

## Chemistry The Central Science 12th Edition Solutions Manual

This book explores the relationship between the content of chemistry education and the history and philosophy of science (HPS) framework that underlies such education. It discusses the need to present an image that reflects how chemistry developed and progresses. It proposes that chemistry should be taught the way it is practiced by chemists: as a human enterprise, at the interface of scientific practice and HPS. Finally, it sets out to convince teachers to go beyond the traditional classroom practice and explore new teaching strategies. The importance of HPS has been recognized for the science curriculum since the middle of the 20th century. The need for teaching chemistry within a historical context is not difficult to understand as HPS is not far below the surface in any science classroom. A review of the literature shows that the traditional chemistry classroom, curricula, and textbooks while dealing with concepts such as law, theory, model, explanation, hypothesis, observation, evidence and idealization, generally ignore elements of the history and philosophy of science. This book proposes that the conceptual understanding of chemistry requires knowledge and understanding of the history and philosophy of science. "Professor Niaz's book is most welcome, coming at a time when there is an urgently felt need to upgrade the teaching of science. The book is a huge aid for adding to the usual way - presenting science as a series of mere facts - also the necessary mandate: to show how science is done, and how science, through its history and philosophy, is part of the cultural development of humanity." Gerald Holton, Mallinckrodt Professor of Physics & Professor of History of Science, Harvard University "In this stimulating and sophisticated blend of history of chemistry, philosophy of science, and science pedagogy, Professor Mansoor Niaz has succeeded in offering a promising new approach to the teaching of fundamental ideas in chemistry. Historians and philosophers of chemistry --- and above all, chemistry teachers --- will find this book full of valuable and highly usable new ideas" Alan Rocke, Case Western Reserve University "This book artfully connects chemistry and chemistry education to the human context in which chemical science is practiced and the historical and philosophical background that illuminates that practice. Mansoor Niaz deftly weaves together historical episodes in the quest for scientific knowledge with the psychology of learning and philosophical reflections on the nature of scientific knowledge and method. The result is a compelling case for historically and philosophically informed science education. Highly recommended!" Harvey Siegel, University of Miami "Books that analyze the philosophy and history of science in Chemistry are quite rare. 'Chemistry Education and Contributions from History and Philosophy of Science' by Mansoor Niaz is one of the rare books on the history and philosophy of chemistry and their importance in teaching this science. The book goes through all the main concepts of chemistry, and analyzes the historical and philosophical

developments as well as their reflections in textbooks. Closest to my heart is Chapter 6, which is devoted to the chemical bond, the glue that holds together all matter in our earth. The chapter emphasizes the revolutionary impact of the concept of the 'covalent bond' on the chemical community and the great novelty of the idea that was conceived 11 years before quantum mechanics was able to offer the mechanism of electron pairing and covalent bonding. The author goes then to describe the emergence of two rival theories that explained the nature of the chemical bond in terms of quantum mechanics; these are valence bond (VB) and molecular orbital (MO) theories. He emphasizes the importance of having rival theories and interpretations in science and its advancement. He further argues that this VB-MO rivalry is still alive and together the two conceptual frames serve as the tool kit for thinking and doing chemistry in creative manners. The author surveys chemistry textbooks in the light of the how the books preserve or not the balance between the two theories in describing various chemical phenomena. This Talmudic approach of conceptual tension is a universal characteristic of any branch of evolving wisdom. As such, Mansoor's book would be of great utility for chemistry teachers to examine how can they become more effective teachers by recognizing the importance of conceptual tension". Sason Shaik Saeree K. and Louis P. Fiedler Chair in Chemistry Director, The Lise Meitner-Minerva Center for Computational Quantum Chemistry, The Hebrew University of Jerusalem, ISRAEL

