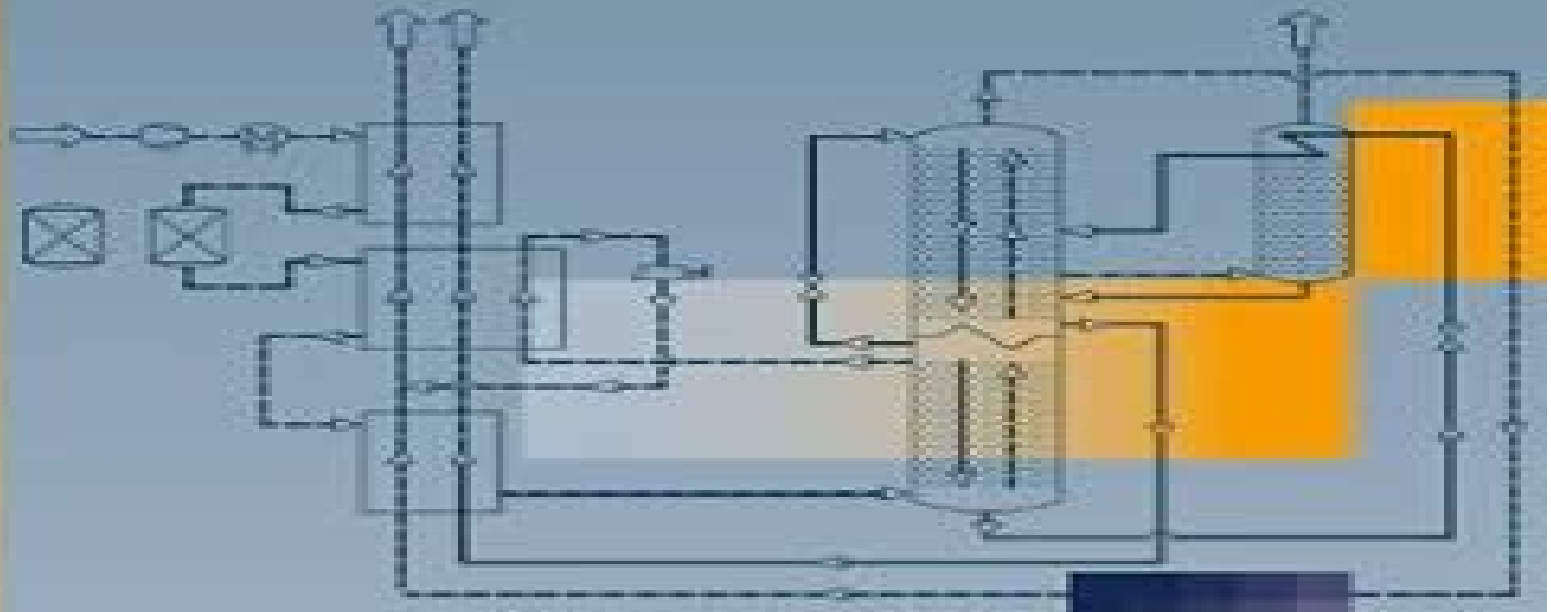
Alfons Mersmann · Matthias Kind
Johann Stichlmair

CHEMICAL ENGINEERING

Thermal Separation Technology

Principles, Methods, Process Design



Springer

VDI

Thermal Separation Technology Principles Methods Process Design Vdi Buch

J. D. Seader

Thermal Separation Technology Principles Methods Process Design Vdi Buch:

