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AMHSAE - ADRIENNE THORNTON

Winner of the CHOICE Outstanding Academic Title 2017 Award This comprehensive collection of top-level contributions provides a thorough review of the vibrant field of chemistry education. Highly-experienced chemistry professors and education experts cover the latest developments in chemistry learning and teaching, as well as the pivotal role of chemistry for shaping a more sustainable future. Adopting a practice-oriented approach, the current challenges and opportunities posed by chemistry education are critically discussed, highlighting the pitfalls that can occur in teaching chemistry and how to circumvent them. The main topics discussed include best practices, project-based education, blended learning and the role of technology, including e-learning, and science visualization. Hands-on recommendations on how to optimally implement innovative strategies of teaching chemistry at university and high-school levels make this book an essential resource for anybody interested in either teaching or learning chemistry more effectively, from experience chemistry professors to secondary school teachers, from educators with no formal training in didactics to frustrated chemistry students.

LABORATORY INQUIRY IN CHEMISTRY, Second Edition provides a unique set of guided-inquiry investigations that focus on constructing knowledge about the conceptual basis of laboratory techniques, instead of simply learning techniques. By focusing on developing skills for designing experiments, solving problems, thinking critically, and selecting and applying appropriate techniques, the authors expose students to a realistic laboratory experience, typical of the practicing chemist. The Second Edition features six new experiments and is accompanied by a revised and updated Instructor's Manual, available online. This new edition continues the proven three-phase learning cycle: exploration of chemical behaviors within the context of the problems posed; concept invention--the use of data and observations to construct accepted scientific knowledge about the concepts explored in the laboratory investigation; and, concept application--where students apply their conceptual understanding of the investigation at hand by modifying or extending the experiments, and write a report that emphasizes conceptual relevance. These college and honors level inquiry-based experiments correlate well with the recommended experiments outlined by the Advanced Placement Chemistry Development Committee.

Acknowledging the importance of national standards, offers case studies, tips, and tools to encourage student curiosity and improve achievement in science.

Science Education Issues and Developments.

This book presents chemical analyses of the most pressing waste, pollution, and resource problems for the undergraduate or graduate student. Its distinctive holistic approach provides a solid introduction to theory as well as a practical laboratory manual detailing beginning and advanced experimental applications. It presents laboratory procedures at microscale conditions, for minimum waste and maximum economy.

Biochemistry laboratory manual for undergraduates – an inquiry based approach by Gerczei and Pattison is the first textbook on the market that uses a highly relevant model, antibiotic resis-

tance, to teach seminal topics of biochemistry and molecular biology while incorporating the blossoming field of bioinformatics. The novelty of this manual is the incorporation of a student-driven real real-life research project into the undergraduate curriculum. Since students test their own mutant design, even the most experienced students remain engaged with the process, while the less experienced ones get their first taste of biochemistry research. Inclusion of a research project does not entail a limitation: this manual includes all classic biochemistry techniques such as HPLC or enzyme kinetics and is complete with numerous problem sets relating to each topic.

Innovative and self-directed, EXPERIMENTS IN GENERAL CHEMISTRY FEATURING MEASURENET, 2nd Edition prepares students for the laboratory setting by asking them multi-component questions, building their knowledge from previous experiments, and incorporating the innovative MeasureNet network data collection system into the manual. MeasureNet improves the laboratory experience by requiring smaller amounts of chemicals for experiments making the lab safer and more environmentally friendly and greatly increasing precision through its electronic data collection, analysis, and reduction features. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

For laboratory courses in General Chemistry Engaging students in real-world applications Laboratory Manual for Chemistry: Structure and Properties provides a series of experiments written to correspond with an atoms-first approach. The experiments connect to the daily lives of students with engaging experiments that have real-world applications and incorporate household items such as Coca-Cola(R), fertiliser, light bulbs, and aluminum cans. The investigations challenge students while exposing them to recent advances in science. The labs also promote critical thinking by placing the experiments in the context of a practical problem and emphasise data collection and analysis versus mere step-by-step instruction. Some of the exercises are inquiry-driven, while others provide a straightforward method for introducing new laboratory techniques. This manual includes a sample of problem-based and traditional experiments to give instructors flexibility.