Fundamentals of Environmental and Toxicological Chemistry: Sustainable Science, Fourth Edition covers university-level environmental chemistry, with toxicological chemistry integrated throughout the book. This new edition of a bestseller provides an updated text with an increased emphasis on sustainability and green chemistry. It is organized based on the five spheres of Earth's environment: (1) the hydrosphere (water), (2) the atmosphere (air), (3) the geosphere (solid Earth), (4) the biosphere (life), and (5) the anthrosphere (the part of the environment made and used by humans). The first chapter defines environmental chemistry and each of the five environmental spheres. The second chapter presents the basics of toxicological chemistry and its relationship to environmental chemistry. Subsequent chapters are grouped by sphere, beginning with the hydrosphere and its environmental chemistry, water pollution, sustainability, and water as nature's most renewable resource. Chapters then describe the atmosphere, its structure and importance for protecting life on Earth, air pollutants, and the sustainability of atmospheric quality. The author explains the nature of the geosphere and discusses soil for growing food as well as geosphere sustainability. He also describes the biosphere and its sustainability. The final sphere described is the anthrosphere. The text explains human influence on the environment, including climate, pollution in and by the anthrosphere, and means of sustaining this sphere. It also discusses renewable, nonpolluting energy and introduces workplace monitoring. For readers needing additional basic chemistry background, the book includes two chapters on

general chemistry and organic chemistry. This updated edition includes three new chapters, new examples and figures, and many new homework problems. De lange weg naar de vrijheid is de beroemde autobiografie van een van de grootste mannen van de twintigste eeuw. Nelson Mandela beschrijft de lange weg die hij heeft moeten afleggen van onwetende jongen tot charismatisch staatsman. Dit is het verhaal van misschien wel de wonderbaarlijkste omwenteling in de geschiedenis, verteld door de man die het allemaal heeft meegemaakt en in gang gezet. Het verhaal van Mandela, door Mandela.

**ALERT:** Before you purchase, check with your instructor or review your course syllabus to ensure that you select the correct ISBN. Several versions of Pearson's MyLab & Mastering products exist for each title, including customized versions for individual schools, and registrations are not transferable. In addition, you may need a CourseID, provided by your instructor, to register for and use Pearson's MyLab & Mastering products. Packages Access codes for Pearson's MyLab & Mastering products may not be included when purchasing or renting from companies other than Pearson; check with the seller before completing your purchase. Used or rental books If you rent or purchase a used book with an access code, the access code may have been redeemed previously and you may have to purchase a new access code. Access codes Access codes that are purchased from sellers other than Pearson carry a higher risk of being either the wrong ISBN or a previously redeemed code. Check with the seller prior to purchase. -- Trusted, innovative, and calibrated, Chemistry: The Central Science has helped millions of students understand and succeed in general chemistry. Its unrivaled problems, scientific accuracy, and clarity are maintained in this new edition, which is the book's biggest revision to date. In the Twelfth Edition, every word and piece of art has been studied for effectiveness. Based on feedback from students like you, this revision reflects the unparalleled expertise of its author team; each chapter has been updated and streamlined to remove any content not proven to increase student comprehension. Joined in this edition by new co-author Patrick Woodward, the book's solid authorship gains a fresh, new perspective yet maintains its unified, consistent voice. Chemistry: The Central Science continues to improve student success beyond the text with MasteringChemistry®, the most advanced online tutorial and assessment program available. Used by over a million science students, the Mastering platform is the most effective and widely used online tutorial, homework, and assessment system for the sciences. This is the product access code card for MasteringChemistry® and does not include the actual bound book. Pearson eText gives students access to the text whenever and wherever they can access the Internet. The eText pages look exactly like the printed text, and include powerful interactive and customization functions. This is the access code card for Pearson eText and does not include the actual bound book.

Without chemistry, bread would not rise, cleaners would not clean, and life itself would not exist. Chemistry is the study of matter and the chemical changes that

matter undergoes. The discovery of the atom and how atoms interact with one another has transformed the world. In this illuminating volume, readers learn about the history of chemistry and the concepts they might encounter in an introductory chemistry course, including chemical and volumetric analysis, atomic theory, gravitation, elements and the periodic table, chemical reactions and formulas, and organic and inorganic compounds and bonds. Sidebars highlight key chemists and scientific principles.