Thermal Separation Technology Alfons Mersmann,Matthias Kind,Johann Stichlmair,2013-11-27 Thermal Separation Technology is a key discipline for many industries and lays the engineering foundations for the sustainable and economic production of high quality materials This book provides fundamental knowledge on this field and may be used both in university teaching and in industrial research and development Furthermore it is intended to support professional engineers in their daily efforts to improve plant efficiency and reliability Previous German editions of this book have gained widespread recognition This first English edition will now make its content available to the international community of students and professionals In the first chapters of the book the fundamentals of thermodynamics heat and mass transfer and multiphase flow are addressed Further chapters examine in depth the different unit operations distillation and absorption extraction evaporation and condensation crystallization adsorption and chromatography and drying while the closing chapter provides valuable guidelines for a conceptual process development **Thermal Separation Technology** Alfons Mersmann,Matthias Kind,Johann Stichlmair,2011-07-28 Thermal Separation Technology is a key discipline for many industries and lays the engineering foundations for the sustainable and economic production of high quality materials This book provides fundamental knowledge on this field and may be used both in university teaching and in industrial research and development Furthermore it is intended to support professional engineers in their daily efforts to improve plant efficiency and reliability Previous German editions of this book have gained widespread recognition This first English edition will now make its content available to the international community of students and professionals In the first chapters of the book the fundamentals of thermodynamics heat and mass transfer and multiphase flow are addressed Further chapters examine in depth the different unit operations distillation and absorption extraction evaporation and condensation crystallization adsorption and chromatography and drying while the closing chapter provides valuable guidelines for a conceptual process development *Thermal Separation Processes* Klaus Sattler,Hans Jacob Feindt,2008-07-11 This much needed book presents a clear and very practice oriented overview of thermal separation processes An extensive introduction elucidates the physical and physicochemical fundamentals of different unit operations used to separate homogenous mixtures This is followed by a concise text with numerous explanatory figures and tables referring to process and design flowsheets basic engineering and examples of separation process applications Very helpful guidance in the form of process descriptions calculation models and operation data is presented in an easy to understand manner thereby assisting the practicing engineer in the choosing and evaluation of separation processes and facilitating the modeling and design of innovative equipment A comprehensive reference list provides further opportunity for the following up of special separation problems Chemical and mechanical engineers chemists physicists and biotechnologists in research and development plant design and environmental protection as well as students in chemical engineering and natural sciences will find this all embracing reference guide of tremendous

value and practical use *Dust Extraction Technology* Wilhelm Batel,1976 German books in print ,1995 Optimization Based Methods for the Conceptual Design of Separation Processes for Azeotropic Mixtures ,2015 Separation Process Principles J. D. Seader,Ernest J. Henley,2005-10-28 Handbook of Separation Process Technology Ronald W. Rousseau,1987-05-13 Surveys the selection design and operation of most of the industrially important separation processes Discusses the underlying principles on which the processes are based and provides illustrative examples of the use of the processes in a modern context Features thorough treatment of newer separation processes based on membranes adsorption chromatography ion exchange and chemical complexation Includes a review of historically important separation processes such as distillation absorption extraction leaching and crystallization and considers these techniques in light of recent developments affecting them Separation Process Engineering Phillip Wankat,2011 The Definitive Fully Updated Guide to Separation Process Engineering Now with a Thorough Introduction to Mass Transfer Analysis Separation Process Engineering Third Edition is the most comprehensive accessible guide available on modern separation processes and the fundamentals of mass transfer Phillip C Wankat teaches each key concept through detailed realistic examples using real data including up to date simulation practice and new spreadsheet based exercises Wankat thoroughly covers each of today s leading approaches including flash column and batch distillation exact calculations and shortcut methods for multicomponent distillation staged and packed column design absorption stripping and more In this edition he also presents the latest design methods for liquid liquid extraction This edition contains the most detailed coverage of membrane separations and of sorption separations adsorption chromatography and ion exchange available Updated with new techniques and references throughout Separation Process Engineering Third Edition also contains more than 300 new homework problems each tested in the author s Purdue University classes This new edition includes Modular up to date process simulation examples and homework problems based on Aspen Plus and easily adaptable to any simulator Extensive new coverage of mass transfer and diffusion including both Fickian and Maxwell Stefan approaches Detailed discussions of liquid liquid extraction including McCabe Thiele triangle and computer simulation analyses mixer settler design Karr columns and related mass transfer analyses Thorough introductions to adsorption chromatography and ion exchange designed to prepare students for advanced work in these areas Complete coverage of membrane separations including gas permeation reverse osmosis ultrafiltration pervaporation and key applications A full chapter on economics and energy conservation in distillation Excel spreadsheets offering additional practice with problems in distillation diffusion mass transfer and membrane separation Author bio Phillip C Wankat is Clifton L Lovell Distinguished Professor of Chemical Engineering and director of undergraduate degree programs at Purdue University s School of Engineering Education His current research interests include adsorption large scale chromatography simulated moving bed systems and distillation as well as improvements in engineering education He rece **Kirk-Othmer Separation Technology, 2 Volume Set** Wiley,2008-02-08 This two volume set delivers over seventy