The U.S. Department of State charged the Academies with the task of producing a protocol for development of standard operating procedures (SOPs) that would serve as a complement to the Chemical Laboratory Safety and Security: A Guide to Prudent Chemical Management and be included with the other materials in the 2010 toolkit. To accomplish this task, a committee with experience and knowledge in good chemical safety and security practices in academic and industrial laboratories with awareness of international standards and regulations was formed. The hope is that this toolkit expansion product will enhance the use of the previous reference book and the accompanying toolkit, especially in developing countries where safety resources are scarce and experience of operators and end-users may be limited.

Chemistry seeks to provide qualitative and quantitative explanations for the observed behaviour of elements and their compounds. Doing so involves making use of three types of representation: the macro (the empirical properties of substances); the

sub-micro (the natures of the entities giving rise to those properties); and the symbolic (the number of entities involved in any changes that take place). Although understanding this triplet relationship is a key aspect of chemical education, there is considerable evidence that students find great difficulty in achieving mastery of the ideas involved. In bringing together the work of leading chemistry educators who are researching the triplet relationship at the secondary and university levels, the book discusses the learning involved, the problems that students encounter, and successful approaches to teaching. Based on the reported research, the editors argue for a coherent model for understanding the triplet relationship in chemical education.

The seventh edition of this superb lab manual offers 36 class-tested experiments, suitable for introductory, preparatory, and health science chemistry courses and texts, including *INTRODUCTORY CHEMISTRY: AN ACTIVE LEARNING APPROACH*, Fourth Edition by Cracolice and Peters. Experiments in this lab manual teach students to collect and analyze experimental data and provide them with a strong foundation for further course work in general chemistry. This edition offers instructors a wide variety of experiments to customize their laboratory program, including many microscale experiments. All experiments can be completed in a three-hour laboratory period. As in the Sixth Edition, there are Work Pages for each experiment as well as Report Sheets for students to take notes and record experimental data and results, which facilitate instructor grading of experiments. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

Discusses the vital aspects of how to make a proper and permanent record of research work. Goes beyond the mechanical of simply filling in the notebook pages with details on the skills needed to create proper records of research, observations, and results. Helps to increase awareness of what is being done in the lab and to develop a flexible style of notekeeping that will serve a variety of research environments.

The application of technology in classroom settings has equipped educators with innovative tools and techniques for effective teaching practice. Integrating digital technologies at the elementary and secondary levels helps to enrich the students' learning experience and maximize competency in the areas of science, technology, engineering, and mathematics. *Improving K-12 STEM Education Outcomes through Technological Integration* focuses on current research surrounding the effectiveness, performance, and benefits of incorporating various technological tools within science, technology, engineering, and mathematics classrooms. Focusing on evidence-based approaches and current educational innovations, this book is an essential reference source for teachers, teacher educators, and professionals interested in how emerging technologies are benefiting teaching and/or learning efficacy.

Research into the educational effectiveness of chemistry practical work has shown that the laboratory offers a unique mode of instruction, assessment and evaluation. Laboratory work is an integral and important part of the learning process, used to encourage the development of high order thinking and learning alongside high order learning and thinking skills such as argumentation and metacognition. Authored by renowned experts in the field of chemistry education, this book provides a holistic approach to cover all issues related to learning and teaching in the chemistry laboratory. With sections focused on developing the skill sets of teachers, as well as approaches to supporting students in the laboratory, the book offers a comprehensive look at vicarious instruction methods, teacher and students' roles, and the blend with ICT, simulations, and other effective approaches to practical work. The book concludes with a focus on retrospective issues, fol-

lowed-up with a look to the future of laboratory learning. A product of nearly fifty years of research, this book will be useful for chemistry teachers, curriculum developers, researchers in chemistry education, and professional development providers.