The doctoral thesis argues that the term Subcreation with its revised and broadened definition, in part differing from J.R.R. Tolkien's original term sub-creation, may be used for the discussion of the making of fictional worlds in literary discourse. The successful conception of a fictional world depends on the reader's willing suspension of disbelief. This depends both on the author and his skilled composition of the world and all its aspects, as well as on the reader's acceptance of this invented fictional world. The author needs to create a narrative with an inner consistency, which is crucial to achieving the effect of the reader's immersion in the fictional world. The fundamental aspects that an author needs to realize to achieve successful Subcreation have been structured into and analysed in four categories: Language and Linguistic Variation, Physiopoeia, Anthropoeia and Mythopoeia. Furthermore, this thesis shows that, as contemporary examples of fantastic literature, both Tad Williams's and Terry Pratchett's fictional worlds are successfully created through the realization of these aspects of Subcreation. Apart from commenting on the success of the subcreative process, this thesis also remarks upon the cultural influences both authors include in their writings. While both may be considered Anglophone in a general categorization, Pratchett's Discworld retains a feeling of 'Britishness' that is not to be found in Williams's Otherland. The thesis proposes several approaches to Subcreation that may be studied subsequently. So, for example, it may be possible to determine the success of an author's Subcreation by collecting empirical data. Apart from literary works this field of studies may also include other media.

Dit boek behandelt de theorie en pikt en passant ook nog kernenergie mee en een hoop natuurkunde.

This thorough one-stop resource draws on solid science and the latest research to play a dual educational role—providing background for students while answering general readers' questions about a wide range of nutrition-related topics.

- Provides accessible essays on today's most relevant nutrition topics
- Meets health education goals as represented by high school health education standards
- Includes up-to-date scientific information on contemporary issues
- Takes a holistic perspective, encompassing the physiological, biochemical, psychological, and societal elements of human nutrition
- Suggests interesting "research issues" students may wish to explore and offers ideas for further reading

Trusted, innovative, and calibrated, Chemistry: The Central Science has helped millions of students understand and succeed in general chemistry. Its unrivaled problems, scientific accuracy, and clarity are maintained in this new edition, which is the

book's biggest revision to date. In the Twelfth Edition, every word and piece of art has been studied for effectiveness. Based on feedback from students like you, this revision reflects the unparalleled expertise of its author team; each chapter has been updated and streamlined to remove any content not proven to increase student comprehension. Joined in this edition by new co-author Patrick Woodward, the book's solid authorship gains a fresh, new perspective yet maintains its unified, consistent voice. Note: This is a standalone book, if you want the book/access code order the ISBN below: 0321741056 / 9780321741059 Chemistry: The Central Science with MasteringChemistry Package consists of 0321696727 / 9780321696724 Chemistry: The Central 0321705106 / 9780321705105 MasteringChemistry with Pearson eText Student Access Code Card for Chemistry: The Central Science

To understand, maintain, and protect the physical environment, a basic understanding of chemistry, biology, and physics, and their hybrids is useful. *Rapid Review of Chemistry for the Life Sciences and Engineering* demystifies chemistry for the non-chemist who, nevertheless, may be a practitioner of some area of science or engineering requiring or involving chemistry. It provides quick and easy access to fundamental chemical principles, quantitative relationships, and formulas. Armed with select, contemporary applications, it is written in the hope to bridge a gap between chemists and non-chemists, so that they may communicate with and understand each other. Chapters 1–10 are designed to contain the standard material in an introductory college chemistry course. Chapters 11–15 present applications of chemistry that should interest and appeal to scientists and engineers engaged in a variety of fields. Additional features More than 100 solved examples clearly illustrated and explained with SI units and conversion to other units using conversion tables included Assists the reader to understand organic and inorganic compounds along with their structures, including isomers, enantiomers, and congeners of organic compounds Provides a quick and easy access to basic chemical concepts and specific examples of solved problems This concise, user-friendly review of general and organic chemistry with environmental applications will be of interest to all disciplines and backgrounds.

Prepared by John H. Nelson and Kenneth C. Kemp, both of the University of Nevada. This manual contains 43 finely tuned experiments chosen to introduce students to basic lab techniques and to illustrate core chemical principles. You can also customize these labs through Catalyst, our custom database program. For more information, visit <http://www.pearsoncustom.com/custom-library/catalyst> In the thirteenth edition, all experiments were carefully edited for accuracy and safety. Pre-labs and questions were revised and several experiments were added or changed. Two of the new experiments are designated for chapter 11, which is notable because no experiments were designated for chapter 11 in the twelfth edition.