carefully selected articles on separation technology from the Kirk Othmer Encyclopedia of Chemical Technology Presenting readers with the principles of separation processes process design equipment operation and applications it features content that has been expanded upon updated and modernized since publication of the first edition Covering a wealth of critical topics the articles have been arranged alphabetically for ease of use and focus on both established and newer separation processes of industrial importance **Separation Process Principles** J. D. Seader,Ernest J. Henley,D. Keith Roper,2016-01-20 Separation Process Principles with Applications Using Process Simulator 4th Edition is the most comprehensive and up to date treatment of the major separation operations in the chemical industry The 4th edition focuses on using process simulators to design separation processes and prepares readers for professional practice Completely rewritten to enhance clarity this fourth edition provides engineers with a strong understanding of the field With the help of an additional co author the text presents new information on bioseparations throughout the chapters A new chapter on mechanical separations covers settling filtration and centrifugation including mechanical separations in biotechnology and cell lysis Boxes help highlight fundamental equations Numerous new examples and exercises are integrated throughout as well **Kirk-Othmer Separation Technology, 2 Volume Set** Wiley,2008-02-08 This two volume set delivers over seventy carefully selected articles on separation technology from the Kirk Othmer Encyclopedia of Chemical Technology Presenting readers with the principles of separation processes process design equipment operation and applications it features content that has been expanded upon updated and modernized since publication of the first edition Covering a wealth of critical topics the articles have been arranged alphabetically for ease of use and focus on both established and newer separation processes of industrial importance **Solid/Liquid Separation: Equipment Selection and Process Design** Steve Tarleton,Richard Wakeman,2006-12-07 In this volume the third in a set specifically written for the industrial process and chemical engineer the authors provide the detailed information on filtration equipment and media which allows the reader to then consider the pre treatment of suspensions selection of the most appropriate equipment for the task data analysis and the subsequent design of the processes involved for particular separations The result is a comprehensive book which is designed to be used frequently and referred to regularly in order to achieve better industrial separations Successful industrial scale separation of solids from liquids requires not only a thorough understanding of the principles involved but also an appreciation of which equipment to use for best effect and a start to finish plan for the various processes involved in the operation If these factors are all correct then successful separations should result Part of 3 volume set Unique approach to industrial separations Internationally known authors **Separation Process Principles** J. D. Seader,2001

Separation Process Design and Synthesis Based on Thermodynamic Insights Cecilia Jaksland,Technical University of Denmark. Department of Chemical Engineering,1996 Abstract This thesis describes the development of a computer based system for design and synthesis of separation process systems The basis of the methodology is the relationships between