Green chemistry involves designing novel ways to create and synthesize products and implement processes that will eliminate or greatly reduce negative environmental impacts. The *Green Chemistry Laboratory Manual for General Chemistry* provides educational laboratory materials that challenge students with the customary topics found in a general chemistry laboratory manual, while encouraging them to investigate the practice of green chemistry. Following a consistent format, each lab experiment begins with objectives and prelab questions highlighting important issues that must be understood prior to getting started. This is followed by detailed step-by-step procedures for performing the experiments. Students report specific results in sections designated for data, observations, and calculations. Once each experiment is completed, analysis questions test students' comprehension of the results. Additional questions encourage inquiry-based investigations and further research about how green chemistry principles compare with traditional, more hazardous experimental methods. By placing the learned concepts within the larger context of green chemistry principles, the lab manual enables students to see how these principles can be applied to real-world issues. Performing laboratory exercises through green experiments results in a safer learning environment, limits the quantity of hazardous waste generated, and reduces the cost for chemicals and waste disposal. Students using this manual will gain a greater appreciation for green chemistry principles and the possibilities for future use in their chosen careers.

The most comprehensive textbook and detailed presentation of the lab techniques organic chemistry students need to know. Compatible with any organic chemistry lab manual or set of experiments, it combines specific instructions for three different kinds of laboratory glassware: miniscale, standard taper microscale, and Williamson microscale. This title provides effective support to all those looking for guided-inquiry and design-based experiments and projects, as well as for traditional lab experiments. This title is for organic students of all levels looking to improve and understand their knowledge of lab work. With new authors David Alberg and Gretchen Hofmeister on board for this fourth edition, both bring copious amounts of experience in organic chemistry. They have been able to revive the writing in the book, while also adding new examples and pitfalls for students to avoid.

Humans, especially children, are naturally curious. Yet, people often balk at the thought of learning science—the "eyes glazed over" syndrome. Teachers may find teaching science a major challenge in an era when science ranges from the hardly imaginable quark to the distant, blazing quasar. *Inquiry and the National Science Education Standards* is the book that educators have been waiting for—a practical guide to teaching inquiry and teaching through inquiry, as recommended by the National Science Education Standards. This will be an important resource for educators who must help school boards, parents, and teachers understand "why we can't teach the way we used to." "Inquiry" refers to the diverse ways in which scientists study the natural world and in which students grasp science knowledge and the methods by which that knowledge is produced. This book explains and illustrates how inquiry helps students learn science content, master how to do science, and understand the nature of science. This book explores the dimensions of teaching and learning science as inquiry for K-12 students across a range of science topics. Detailed examples help clarify when teachers should use the inquiry-based approach and how much structure, guidance, and

coaching they should provide. The book dispels myths that may have discouraged educators from the inquiry-based approach and illuminates the subtle interplay between concepts, processes, and science as it is experienced in the classroom. Inquiry and the National Science Education Standards shows how to bring the standards to life, with features such as classroom vignettes exploring different kinds of inquiries for elementary, middle, and high school and Frequently Asked Questions for teachers, responding to common concerns such as obtaining teaching supplies. Turning to assessment, the committee discusses why assessment is important, looks at existing schemes and formats, and addresses how to involve students in assessing their own learning achievements. In addition, this book discusses administrative assistance, communication with parents, appropriate teacher evaluation, and other avenues to promoting and supporting this new teaching paradigm.

This is a guide to recommended practices for crime scene investigation. The guide is presented in five major sections, with subsections as noted: (1) Arriving at the Scene: Initial Response/Prioritization of Efforts (receipt of information, safety procedures, emergency care, secure and control persons at the scene, boundaries, turn over control of the scene and brief investigator/s in charge, document actions and observations); (2) Preliminary Documentation and Evaluation of the Scene (scene assessment, "walk-through" and initial documentation); (3) Processing the Scene (team composition, contamination control, documentation and prioritize, collect, preserve, inventory, package, transport, and submit evidence); (4) Completing and Recording the Crime Scene Investigation (establish debriefing team, perform final survey, document the scene); and (5) Crime Scene Equipment (initial responding officers, investigator/evidence technician, evidence collection kits).

Since the introduction of green chemistry principles in industrial processes, interest has continued to grow and green chemistry has started to take roots in educational laboratories of all disciplines of chemistry. Entire courses centered around green chemistry are becoming more prevalent. By introducing students to green chemistry at a collegiate level, they will better be prepared for industry, graduate schools, and also have a better appreciation for the environment. This book includes experiments that cover a range of green chemistry principles, particularly in the field of organic chemistry. Green chemistry, as we know it today, revolves around a set of twelve principles that were outlined 1998. The experiments presented in this text utilize many of the 12 Principles of Green Chemistry. Each chapter presents an experiment that utilizes at least one, if not more, of these principles. This book is targeted for any professor who would like to introduce green or "greener" laboratory experiments for their students in any chemistry course regardless of level. The book is designed to introduce students to the ideas, principles, and benefits of green chemistry and inspire educators to adopt more green chemistry principles in their course.

