> Ga Gallium 69.723	<sup>32</sup> Ge Germanium 72.63	<sup>33</sup> As Arsenic 74.922	<sup>34</sup> Se Selenium 78.96	<sup>35</sup> Br Bromine 79.904	<sup>36</sup> Kr Krypton 83.80
<sup>37</sup> Rb Rubidium 85.468	<sup>38</sup> Sr Strontium 87.62	<sup>39</sup> Y Yttrium 88.906	<sup>40</sup> Zr Zirconium 91.224	<sup>41</sup> Nb Niobium 92.906	<sup>42</sup> Mo Molybdenum 95.94	<sup>43</sup> Tc Technetium 98.906	<sup>44</sup> Ru Ruthenium 101.07	<sup>45</sup> Rh Rhodium 102.91	<sup>46</sup> Pd Palladium 106.36	<sup>47</sup> Ag Silver 107.87	<sup>48</sup> Cd Cadmium 112.41	<sup>49</sup> In Indium 114.82	<sup>50</sup> Sn Tin 118.71	<sup>51</sup> Sb Antimony 121.76	<sup>52</sup> Te Tellurium 127.6	<sup>53</sup> I Iodine 126.91	<sup>54</sup> Xe Xenon 131.29
<sup>55</sup> Cs Cesium 132.91	<sup>56</sup> Ba Barium 137.33	<sup>57-71</sup> f Lanthanides	<sup>72</sup> Hf Hafnium 178.49	<sup>73</sup> Ta Tantalum 180.95	<sup>74</sup> W Tungsten 183.84	<sup>75</sup> Re Rhenium 186.21	<sup>76</sup> Os Osmium 190.23	<sup>77</sup> Ir Iridium 192.22	<sup>78</sup> Pt Platinum 195.08	<sup>79</sup> Au Gold 196.97	<sup>80</sup> Hg Mercury 200.59	<sup>81</sup> Tl Thallium 204.38	<sup>82</sup> Pb Lead 207.2	<sup>83</sup> Bi Bismuth 208.98	<sup>84</sup> Po Polonium 209	<sup>85</sup> At Astatine 210	<sup>86</sup> Rn Radon 222
<sup>87</sup> Fr Francium 223	<sup>88</sup> Ra Radium 226	<sup>89-103</sup> f Actinides	<sup>104</sup> Rf Rutherfordium 261	<sup>105</sup> Db Dubnium 262	<sup>106</sup> Sg Seaborgium 266	<sup>107</sup> Bh Bohrium 264	<sup>108</sup> Hs Hassium 277	<sup>109</sup> Mt Meitnerium 268	<sup>110</sup> Ds Darmstadtium 271	<sup>111</sup> Rg Roentgenium 272	<sup>112</sup> Cn Copernicium 285	<sup>113</sup> Nh Nihonium 284	<sup>114</sup> Fl Flerovium 289	<sup>115</sup> Mc Moscovium 288	<sup>116</sup> Lv Livermorium 293	<sup>117</sup> Ts Tennessine 289	<sup>118</sup> Og Oganesson 294

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•• <sup>89</sup> Ac Actinium 227	<sup>90</sup> Th Thorium 232.04	<sup>91</sup> Pa Protactinium 231.04	<sup>92</sup> U Uranium 238.03	<sup>93</sup> Np Neptunium 237.05	<sup>94</sup> Pu Plutonium 244.06	<sup>95</sup> Am Americium 243.06	<sup>96</sup> Cm Curium 247.07	<sup>97</sup> Bk Berkelium 247.07	<sup>98</sup> Cf Californium 251.08	<sup>99</sup> Es Einsteinium 252.08	<sup>100</sup> Fm Fermium 257.10	<sup>101</sup> Md Mendelevium 258.10	<sup>102</sup> No Nobelium 259.10	<sup>103</sup> Lr Lawrencium 262.11

# Main Group Chemistry

**V. G. Kumar Das**



## **Main Group Chemistry:**

*Main Group Chemistry* W. Henderson, 2000 *Main Group Chemistry* covers the chemistry of the s and p block elements together with a brief chapter on the chemistry of zinc cadmium and mercury often classified as main group elements rather than as transition elements The Periodic Table is an important predictive tool in main group chemistry and in this book forms the basis for describing the trends and variations in the chemistry of the elements Introductory material covers the basic principles behind the Periodic Table bonding electronegativity and VSEPR Valence Shell Electron Pair Repulsion theory The chemistry of various groups of elements is then discussed The book incorporates a valuable chapter on inorganic polymers discussing the chemistry of materials such as silicates silicones phosphazenes and diamond Additional material is available on the website at [www.rsc.org/tct](http://www.rsc.org/tct) Ideal for the needs of undergraduate chemistry students Tutorial Chemistry Texts is a major 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 *Main Group Chemistry* A. G.