physio chemical properties and the separation process principles The methodology covers a wide range of separation problems and includes identification of separation techniques selection and sequencing of separation tasks determination of estimates of appropriate and consistent conditions of operation as well as identification of Mass Separating Agents solvents Given the mixture information and the product specifications employing pure component properties the feasible separation technique alternatives are identified for each possible separation task at a lower level At the higher level employing mainly mixture properties the methodology structures the physically feasible flowsheets through selection and sequencing of separation tasks with corresponding separation techniques and determines conditions of operation The relationships identified between properties process synthesis process design and product design are verified by applying the methodology to several examples *Separation Process Engineering* Phillip C. Wankat,2012 The Definitive Fully Updated Guide to Separation Process Engineering Now with a Thorough Introduction to Mass Transfer Analysis Separation Process Engineering Third Edition is the most comprehensive accessible guide available on modern separation processes and the fundamentals of mass transfer Phillip C Wankat teaches each key concept through detailed realistic examples using real data including up to date simulation practice and new spreadsheet based exercises Wankat thoroughly covers each of today s leading approaches including flash column and batch distillation exact calculations and shortcut methods for multicomponent distillation staged and packed column design absorption stripping and more In this edition he also presents the latest design methods for liquid liquid extraction This edition contains the most detailed coverage available of membrane separations and of sorption separations adsorption chromatography and ion exchange Updated with new techniques and references throughout Separation Process Engineering Third Edition also contains more than 300 new homework problems each tested in the author s Purdue University classes Coverage includes Modular up to date process simulation examples and homework problems based on Aspen Plus and easily adaptable to any simulator Extensive new coverage of mass transfer and diffusion including both Fickian and Maxwell Stefan approaches Detailed discussions of liquid liquid extraction including McCabe Thiele triangle and computer simulation analyses mixer settler design Karr columns and related mass transfer analyses Thorough introductions to adsorption chromatography and ion exchange designed to prepare students for advanced work in these areas Complete coverage of membrane separations including gas permeation reverse osmosis ultrafiltration pervaporation and key applications A full chapter on economics and energy conservation in distillation Excel spreadsheets offering additional practice with problems in distillation diffusion mass transfer and membrane separation **Separation Process Technology** Jimmy L. Humphrey,George E. Keller,1997 Separation Process Technology is a comprehensive guide to the fundamentals selection applications and installation methods of innovative separation technologies *Industrial Separation Processes* André B. de Haan,Hans Bosch,2013-07-15 Separation operations are crucial throughout the process industry with respect to energy consumption contribution to investments and ability to achieve the desired product with the

right specifications Our main objective in creating this graduate level textbook is to present an overview of the fundamentals underlying the most frequently used industrial separation methods We focus on their physical principles and the basic computation methods that are required to assess their technical and economical feasibility The textbook is organized into three main parts Separation processes for homogeneous mixtures are treated in the parts on equilibrium based molecular separations and rate controlled molecular separations The part on mechanical separation technology presents an overview of the most important techniques for heterogeneous mixture separation Each chapter provides a condensed overview of the most commonly used equipment types The textbook is concluded with a final chapter on the main considerations in selecting an appropriate separation process for a separation task As the design of separation processes can only be learned by doing we have included exercises at the end of each chapter Short answers are given at the end of this book detailed solutions are given in a separate solution manual Sustainable Separation Engineering Gyorgy Szekely,Dan Zhao,2022-04-04 Sustainable Separation Engineering Explore an insightful collection of resources exploring conventional and emerging materials and techniques for separations In Sustainable Separation Engineering Materials Techniques and Process Development a team of distinguished chemical engineers delivers a comprehensive discussion of the latest trends in sustainable separation engineering Designed to facilitate understanding and knowledge transfer between materials scientists and chemical engineers the book is beneficial for scientists practitioners technologists and industrial managers Written from a sustainability perspective the status and need for more emphasis on sustainable separations in the chemical engineering curriculum is highlighted The accomplished editors have included contributions that explore a variety of conventional and emerging materials and techniques for efficient separations as well as the prospects for the use of artificial intelligence in separation science and technology Case studies round out the included material discussing a broad range of separation applications like battery recycling carbon sequestration and biofuel production This edited volume also provides Thorough introductions to green materials for sustainable separations as well as advanced materials for sustainable oil and water separation Comprehensive explorations of the recycling of lithium batteries and ionic liquids for sustainable separation processes Practical discussions of carbon sequestration the recycling of polymer materials and AI for the development of separation materials and processes In depth examinations of membranes for sustainable separations green extraction processes and adsorption processes for sustainable separations Perfect for academic and industrial researchers interested in the green and sustainable aspects of separation science Sustainable Separation Engineering Materials Techniques and Process Development is an indispensable resource for chemical engineers materials scientists polymer scientists and renewable energy professionals Separation Technology John Garside,Institution of Chemical Engineers (Great Britain),1994 Separation technology is at the heart of engineering in the chemical and process industries This book takes the pulse of the technology and assesses its health for future use Recently separation technology has been under pressure to

improve both the quality and diversity of products In response the condition of older technologies drying crystallization and distillation has been improved while newer ideas like adsorption and bioseparations have been brought rapidly into training Understanding of the underlying phenomena of separations argue the authors leads to better equipment design and more applications Newer processes depend on subtle differences in the molecular architecture of the components to be separated chiral molecules for example The way in which this is reflected at a larger scale is one of the themes of the book

Recognizing the pretension ways to acquire this ebook **Thermal Separation Technology Principles Methods Process Design Vdi Buch** is additionally useful. You have remained in right site to begin getting this info. get the Thermal Separation Technology Principles Methods Process Design Vdi Buch colleague that we pay for here and check out the link.