In this book, Dewey tries to criticize and expand on the educational philosophies of Rousseau and Plato. Dewey's ideas were seldom adopted in America's public schools, although a number of his prescriptions have been continually advocated by those who have had to teach in them.

This separate manual contains detailed solutions and explanations for all odd-numbered problems in the text.

Two recent initiatives from the EU, namely the Bologna Process and the Lisbon Agenda are likely to have a major influence on European Higher Education. It seems unlikely that traditional teaching approaches, which supported the elitist system of the past, will promote the mobility, widened participation and culture of

'life-long learning' that will provide the foundations for a future knowledge-based economy. There is therefore a clear need to seek new approaches to support the changes which will inevitably occur. The European Chemistry Thematic Network (ECTN) is a network of some 160 university chemistry departments from throughout the EU as well as a number of National Chemical Societies (including the RSC) which provides a discussion forum for all aspects of higher education in chemistry. This handbook is a result of one of their working groups, who identified and collated good practice with respect to innovative methods in Higher Level Chemistry Education. It provides a comprehensive overview of innovations in university chemistry teaching from a broad European perspective. The generation of this book through a European Network, with major national chemical societies and a large number of chemistry departments as members make the book unique. The wide variety of scholars who have contributed to the book, make it interesting and invaluable reading for both new and experienced chemistry lecturers throughout the EU and beyond. The book is aimed at chemistry education at universities and other higher level institutions and at all academic staff and anyone interested in the teaching of chemistry at the tertiary level. Although newly appointed teaching staff are a clear target for the book, the innovative aspects of the topics covered are likely to prove interesting to all committed chemistry lecturers.

This book reflects on science education in the first 20 years of the 21st century in order to promote academic dialogue on science education from various standpoints, and highlights emergent new issues, such as education in science education research. It also defines new research agendas that should be "moved forward" and inform new trajectories through the rest of the century. Featuring 21 thematically grouped chapters, it includes award-winning papers and other significant papers that address the theme of the 2018 International Science Education Conference.

The mission of the book series, Research in Science Education, is to provide a comprehensive view of current and emerging knowledge, research strategies, and policy in specific professional fields of science education. This series would present currently unavailable, or difficult to gather, materials from a variety of viewpoints and sources in a usable and organized format. Each volume in the series would present a juried, scholarly, and accessible review of research, theory, and/or policy in a specific field of science education, K-16. Topics covered in each volume would be determined by present issues and trends, as well as generative themes related to current research and theory. Published volumes will include empirical studies, policy analysis, literature reviews, and positing of theoretical and conceptual bases.

"Compatible with standard taper miniscale, 14/10 standard taper microscale, Williamson microscale. Supports guided inquiry"--Cover.

Experimental Organic Chemistry: Laboratory Manual is designed as a primer to initiate students in Organic Chemistry laboratory work. Organic Chemistry is an eminently experimental science that is based on a well-established theoretical framework where the basic aspects are well established but at the same time are under constant development. Therefore, it is essential for future professionals to develop a strong background in the laboratory as soon as possible, forming good habits from the outset and developing the necessary skills to address the challenges of the experimental work. This book is divided into three parts. In the first, safety issues in laboratories are addressed, offering tips for keeping laboratory notebooks. In the second, the material, the main basic laboratory procedures, preparation of samples for different spectroscopic techniques, Microscale, Green Chemistry, and qualitative organic analysis are described. The third part consists of a

collection of 84 experiments, divided into 5 modules and arranged according to complexity. The last two chapters are devoted to the practices at Microscale Synthesis and Green Chemistry, seeking alternatives to traditional Organic Chemistry.