The adulteration and fraudulent manufacture of medicines is an old problem, vastly aggravated by modern manufacturing and trade. In the last decade, impotent antimicrobial drugs have compromised the treatment of many deadly diseases in poor countries. More recently, negligent production at a Massachusetts compounding pharmacy sickened hundreds of Americans. While the national drugs regulatory authority (hereafter, the regulatory authority) is responsible for the safety of a country's drug supply, no single country can entirely guarantee this today. The once common use of the term counterfeit to describe any drug that is not what it claims to be is at the heart

of the argument. In a narrow, legal sense a counterfeit drug is one that infringes on a registered trademark. The lay meaning is much broader, including any drug made with intentional deceit. Some generic drug companies and civil society groups object to calling bad medicines counterfeit, seeing it as the deliberate conflation of public health and intellectual property concerns. Countering the Problem of Falsified and Substandard Drugs accepts the narrow meaning of counterfeit, and, because the nuances of trademark infringement must be dealt with by courts, case by case, the report does not discuss the problem of counterfeit medicines.

Introduction : matter and measurement -- Atoms, molecules, and ions -- Chemical reactions and reaction stoichiometry -- Reactions in aqueous solution -- Thermochemistry -- Electronic structure of atoms -- Periodic properties of the elements -- Basic concepts of chemical bonding -- Molecular geometry and bonding theories -- Gases -- Liquids and intermolecular forces -- Solids and modern materials -- Properties of solutions -- Chemical kinetics -- Chemical equilibrium -- Acid-base equilibria -- Additional aspects of aqueous equilibria -- Chemistry of the environment -- Chemical thermodynamics -- Electrochemistry -- Nuclear chemistry -- Chemistry of the nonmetals -- Transition metals and coordination chemistry -- The chemistry of life : organic and biological chemistry

Promotes ease of understanding with a unique problem-solving method and new clinical application scenarios! With a focus on chemistry and physics content that is directly relevant to the practice of anesthesia, this text delivers—in an engaging, conversational style--the breadth of scientific information required for the combined chemistry and physics course for nurse anesthesia students. Now in its third edition, the text is updated and reorganized to facilitate a greater ease and depth of understanding. It includes additional clinical application scenarios, detailed, step-by-step solutions to problems, and a Solutions Manual demonstrating a unique method for solving chemistry and physics problems and explaining how to use a calculator. The addition of a third author--a practicing nurse anesthetist--provides additional clinical relevance to the scientific information. Also included is a comprehensive listing of need-to-know equations. The third edition retains the many outstanding learning features from earlier editions, including a special focus on gases, the use of illustrations to demonstrate how scientific concepts relate directly to their clinical application in anesthesia, and end-of-chapter summaries and review questions to facilitate self-assessment. Ten on-line videos enhance teaching and learning, and abundant clinical application scenarios help reinforce scientific principles and relate them to day-to-day anesthesia procedures. This clear, easy-to-read text will help even the most chemistry- and physics-phobic students to master the foundations of these sciences and competently apply them in a variety of clinical situations. New to the Third Edition: The addition of a third co-author--a practicing nurse anesthetist—provides additional clinical relevance Revised and updated to foster ease of understanding Detailed, step-by-step solutions to end-of-chapter problems Solutions Manual providing guidance on general problem-solving, calculator use, and a unique step-by-step problem-solving method Additional clinical application scenarios Comprehensive list of all key equations with explanation of symbols New instructor materials include PowerPoint slides. Updated information on the gas laws Key Features: Written in an engaging, conversational style for ease of understanding Focuses solely on chemistry and physics principles relevant to nurse anesthetists

Provides end-of-chapter summaries and review questions Includes abundant illustrations highlighting application of theory to practice

A fun-filled introduction to matter, the elements of the periodic table, atoms, electrons, reactions and bonding, and radioactivity, this volume provides young adults with chemistry examples that reflect their real-world interconnections in science. Key terms, easy experiments, and clear illustrations help to guide students through chemical applications. A chapter about Niels Bohr and his model for the atom honors his contribution to the understanding of atomic structure and to nuclear fission. Tools and techniques, such as a scanning tunneling microscope, Rutherford's gold foil experiment, and a mass spectrometer, highlight this instructive text that is aligned to the Common Core Standards.