You could purchase lead Thermal Separation Technology Principles Methods Process Design Vdi Buch or acquire it as soon as feasible. You could quickly download this Thermal Separation Technology Principles Methods Process Design Vdi Buch after getting deal. So, as soon as you require the ebook swiftly, you can straight get it. Its fittingly extremely simple and so fats, isnt it? You have to favor to in this make public

https://ftp.barnabastoday.com/public/publication/Documents/W211_User_Manual_Torrent.pdf

Table of Contents Thermal Separation Technology Principles Methods Process Design Vdi Buch

Thermal Separation Technology Principles Methods Process Design Vdi Buch Introduction

Thermal Separation Technology Principles Methods Process Design Vdi Buch Offers over 60,000 free eBooks, including many classics that are in the public domain. Open Library: Provides access to over 1 million free eBooks, including classic literature and contemporary works. Thermal Separation Technology Principles Methods Process Design Vdi Buch Offers a vast collection of books, some of which are available for free as PDF downloads, particularly older books in the public domain. Thermal Separation Technology Principles Methods Process Design Vdi Buch : This website hosts a vast collection of scientific articles, books, and textbooks. While it operates in a legal gray area due to copyright issues, its a popular resource for finding various publications. Internet Archive for Thermal Separation Technology Principles Methods Process Design Vdi Buch : Has an extensive collection of digital content, including books, articles, videos, and more. It has a massive library of free downloadable books. Free-eBooks Thermal Separation Technology Principles Methods Process Design Vdi Buch Offers a diverse range of free eBooks across various genres. Thermal Separation Technology Principles Methods Process Design Vdi Buch Focuses mainly on educational books, textbooks, and business books. It offers free PDF downloads for educational purposes. Thermal Separation Technology Principles Methods Process Design Vdi Buch Provides a large selection of free eBooks in different genres, which are available for download in various formats, including PDF. Finding specific Thermal Separation Technology Principles Methods Process Design Vdi Buch, especially related to Thermal Separation Technology Principles Methods Process Design Vdi Buch, might be challenging as theyre often artistic creations rather than practical blueprints. However, you can explore the following steps to search for or create your own Online Searches: Look for websites, forums, or blogs dedicated to Thermal Separation Technology Principles Methods Process Design Vdi Buch, Sometimes enthusiasts share their designs or concepts in PDF format. Books and Magazines Some Thermal Separation Technology Principles Methods Process Design Vdi Buch books or magazines might include. Look for these in online stores or libraries. Remember that while Thermal Separation Technology Principles Methods Process Design Vdi Buch, sharing copyrighted material without permission is not legal. Always ensure youre either creating your own or obtaining them from legitimate sources that allow sharing and downloading. Library Check if your local library offers eBook lending services.

Many libraries have digital catalogs where you can borrow Thermal Separation Technology Principles Methods Process Design Vdi Buch eBooks for free, including popular titles.Online Retailers: Websites like Amazon, Google Books, or Apple Books often sell eBooks. Sometimes, authors or publishers offer promotions or free periods for certain books.Authors Website Occasionally, authors provide excerpts or short stories for free on their websites. While this might not be the Thermal Separation Technology Principles Methods Process Design Vdi Buch full book , it can give you a taste of the authors writing style.Subscription Services Platforms like Kindle Unlimited or Scribd offer subscription-based access to a wide range of Thermal Separation Technology Principles Methods Process Design Vdi Buch eBooks, including some popular titles.