Massey, 2000-12-27 Lately there has been much interest in the chemistry of Main Group elements with novel compounds being synthesised both in academia and industry This book examines their synthesis structure and how they behave chemically The second edition follows the same structure as the first except that the biochemistry section has been removed to allow for the inclusion of a wide range of new material This includes complexation and the stabilization of unstable species new elements and isotopes discussion of for example pπ bonding in compounds of the heavier main group elements electronegativity of F bonding in sulfur and phosphorus oxo anions examples of new compounds developed around traditional models for example compounds in which multiply bonded C is replaced by Si and pentavalent organo derivatives of Group 15 All other information is fully revised and updated in the light of more recent data Where relevant the author indicates where gaps exist in current knowledge and offers non typical examples which are at the limits of current research The new edition is aimed at Honors and postgraduate students as well as researchers interested in Main Group elements and their compounds On the first edition This is a book I would recommend as background reading for undergraduates and postgraduates Education in Chemistry Chemistry in Britain This is a sound and sensible book coherently produced and well written The Times Higher Educational Supplement *Inorganic Chemistry of Main Group Elements* R. Bruce King, 1995

Many chapters include the following a summary of the typical coordination number oxidation states bonding types etc found in the elements covered important properties of the free elements including a discussion of allotropic forms discussions of halides oxides oxyacids organometallic derivatives and other compound types in separate sections *Molecular Clusters of the Main Group Elements* Matthias Driess, Heinrich Nöth, 2008-11-21 With more than 20 contributions from leading research groups this book provides essential information for chemists and materials scientists working with molecular clusters It

treats both homonuclear and heteronuclear clusters including the theory and concepts in main group cluster chemistry novel boranes and heteroboranes silicon germanium tin clusters alkali metal suboxides clusters in alloys with mercury chalcogen clusters and numerous other compound classes The whole is illustrated by examples of the great potential for technical applications such as electron storage cancer therapy and in optoelectronic devices Its systematic coverage of all relevant main group elements makes this the prime reference source in the field

**Organo Main Group Chemistry** Kin-ya Akiba, 2011-08-24 Forging a new association main group elements and organic chemistry Covering the essentials of all main group elements in organic chemistry along with the synthesis and reactions of their organic compounds in just one volume Organo Main Group Chemistry breaks important new ground While main group chemistry has traditionally been classified as part of inorganic chemistry this book establishes the organic chemistry of main group elements for the first time The organic compounds of elements in the second period of the periodic table which are centered around carbon are the major components of animals and plants while those in the third period and below also play key roles worthy of discussion when studying main group element chemistry The major chapters describe synthesis and reactivity of organic compounds in the third period and below and are arranged according to the order of the periodic table Starting with the role of lithium and magnesium cations the chapters reach fluorine and iodine compounds The first two chapters summarize the unique and common characteristics of main group elements in relation to carbon The latter chapters deal with modern topics that address the unique characteristics of organo main group compounds Suitable for professional researchers chemistry professors and advanced students Organo Main Group Chemistry presents a novel new approach to the way we view both main groups and organic chemistry itself

**Chemical Structure and Reactivity** James Keeler, Peter Wothers, 2013-11 Why do certain substances react together in the way that they do What determines the shape of molecules And how can we predict whether a particular reaction will happen at all Such questions lie at the heart of chemistry the science of understanding the composition of substances their reactions and properties Though introductory chemistry is often broken into three sections inorganic organic and physical the only way for students to fully understand the subject is to see it as a single unified whole Chemical Structure and Reactivity rises to the challenge of depicting the reality of chemistry Offering a fresh approach to the subject by depicting it as a seamless discipline the text shows how organic inorganic and physical concepts can be blended together in order to achieve the common goal of understanding chemical systems With a lively and engaging writing style enhanced by vivid illustrations only Chemical Structure and Reactivity makes teaching chemistry with an integrated approach possible