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Environmental studies provide an ideal opportunity for children of any age to build critical and creative thinking skills while also building skills in science, technology, engineering, and mathematics (STEM). Exploring issues related to sustainability and environmental concerns permits learners to identify problems, develop research questions, gather and analyze data, develop possible solutions, and disseminate this information to others. Despite the advantages of green education and its ability to improve student achievement, there is a gap in understanding the interplay between curriculum and instruction and how this affects teaching and learning. Building STEM Skills Through Environmental Education is an essential publication that addresses gaps in the understanding of green education and offers educators meaningful and comprehensive examples of environmental and sustainability education in the Pre-K through secondary grade levels. The book offers a unique combination of foundational understanding of green education and chapters that illustrate the principles and impact of green education across grade levels, content areas, assessment systems, instructional strategies, technology, and other related topics. It is ideally designed for educators, curriculum developers, instructional designers,

advocates, policymakers, researchers, academicians, and students.

Serieuze wetenschappelijke antwoorden op belangrijke hypothetische vragen  
Wat als? geeft hilarische en informatieve antwoorden op belangrijke vragen waar je nooit aan zou denken. Vragen als: • Als iedereen op aarde een paar weken bij elkaar uit de buurt blijft, is de verkoudheid dan niet de wereld uit? / br• Wat als je een baseball probeert te raken die met 90% van de snelheid van het licht op je af komt? / br• Van welke hoogte moet je een steak laten vallen om hem gaar te laten zijn als hij de grond raakt? / br• Als mijn printer letterlijk geld kan drukken, heeft dat dan grote gevolgen voor de wereld? / br• Wat gebeurt er als iedereen op aarde zo dicht mogelijk bij elkaar gaat staan en opspringt, waarna iedereen op hetzelfde moment neerkomt? De antwoorden van Munroe zijn kleine meesterwerken van duidelijkheid en hilariteit aangevuld met zijn kenmerkende tekeningen. De antwoorden voorspellen vaak volledige vernietiging van de mensheid of op z'n minst een heel grote explosie. Randall Munroe is de bedenker van xkcd.com, de razend populaire website die elke week door miljoenen mensen wordt bezocht. Na z'n studie fysica bouwde Munroe robots bij NASA, waarna hij in 2006 fulltime striptekenaar werd.

'Het blinde licht' van Benjamín Labatut gaat over Fritz Haber, Werner Heisenberg, Alexander Grothendieck – grote natuurwetenschappers die de loop van de twintigste eeuw hebben veranderd. En de mensheid dichterbij de afgrond hebben gebracht. 'Het blinde licht' is een roman over menselijke (over)moed en de morele consequenties van wetenschappelijke vooruitgang. En over de onmetelijke verbeelding die nodig is om het ondenkbare te bedenken.

This title reports the state-of-the-art advancements in modeling and characterization of fundamental and the recently designed carbon based nanocomposites (graphenes, fullerenes, polymers, crystals and allotropic forms). Written by leading experts in the field, the book explores the quantification, indexing, and interpretation of physical and chemical exotic properties related with space-time structure-evolution, phase transitions, chemical reactivity, and topology. Exotic Properties of Carbon Nanomatter is aimed at researchers in academia and industry.

In recent years, our world has experienced a profound shift and progression in available computing and knowledge sharing innovations. These emerging advancements have developed at a rapid pace, disseminating into and affecting numerous aspects of contemporary society. This has created a pivotal need for an innovative compendium encompassing the latest trends, concepts, and issues surrounding this relevant discipline area. During the past 15 years, the Encyclopedia of Information Science and Technology has become recognized as one of the landmark sources of the latest knowledge and discoveries in this discipline. The Encyclopedia of Information Science and Technology, Fourth Edition is a 10-volume set which includes 705 original and previously unpublished research articles covering a full range of perspectives, applications, and techniques contributed by thousands of experts and researchers from

around the globe. This authoritative encyclopedia is an all-encompassing, well-established reference source that is ideally designed to disseminate the most forward-thinking and diverse research findings. With critical perspectives on the impact of information science management and new technologies in modern settings, including but not limited to computer science, education, healthcare, government, engineering, business, and natural and physical sciences, it is a pivotal and relevant source of knowledge that will benefit every professional within the field of information science and technology and is an invaluable addition to every academic and corporate library.