Laboratory experiences as a part of most U.S. high school science curricula have been taken for granted for decades, but they have rarely been carefully examined. What do they contribute to science learning? What can they contribute to science learning? What is the current status of labs in our nation's high schools as a context for learning science? This book looks at a range of questions about how laboratory experiences fit into U.S. high schools: What is effective laboratory teaching? What does research tell us about learning in high school science labs? How should student learning in laboratory experiences be assessed? Do all students have access to laboratory experiences? What changes need to be made to improve laboratory experiences for high school students? How can school organization contribute to effective laboratory teaching? With increased attention to the U.S. education system and student outcomes, no part of the high school curriculum should escape scrutiny. This timely book investigates factors that influence a high school laboratory experience, looking closely at what currently takes place and what the goals of those experiences are and should be. Science educators, school administrators, policy makers, and parents will all benefit from a better understanding of the need for laboratory experiences to be an integral part of the science curriculum—and how that can be accomplished.

"...this substantial and engaging text offers a wealth of practical (in every sense of the word) advice...Every undergraduate laboratory, and, ideally, every undergraduate chemist, should have a copy of what is by some distance the best book I have seen on safety in the undergraduate laboratory." *Chemistry World*, March 2011

Laboratory Safety for Chemistry Students is uniquely designed to accompany students throughout their four-year undergraduate education and beyond, progressively teaching them the skills and knowledge they need to learn their science and stay safe while working in any lab. This new principles-based approach treats lab safety as a distinct, essential discipline of chemistry, enabling you to instill and sustain a culture of safety among students. As students progress through the text, they'll learn about laboratory and chemical hazards, about routes of exposure, about ways to manage these hazards, and about handling common laboratory emergencies. Most importantly, they'll learn that it is very possible to safely use hazardous chemicals in the laboratory by applying safety principles that prevent and minimize exposures. Continuously Reinforces and Builds Safety Knowledge and Safety Culture Each of the book's eight chapters is organized into three tiers of sections, with a variety of topics suited to beginning, intermediate, and advanced course levels. This enables your students to gather relevant safety information as they advance in their lab work. In some cases, individual topics are presented more than once, progressively building knowledge with new information that's appropriate at different levels. A Better, Easier Way to Teach and Learn Lab Safety We all know that safety is of the utmost importance; however, instructors continue to struggle with finding ways to incorporate safety into their curricula. *Laboratory Safety for Chemistry Students* is the ideal solution: Each section can be treated as a pre-lab assignment, enabling you to easily incorporate lab safety into all your lab courses without building in additional teaching time. Sections begin with a preview, a quote, and a brief description of a laboratory incident that illustrates the importance of the topic. References at the end of each section guide your students to the latest print and web resources. Students will also find "Chemical Connections" that illustrate how chemical principles apply to laboratory safety and "Special Top-

ics" that amplify certain sections by exploring additional, relevant safety issues. Visit the companion site at <http://userpages.wittenberg.edu/dfinster/LSCS/>.

The core practice of professional scientists is inquiry, often referred to as research. If educators are to prepare students for a role in the professional scientific and technological community, exposing them to inquiry-based learning is essential. Despite this, inquiry-based teaching and learning (IBTL) remains relatively rare, possibly due to barriers that teachers face in deploying it or to a lack of belief in the teaching community that inquiry-based learning is effective. *Comparative Perspectives on Inquiry-Based Science Education* examines stories and experiences from members of an international science education project that delivered learning resources based around guided inquiry for students to a wide range of schools in 12 different countries in order to identify key themes that can provide useful insights for student learning, teacher support, and policy formulation at the continental level. The book provides case studies across these 12 different settings that enable readers to compare and contrast both practice and policy issues with their own contexts while accessing a cutting-edge model of professional development. It is designed for educators, instructional designers, administrators, principals, researchers, policymakers, practitioners, and students seeking current and relevant research on international education and education strategies for science courses.

This clearly written, class-tested manual has long given students hands-on experience covering all the essential topics in general chemistry. Stand alone experiments provide all the background introduction necessary to work with any general chemistry text. This revised edition offers new experiments and expanded information on applications to real world situations.

As teachers we often tend to expect other countries to teach chemistry in much the same way as we do, but educational systems differ widely. At Bielefeld University we started a project to analyse the approach to chemical education in different countries from all over the world: *Teaching Chemistry around the World*. 25 countries have participated in the project. The resulting country studies are presented in this book. This book may be seen as a contribution to make the structure of chemistry teaching in numerous countries more transparent and to facilitate communication between these countries. Especially in the case of the school subject chemistry, which is very unpopular on the one hand and occupies an exceptional position on the other hand – due to its relevance to jobs and everyday life and most notably due to its importance for innovation capacity and problem solving – we have to learn from each others' educational systems.