**Special Features** The only introductory text to take a truly integrated approach in explaining the fundamentals of chemistry Fosters an orbital based understanding of reactions with clear curly arrow mechanistic detail throughout A two part structure allows flexibility of use Part I lays down the core of the subject while Part II describes a series of relatively standalone topics which can be selected to fit a particular course Numerous concepts are illustrated with

fully cross referenced custom developed online modules enabling students to develop an understanding through active learning Self test exercises embedded in the text with solutions at the end of each chapter and extensive question sets encourage hands on learning to help students master the subject and gain confidence The Online Resource Centre features a range of additional resources for both students and registered adopters of the book New to this Edition A new chapter on symmetry has been added to Part I Discussions of organometallic chemistry spectroscopy and molecular geometry have been expanded Cross references from Part I to Part II have been increased to make the links between core concepts and more advanced topics clearer More self test questions and exercises have been provided

**Organometallic Chemistry of the Main Group Elements** Peter Simpson, 1970      **Inorganic Chemistry of the Main-group Elements**, 1974

Organometallics Christoph Elschenbroich, 2016-02-10 THE textbook on organometallic chemistry Comprehensive and up to date the German original is already a classic making this third completely revised and updated English edition a must for graduate students and lecturers in chemistry inorganic chemists chemists working with on organometallics bioinorganic chemists complex chemists and libraries Over one third of the chapters have been expanded to incorporate developments since the previous editions while the chapter on organometallic catalysis in synthesis and production appears for the first time in this form From the reviews of the first English editions The selection of material and the order of its presentation is first class Students and their instructors will find this book extraordinarily easy to use and extraordinarily useful Chemistry in Britain Elschenbroich and Salzer have written the textbook of choice for graduate or senior level courses that place an equal emphasis on main group element and transition metal organometallic chemistry this book can be unequivocally recommended to any teacher or student of organometallic chemistry Angewandte Chemie International Edition The breadth and depth of coverage are outstanding and the excitement of synthetic organometallic chemistry comes across very strongly Journal of the American Chemical Society

**Organometallic Chemistry and Catalysis** Didier Astruc, 2007-08-14 This volume covers both basic and advanced aspects of organometallic chemistry of all metals and catalysis In order to present a comprehensive view of the subject it provides broad coverage of organometallic chemistry itself The catalysis section includes the challenging activation and fictionalization of the main classes of hydrocarbons and the industrially crucial heterogeneous catalysis Summaries and exercises are provided at the end of each chapter and the answers to these exercises can be found at the back of the book Beginners in inorganic organic and organometallic chemistry as well as advanced scholars and chemists from academia and industry will find much value in this title

**Organometallic Chemistry** Clare Bakewell, Nildo Costa, Rebecca Musgrave, Gareth Owen, 2024-12-06 Compiled by a new editorial team this volume provides an invaluable resource covering many aspects of organometallic and coordination chemistry The book has been developed through contributions from future leaders in organometallic chemistry at the forefront of their research With continued increases and expansion of chemical literature researchers can find it challenging to keep up with recent developments The

volume provides a comprehensive overview of emerging themes and key developments in the field. The reviews in this volume reflect current interests and range in scope from the application of heterobimetallic complexes in catalysis to progress in dinitrogen functionalisation, the role of Lewis acids in Ni catalysis, hydrogenation of CO<sub>2</sub> and the photo-induced activity of main group metals and metalloids. It also includes computational strategies for modelling excited states in organometallic chemistry. This volume is a key reference for researchers in academic and industrial settings.

**Main Group Elements and Their Compounds** V. G. Kumar Das, 1996     Mosaic, 1983     **Polar Organometallic Reagents** Andrew E. H. Wheatley, Masanobu Uchiyama, 2022-03-03

Outlines recent advances in the field of polar organometallic chemistry particularly in the context of the emergent areas of synergic and cooperative species. Polar Organometallic Reagents provides a critical overview of developments in the field of modern polar organometallic chemistry. With a particular focus on the emergent area of synergic heterometallic reagents, this timely volume describes our attempts to understand recently developed polar organometallics and their application in a range of new directions. Contributions from leading researchers present new synthetic work and discuss recent advances in characterization techniques, synthetic applications and mechanistic understanding of heterometallic complexes. In-depth chapters provide detailed information on fundamental structural and theoretical aspects of polar organometallic chemistry while articulating the need and rationale for the advent of new reagents. Topics include alkali and alkaline earth organometallics, synergy and cooperativity, cationic p-block clusters and other developments in main group catalysis, synthetic trends in alkenyl copper ate complex and borylmetal chemistry, non-traditional reaction environments and trends in developing greener processes. Designed to keep readers updated with the latest progress in the field, this much-needed book includes an introductory chapter outlining the development of synergic bases and the logic behind their creation. Highlights the role of solid-state structural work in elucidating the bonding and reactivity displayed by modern polar organometallics. Examines the use of calculations in catalyst design and plotting more sustainable reaction pathways. Discusses modern trends in solution techniques that have achieved new insights into the structures of active species. Presents striking advances in the ease of handling of polar organometallics and the emergence of main group catalysis. Polar Organometallic Reagents is essential reading for researchers in chemical disciplines including synthetic inorganic and coordination chemistry, main group chemistry, organometallic chemistry, organic synthesis and catalysis.