This volume emphasizes the role of chemical education for development and, in particular, for sustainable development in Africa, by sharing experiences among specialists across the African continent and with specialists from other continents. It considers all areas and levels of chemistry education, gives specific attention to known major challenges and encourages explorations of novel approaches. The chapters in this book describe new teaching approaches, approach-explorations and in-class activities, analyse educational challenges and possible ways of addressing them and explore cross-discipline possibilities and their potential benefits for chemistry education. This makes the volume an up to date compendium for chemistry educators and educational researchers worldwide.

De hilarische opvolger van *Wat als?* Van de auteur van *Wat als?* en het brein achter *xkcd.com* – al meer dan 90.000 exemplaren verkocht 'Briljant.' Bill Gates Voor elke taak bestaat er een juiste aanpak, een verkeerde aanpak en een aanpak die zo ontzettend bizar is dat niemand er ook maar over peinst hem te gebruiken. *Hoe dan?* is een humoristische handleiding van bestsellerauteur Randall Munroe voor deze derde aanpak. Een wegwijzer boordevol uiterst onpraktisch advies voor van alles en nog wat, van een gat graven tot hoe je een vliegtuig veilig aan de grond zet. Net als in zijn eerdere boek *Wat als?* moedigt Randall Munroe ons op briljante wijze aan om de meest absurde uitersten van het mogelijke op te zoeken. In combinatie met zijn scherpe strips en amusante illustraties is *Hoe dan?* een heerlijke, verbazingwekkende en hilarische manier om de wetenschap en technologie die achter het dagelijkse leven schuilgaan beter te begrijpen. Een perfect cadeauboek voor iedereen die meer te weten wil komen over 'Door de absurditeit en de vrolijke tekeningen voelt het boek vederlicht, maar toch leer je veel. Over raketten, over vlinders, over geschiedenis. En je leert vooral om met de onverzadigbaar nieuwsgierige blik van Munroe naar de wereld te kijken.' De Correspondent 'Continu fascinerend en vermakelijk.' The Wall Street Journal

**MATCHES THE NEW EXAM!** Get ready to ace your AP Chemistry Exam with this easy-to-follow, multi-platform study guide Teacher-recommended and expert-reviewed The immensely popular test prep guide has been updated and revised with new material and is now accessible in print, online and mobile formats. 5 Steps to a 5: AP Chemistry 2021 introduces an easy to follow, effective 5-step

study plan to help you build the skills, knowledge, and test-taking confidence you need to reach your full potential. The book includes hundreds of practice exercises with thorough answer explanations and sample responses. You'll learn how to master the multiple-choice questions and achieve a higher score on this demanding exam. Because this guide is accessible in print and digital formats, you can study online, via your mobile device, straight from the book, or any combination of the three. This essential guide reflects the latest course syllabus and includes 4 full-length practice exams (2 in the book and 2 online), plus proven strategies specific to each section of the test. 5 Steps to a 5: AP Chemistry 2021 features:

- 4 Practice Exams (2 in the book + 2 online) that match the latest exam requirements
- Access to the entire Cross-Platform Prep Course in AP Chemistry 2021
- Hundreds of practice exercises with thorough answer explanations
- Powerful analytics you can use to assess your test readiness
- Flashcards, games, and more

If you think you know the Brown, LeMay Bursten Chemistry text, think again. In response to market request, we have created the third Australian edition of the US bestseller, Chemistry: The Central Science. An extensive revision has taken this text to new heights! Triple checked for scientific accuracy and consistency, this edition is a more seamless and cohesive product, yet retains the clarity, innovative pedagogy, functional problem-solving and visuals of the previous version. All artwork and images are now consistent in quality across the entire text. And with a more traditional and logical organisation of the Organic Chemistry content, this comprehensive text is the source of all the information and practice problems students are likely to need for conceptual understanding, development of problem solving skills, reference and test preparation.

Studieboek op hbo-niveau.