FAQs About Thermal Separation Technology Principles Methods Process Design Vdi Buch Books

1. Where can I buy Thermal Separation Technology Principles Methods Process Design Vdi Buch books? Bookstores: Physical bookstores like Barnes & Noble, Waterstones, and independent local stores. Online Retailers: Amazon, Book Depository, and various online bookstores offer a wide range of books in physical and digital formats.
2. What are the different book formats available? Hardcover: Sturdy and durable, usually more expensive. Paperback: Cheaper, lighter, and more portable than hardcovers. E-books: Digital books available for e-readers like Kindle or software like Apple Books, Kindle, and Google Play Books.
3. How do I choose a Thermal Separation Technology Principles Methods Process Design Vdi Buch book to read? Genres: Consider the genre you enjoy (fiction, non-fiction, mystery, sci-fi, etc.). Recommendations: Ask friends, join book clubs, or explore online reviews and recommendations. Author: If you like a particular author, you might enjoy more of their work.
4. How do I take care of Thermal Separation Technology Principles Methods Process Design Vdi Buch books? Storage: Keep them away from direct sunlight and in a dry environment. Handling: Avoid folding pages, use bookmarks, and handle them with clean hands. Cleaning: Gently dust the covers and pages occasionally.
5. Can I borrow books without buying them? Public Libraries: Local libraries offer a wide range of books for borrowing. Book Swaps: Community book exchanges or online platforms where people exchange books.
6. How can I track my reading progress or manage my book collection? Book Tracking Apps: Goodreads, LibraryThing, and Book Catalogue are popular apps for tracking your reading progress and managing book collections. Spreadsheets: You can create your own spreadsheet to track books read, ratings, and other details.
7. What are Thermal Separation Technology Principles Methods Process Design Vdi Buch audiobooks, and where can I

find them? Audiobooks: Audio recordings of books, perfect for listening while commuting or multitasking. Platforms: Audible, LibriVox, and Google Play Books offer a wide selection of audiobooks.

8. How do I support authors or the book industry? Buy Books: Purchase books from authors or independent bookstores. Reviews: Leave reviews on platforms like Goodreads or Amazon. Promotion: Share your favorite books on social media or recommend them to friends.
9. Are there book clubs or reading communities I can join? Local Clubs: Check for local book clubs in libraries or community centers. Online Communities: Platforms like Goodreads have virtual book clubs and discussion groups.
10. Can I read Thermal Separation Technology Principles Methods Process Design Vdi Buch books for free? Public Domain Books: Many classic books are available for free as theyre in the public domain. Free E-books: Some websites offer free e-books legally, like Project Gutenberg or Open Library.

Find Thermal Separation Technology Principles Methods Process Design Vdi Buch :

w211 user manual torrent
vw transporter 1600 service manual
wanderer tainted universe wanderers odyssey book 3
~~walkowanie ameryki polska wersja jezykowa~~
wanco arrow board model wtsp55 lsa manual
~~waar gaan we heen papa~~
walt disney world the 71 things you need to see
wallflower rear entrance video
~~vw passat repair manual 2015~~
vz adventra service manual
waddenland en waddenzee
vw polo 2008 service manual
walker lab manual
vw t5 manual 2015
waar naar toe vandaag 3 veluwe en betuwe

Thermal Separation Technology Principles Methods Process Design Vdi Buch :