Halogens and Noble Gases, Second Edition Monica Halka, Brian Nordstrom, 2019-12-01

In spite of their adjacency in the periodic table, halogens and nonmetals have very different properties. Halogens are among the most chemically reactive elements in the periodic table, exhibiting a diverse chemistry in terms of the large numbers of compounds they can form. On the other hand, noble gases are the least chemically reactive elements. In fact, before the 1960s, chemists referred to these elements as inert gases because it was believed that they exhibited no chemistry whatsoever. Providing the basics of these elements, including their role in history and some of the important scientists involved in their discovery, this

newly updated full color resource features up to date scientific understanding in a clear and accessible format Halogens and Noble Gases Second Edition examines the ways humans use halogens and noble gases and the resulting benefits and challenges to society health and the environment Fluorine chlorine bromine iodine helium and krypton are covered in this eBook along with the fundamentals of chemistry and physics as well as possible future developments in halogen and noble gas science and its applications Nonmetals, Second Edition Monica Halka, Brian Nordstrom, 2019-12-01 Praise for the

previous edition a solid addition to a high school and public library science collection Recommended Library Media Connection Materials that are poor conductors of electricity are generally considered nonmetals One important use of nonmetals is the ability to insulate against current flow The Earth's atmosphere is composed of nonmetallic elements but lightning can break down the electron bonds and allow huge voltages to make their way to the ground Water in its pure form is nonmetallic though it almost always contains impurities called electrolytes that allow for an electric field With an exploration of the benefits and challenges to society health and the environment Nonmetals Second Edition provides readers with new developments in the research of nonmetals including where they came from how they fit into our current technological society and where they may lead us Written in an easy to read format this newly updated full color resource discusses new developments and dilemmas past present and future uses of nonmetals in science and technology and much more Nonmetals explored in this title include hydrogen carbon nitrogen phosphorus oxygen sulfur and selenium *Alkali and Alkaline Earth Metals, Second Edition* Monica Halka, Brian Nordstrom, 2019-12-01 Scientists categorize the chemical elements as metals nonmetals and metalloids largely based on the elements abilities to conduct electricity at normal temperatures and pressures but there are other distinctions taken into account when classifying the elements in the periodic table The alkali metals for example are metals but have such special properties that they are given their own classification The same is true for the alkaline earths Alkali and Alkaline Earth Metals Second Edition presents the current scientific understanding of the physics chemistry geology and biology of these two families of elements including how they are synthesized in the universe when and how they were discovered and where they are found on Earth With information pertaining to the discovery and naming of these elements as well as new developments and dilemmas this newly updated eBook examines how humans use alkalis and alkaline earths and their benefits and challenges to society health and the environment Lithium sodium potassium magnesium and calcium are only a few of the topics covered in this full color resource Alkali and Alkaline Earth Metals Second Edition provides students and scientists with an up to date understanding of each of the nonmetals where they came from how they fit into our current technological society and where they may lead us Synthesis and Technique in Inorganic Chemistry Gregory S. Girolami, Thomas B. Rauchfuss, Robert J. Angelici, 1999 Previously by Angelici this laboratory manual for an upper level undergraduate or graduate course in inorganic synthesis has for many years been the standard in the field In this newly revised third edition the manual has been extensively updated to

reflect new developments in inorganic chemistry Twenty three experiments are divided into five sections solid state chemistry main group chemistry coordination chemistry organometallic chemistry and bioinorganic chemistry The included experiments are safe have been thoroughly tested to ensure reproducibility are illustrative of modern issues in inorganic chemistry and are capable of being performed in one or two laboratory periods of three or four hours Because facilities vary from school to school the authors have included a broad range of experiments to help provide a meaningful course in almost any academic setting Each clearly written illustrated experiment begins with an introduction that highlights the theme of the experiment often including a discussion of a particular characterization method that will be used followed by the experimental procedure a set of problems a listing of suggested Independent Studies and literature references