This edited book will address creativity and innovation among the two cultures of science and art. Disciplines within science and art include: medicine (neurology), music therapy, art therapy, physics, chemistry, engineering, music, improvisation, education and aesthetics. This book will be the first of its kind to appeal to a broad audience of students, scholars, scientists, professionals, practitioners (physicians, psychologists, counsellors and social workers), musicians, artists, educators and administrators. In order to understand creativity and innovation across fields, the approach is multidisciplinary. While there is overlap across disciplines, unique domain specific traits exist in each field and are also discussed in addition to similarities. This book engages the reader with the comparison of similarities and differences through dialog across disciplines. Authors of each chapter address creativity and innovation from their own distinct perspective. Each chapter is transdisciplinary in approach. These perspectives entail a representation of their field through research, teaching, service and/or practice.

The why, what and how of the electric vehicle powertrain Empowers engineering professionals and students with the knowledge and skills required to engineer electric

vehicle powertrain architectures, energy storage systems, power electronics converters and electric drives. The modern electric powertrain is relatively new for the automotive industry, and engineers are challenged with designing affordable, efficient and high-performance electric powertrains as the industry undergoes a technological evolution. Co-authored by two electric vehicle (EV) engineers with decades of experience designing and putting into production all of the powertrain technologies presented, this book provides readers with the hands-on knowledge, skills and expertise they need to rise to that challenge. This four-part practical guide provides a comprehensive review of battery, hybrid and fuel cell EV systems and the associated energy sources, power electronics, machines, and drives. The first part of the book begins with a historical overview of electromobility and the related environmental impacts motivating the development of the electric powertrain. Vehicular requirements for electromechanical propulsion are then presented. Battery electric vehicles (BEV), fuel cell electric vehicles (FCEV), and conventional and hybrid electric vehicles (HEV) are then described, contrasted and compared for vehicle propulsion. The second part of the book features in-depth analysis of the electric powertrain traction machines, with a particular focus on the induction machine and the surface- and interior-permanent magnet ac machines. The brushed dc machine is also considered due to its ease of operation and understanding, and its historical place, especially as the traction machine on NASA's Mars rovers. The third part of the book features the theory and applications for the propulsion, charging, accessory, and auxiliary power electronics converters. Chapters are presented on isolated and non-isolated dc-dc converters, traction inverters, and battery charging. The fourth part presents the introductory and applied electromagnetism required as a foundation throughout the book.

- Introduces and holistically integrates the key EV powertrain technologies.
- Provides a comprehensive overview of existing and emerging automotive solutions.
- Provides experience-based expertise for vehicular and powertrain system and sub-system level study, design, and optimization.
- Presents many examples of powertrain technologies from leading manufacturers.
- Discusses the dc traction machines of the Mars rovers, the ultimate EVs from NASA.
- Investigates the environmental motivating factors and impacts of electromobility.
- Presents a structured university teaching stream from introductory undergraduate to postgraduate.
- Includes real-world problems and assignments of use to design engineers, researchers, and students alike.
- Features a companion website with numerous references, problems, solutions, and practical assignments.
- Includes introductory material throughout the book for the general scientific reader.
- Contains essential reading for government regulators and policy makers.

**Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles** is an important professional resource for practitioners and researchers in the battery, hybrid, and fuel cell EV transportation industry. The book is a structured holistic textbook for the teaching of the fundamental theories and applications of energy sources, power electronics, and electric machines and drives to engineering undergraduate and postgraduate students.

**Textbook Structure and Suggested Teaching Curriculum** This is primarily an engineering textbook covering the automotive powertrain, energy storage and energy conversion, power electronics, and electrical machines. A significant additional focus is placed on the engineering design, the energy for transportation, and the related environmental impacts. This textbook is an