Scores of talented and dedicated people serve the forensic science community, performing vitally important work. However, they are often constrained by lack of adequate resources, sound policies, and national support. It is clear that change and advancements, both systematic and scientific, are needed in a number of forensic science disciplines to ensure the reliability of work, establish enforceable standards, and promote best practices with consistent application. *Strengthening Forensic Science in the United States: A Path Forward* provides a detailed plan for addressing these needs and suggests the creation of a new government entity, the National Institute of Forensic Science, to establish and enforce standards within the forensic science community. The benefits of improving and regulating the forensic science disciplines are clear: assisting law enforcement officials, enhancing homeland security, and reducing the risk of wrongful conviction and exoneration. *Strengthening Forensic Science in the United States* gives a full account of what is needed to advance the forensic science disciplines, including upgrading of systems and

organizational structures, better training, widespread adoption of uniform and enforceable best practices, and mandatory certification and accreditation programs. While this book provides an essential call-to-action for congress and policy makers, it also serves as a vital tool for law enforcement agencies, criminal prosecutors and attorneys, and forensic science educators.

Continuous professional development of chemistry teachers is essential for any effective chemistry teaching due to the evolving nature of the subject matter and its instructional techniques. Professional development aims to keep chemistry teaching up-to-date and to make it more meaningful, more educationally effective, and better aligned to current requirements. Presenting models and examples of professional development for chemistry teachers, from pre-service preparation through to continuous professional development, the authors walk the reader through theory and practice. The authors discuss factors which affect successful professional development, such as workload, availability and time constraints, and consider how we maintain the life-long learning of chemistry teachers. With a solid grounding in the literature and drawing on many examples from the authors' rich experiences, this book enables researchers and educators to better understand teachers' roles in effective chemistry education and the importance of their professional development.

Chemical education is essential to everybody because it deals with ideas that play major roles in personal, social, and economic decisions. This book is based on three principles: that all aspects of chemical education should be associated with research; that the development of opportunities for chemical education should be both a continuous process and be linked to research; and that the professional development of all those associated with chemical education should make extensive and diverse use of that research. It is intended for: pre-service and practising chemistry teachers and lecturers; chemistry teacher educators; chemical education researchers; the designers and managers of formal chemical curricula; informal chemical educators; authors of textbooks

and curriculum support materials; practising chemists and chemical technologists. It addresses: the relation between chemistry and chemical education; curricula for chemical education; teaching and learning about chemical compounds and chemical change; the development of teachers; the development of chemical education as a field of enquiry. This is mainly done in respect of the full range of formal education contexts (schools, universities, vocational colleges) but also in respect of informal education contexts (books, science centres and museums).

Teaching Chemistry in Higher Education celebrates the contributions of Professor Tina Overton to the scholarship and practice of teaching and learning in chemistry education. Leading educators in United Kingdom, Ireland, and Australia—three countries where Tina has had enormous impact and influence—have contributed chapters on innovative approaches that are well-established in their own practice. Each chapter introduces the key education literature underpinning the approach being described. Rationales are discussed in the context of attributes and learning outcomes desirable in modern chemistry curricula. True to Tina's personal philosophy, chapters offer pragmatic and useful guidance on the implementation of innovative teaching approaches, drawing from the authors' experience of their own practice and evaluations of their implementation. Each chapter also offers key guidance points for implementation in readers' own settings so as to maximise their adaptability. Chapters are supplemented with further reading and supplementary materials on the book's website (overtonfestschrift.wordpress.com). Chapter topics include innovative approaches in facilitating group work, problem solving, context- and problem-based learning, embedding transferable skills, and laboratory education—all themes relating to the scholarly interests of Professor Tina Overton. About the Editors: Michael Seery is Professor of Chemistry Education at the University of Edinburgh, and is Editor of Chemistry Education Research and Practice. Claire Mc Donnell is Assistant Head of School of Chemical and Pharmaceutical Sciences at Technological University Dublin. Cover Art: Christopher Armstrong, University of Hull