*Sustainable Inorganic Chemistry* David A. Atwood, 2016-09-20 The Earth's natural resources are finite and easily compromised by contamination from industrial chemicals and byproducts from the degradation of consumer products The growing field of green and sustainable chemistry seeks to address this through the development of products and processes that are environmentally benign while remaining economically viable Inorganic chemistry plays a critical role in this endeavor in areas such as resource extraction and isolation renewable energy catalytic processes waste minimization and avoidance and renewable industrial feedstocks *Sustainable Inorganic Chemistry* presents a comprehensive overview of the many new developments taking place in this rapidly expanding field in articles that discuss fundamental concepts alongside cutting edge developments and applications The volume includes educational reviews from leading scientists on a broad range of topics including inorganic resources sustainable synthetic methods alternative reaction conditions heterogeneous catalysis photocatalysis sustainable nanomaterials renewable and clean fuels water treatment and remediation waste valorization and life cycle sustainability assessment The content from this book will be added online to the Encyclopedia of Inorganic and Bioinorganic Chemistry

**A Textbook of Inorganic Chemistry - Volume 1** Mandeep Dalal, 2017-01-01 An advanced level textbook of inorganic chemistry for the graduate B Sc and postgraduate M Sc students of Indian and foreign universities This book is a part of four volume series entitled *A Textbook of Inorganic Chemistry* Volume I II III IV

**CONTENTS** Chapter 1 Stereochemistry and Bonding in Main Group Compounds VSEPR theory d p bonds Bent rule and energetic of hybridization Chapter 2 Metal Ligand Equilibria in Solution Stepwise and overall formation constants and their interactions Trends in stepwise constants Factors affecting stability of metal complexes with reference to the nature of metal ion and ligand Chelate effect and its thermodynamic origin Determination of binary formation constants by pH metry and spectrophotometry Chapter 3 Reaction Mechanism of Transition Metal Complexes I Inert and labile complexes Mechanisms for ligand replacement reactions Formation of complexes from aquo ions Ligand displacement reactions in octahedral complexes acid hydrolysis base hydrolysis Racemization of tris chelate complexes Electrophilic attack on ligands Chapter 4 Reaction Mechanism of Transition Metal Complexes II Mechanism of ligand displacement reactions in square planar



complexes The trans effect Theories of trans effect Mechanism of electron transfer reactions types outer sphere electron transfer mechanism and inner sphere electron transfer mechanism Electron exchange Chapter 5 Isopoly and Heteropoly Acids and Salts Isopoly and Heteropoly acids and salts of Mo and W structures of isopoly and heteropoly anions Chapter 6 Crystal Structures Structures of some binary and ternary compounds such as fluorite antiferite rutile antirutile cristobalite layer lattices  $\text{CdI}_2$   $\text{BiI}_3$   $\text{ReO}_3$   $\text{Mn}_2\text{O}_3$  corundum perovskite Ilmenite and Calcite Chapter 7 Metal Ligand Bonding Limitation of crystal field theory Molecular orbital theory octahedral tetrahedral or square planar complexes bonding and molecular orbital theory Chapter 8 Electronic Spectra of Transition Metal Complexes Spectroscopic ground states Correlation and spin orbit coupling in free ions for 1st series of transition metals Orgel and Tanabe Sugano diagrams for transition metal complexes  $d^1$   $d^9$  states Calculation of  $Dq$   $B$  and parameters Effect of distortion on the d orbital energy levels Structural evidence from electronic spectrum Jahn Teller effect Spectrochemical and nephelauxetic series Charge transfer spectra Electronic spectra of molecular addition compounds Chapter 9 Magnetic Properties of Transition Metal Complexes Elementary theory of magneto chemistry Gouy's method for determination of magnetic susceptibility Calculation of magnetic moments Magnetic properties of free ions Orbital contribution effect of ligand field Application of magneto chemistry in structure determination Magnetic exchange coupling and spin state cross over Chapter 10 Metal Clusters Structure and bonding in higher boranes Wade's rules Carboranes Metal carbonyl clusters low nuclearity carbonyl clusters Total electron count TEC Chapter 11 Metal Complexes Metal carbonyls structure and bonding Vibrational spectra of metal carbonyls for bonding and structure elucidation Important reactions of metal carbonyls Preparation bonding structure and important reactions of transition metal nitrosyl dinitrogen and dioxygen complexes Tertiary phosphine as ligand

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