educational tool for practicing engineers and others, such as transportation policy planners and regulators. The modern automobile is used as the vehicle upon which to base the theory and applications, which makes the book a useful educational reference for our industry colleagues, from chemists to engineers. This material is also written to be of interest to the general reader, who may have little or no interest in the power electronics and machines. Introductory science, mathematics, and an inquiring mind suffice for some chapters. The general reader can read the introduction to each of the chapters and move to the next as soon as the material gets too advanced for him or her. Part I Vehicles and Energy Sources Chapter 1 Electromobility and the Environment Chapter 2 Vehicle Dynamics Chapter 3 Batteries Chapter 4 Fuel Cells Chapter 5 Conventional and Hybrid Powertrains Part II Electrical Machines Chapter 6 Introduction to Traction Machines Chapter 7 The Brushed DC Machine Chapter 8 Induction Machines Chapter 9 Surface-permanent-magnet AC Machines Chapter 10: Interior-permanent-magnet AC Machines Part III Power Electronics Chapter 11 DC-DC Converters Chapter 12 Isolated DC-DC Converters Chapter 13 Traction Drives and Three-phase Inverters Chapter 14 Battery Charging Chapter 15 Control of the Electric Drive Part IV Basics Chapter 16 Introduction to Electromagnetism, Ferromagnetism, and Electromechanical Energy Conversion The first third of the book (Chapters 1 to 6), plus parts of Chapters 14 and 16, can be taught to the general science or engineering student in the second or third year. It covers the introductory automotive material using basic concepts from mechanical, electrical, environmental, and electrochemical engineering. Chapter 14 on electrical charging and Chapter 16 on electromagnetism can also be used as a general introduction to electrical engineering. The basics of electromagnetism, ferromagnetism and electromechanical energy conversion (Chapter 16) and dc machines (Chapter 7) can be taught to second year (sophomore) engineering students who have completed introductory electrical circuits and physics. The third year (junior) students typically have covered ac circuit analysis, and so they can cover ac machines, such as the induction machine (Chapter 8) and the surface permanent-magnet ac machine (Chapter 9). As the students typically have studied control theory, they can investigate the control of the speed and torque loops of the motor drive (Chapter 15). Power electronics, featuring non-isolated buck and boost converters (Chapter 11), can also be introduced in the third year. The final-year (senior) students can then go on to cover the more advanced technologies of the interior-permanent-magnet ac machine (Chapter 10). Isolated power converters (Chapter 12), such as the full-bridge and resonant converters, inverters (Chapter 13), and power-factor-corrected battery chargers (Chapter 14), are covered in the power electronics section. This material can also be covered at the introductory postgraduate level. Various homework, simulation, and research exercises are presented throughout the textbook. The reader is encouraged to attempt these exercises as part of the learning experience. Instructors are encouraged to contact the author, John Hayes, direct to discuss course content or structure.

This book explores the evolving nature of objectivity in the history of science and its implications for science education. It is generally considered that objectivity, certainty, truth, universality, the scientific method and the accumulation of experimental data characterize both science and science education. Such universal values associated with science may be challenged while studying controversies in their original historical

context. The scientific enterprise is not characterized by objectivity or the scientific method, but rather controversies, alternative interpretations of data, ambiguity, and uncertainty. Although objectivity is not synonymous with truth or certainty, it has eclipsed other epistemic virtues and to be objective is often used as a synonym for scientific. Recent scholarship in history and philosophy of science has shown that it is not the experimental data (Baconian orgy of quantification) but rather the diversity / plurality in a scientific discipline that contributes toward understanding objectivity. History of science shows that objectivity and subjectivity can be considered as the two poles of a continuum and this dualism leads to a conflict in understanding the evolving nature of objectivity. The history of objectivity is nothing less than the history of science itself and the evolving and varying forms of objectivity does not mean that one replaced the other in a sequence but rather each form supplements the others. This book is remarkable for its insistence that the philosophy of science, and in particular that discipline's analysis of objectivity as the supposed hallmark of the scientific method, is of direct value to teachers of science. Meticulously, yet in a most readable way, Mansoor Niaz looks at the way objectivity has been dealt with over the years in influential educational journals and in textbooks; it's fascinating how certain perspectives fade, while basic questions show no sign of going away. There are few books that take both philosophy and education seriously – this one does! Roald Hoffmann, Cornell University, chemist, writer and Nobel Laureate in Chemistry

Media and communication advancements allow individuals across the globe to connect in the blink of an eye. Individuals can share information and collaborate on new projects like never before while also remaining informed on global issues through ever-improving media outlets and technologies. *Advanced Methodologies and Technologies in Media and Communications* provides emerging research on the modern effects of media on cultures, individuals, and groups. While highlighting a range of topics such as social media use and marketing, media influence, and communication technology, this book explores how these advancements shape and further the global society. This book is an important resource for media researchers and professionals, academics, students, and communications experts seeking new information on the effective use of modern technology in communication applications.

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