STAAR Algebra 1 Practice Test Questions STAAR Algebra 1 Practice Test Questions. Prepare with our STAAR Study Guide and Practice Questions. Print or eBook. Guaranteed to raise your score. Math with Ms. Jones at AHHS - Algebra 1 EOC Review A website that has 29 pages of review for the STAAR EOC test. http ... Algebra 1 STAAR Review 1 Algebra 1 STAAR Review 2 Algebra 1 EOY Test (Not Texas). Staar algebra 1 review GOOGLE FORMS STAAR ALGEBRA 1 EOC Review Reporting Category 5 TEST PREP ... This is the 2019 STAAR released test spread out over one week of instruction. There ... Algebra IPractice Assessment 3 A graph of a quadratic function is shown. What are the x-intercepts of the function? Shade the TWO correct circles that represent the points. Algebra I. Staar algebra review Algebra 1 STAAR EOC Review Practice Foldable Booklet BUNDLE. Created by. Algebra Accents. These FIVE Independent Practice Booklets are specifically aligned ... STAAR Review - Algebra I Algebra I. STAAR released test- use for practice/preparation. staar-eoc-testalgi.pdf. File Size: 3368 kb. File Type: pdf. Download File. Tuesday, 4/29/14 ... STAAR Algebra I May 2021 Released Read each question carefully. For a multiple-choice question, determine the best answer to the question from the four answer choices provided. For a. Algebra I EOC STAAR Review Activities The ESC-18 Math Team has created a variety of activities where students practice and apply important grade-level TEKS aligned topics to cement their learning. STAAR Algebra 1 Test Prep - Tutoring - MathHelp.com Our STAAR Algebra 1 test prep course is an online study guide with video tutoring and practice tests covering the exact questions on the exam. An Introduction to Medical Malpractice in the United States An Introduction to Medical Malpractice in the United States Summary Medical Liability/Medical Malpractice Laws Jul 13, 2021 — A health care provider's personal liability is limited to $200,000 for monetary damages and medical care and related benefits as provided in §41 ... Medical Malpractice Law Oct 14, 2023 — Medical malpractice happens when a doctor or another medical professional whose actions fall below the appropriate standard of care hurts a ... What is Medical Malpractice Law? Aug 3, 2023 — Medical malpractice involves injury or harm caused by a doctor's negligence. Learn about time limits, forms of negligence, and much more at ... Medical malpractice: What does it involve? Medical malpractice refers to professional negligence by a health care provider that leads to substandard treatment, resulting in injury to a patient. malpractice | Wex | US Law | LII / Legal Information Institute Malpractice, or professional negligence, is a tort committed when a professional breaches their duty to a client. The duty of a professional to a client is ... Medical malpractice Medical malpractice is a legal cause of action that occurs when a medical or health care professional, through a negligent act or omission, deviates from ... 22 U.S. Code § 2702 - Malpractice protection - Law.Cornell.Edu ... negligence in the furnishing of medical care or related services, including the conducting of clinical studies or investigations. (f) Holding harmless or ... Medical Malpractice Sep 23, 2016 — Medical malpractice is negligence committed by a professional health care provider—a doctor ... Health Care Law · Managed Care · Law for Older ... Medical Malpractice Medical malpractice is a type of personal injury claim that involves negligence by a

healthcare provider. Of course, medical treatments do not always work, and ... The ROM Field Guide to Birds of Ontario: Janice M. Hughes This landmark publication features: • Detailed and clearly written descriptions of more than 300 migrant and resident Ontario bird species and accidentals, ... The ROM Field Guide to Birds of Ontario The definitive guide to birds of Ontario. Includes all species observed in Ontario. Written in clear, assesible language. Hundreds of photographs from many ... American Birding Association Field Guide to Birds of Ontario ... Ontario is a paradise for birds and for birders. This new field guide is the most comprehensive and up-to-date photographic guide to birds of Ontario: • 550 ... The ROM Field Guide to Birds of Ontario - Janice M. Hughes It is the most authoritative, easy to use, and beautifully designed guide to Ontario birds available. This landmark publication features: · Detailed and clearly ... The ROM Field Guide to Birds of Ontario - Over 300 easy-to-read colour distribution maps, showing summer and winter ranges and breeding grounds. - Handy page-per-species format, with photo, ... The ROM Field Guide to Birds of Ontario This unique publication, produced in association with the Royal Ontario Museum, is the guide Ontario birders have been waiting for... The ROM Field Guide to ... The ROM Field Guide to Birds of Ontario by Royal ... - Over 300 easy-to-read colour distribution maps, showing summer and winter ranges and breeding grounds. - Handy page-per-species format, with photo, ... The Rom Field Guide to Birds of Ontario The guide is prefaced with a list of tips for easier bird identification, including seasonal migration habits, an explanation of Ontario's diverse habitats, and ... The Rom Field Guide To Birds Of Ontario Buy the book The Rom Field Guide To Birds Of Ontario by janice hughes,royal ontario museum at Indigo. The ROM Field Guide to Birds of Ontario birds of Ontario. The book works on a one-bird-per-page basis for 345 birds considered regular in the province, plus an appendix giving briefer ...