

Following Exercise questions are **IMPORTANT!**

2.4, 2.5, 2.13, 2.14, 2.16, 2.17, 2.18, 2.19, 2.22, 2.23, 2.27, 2.28, 2.29, 2.30, 2.31

D2.1 (a). $Q_A = -20\mu C$ located at A(-6,4,7) , $Q_B = 50\mu C$ located at B(5,8,-2)
Find \vec{R}_{AB}

$$\vec{R}_{AB} = (5 - (-6))\hat{a}_x + (8 - 4)\hat{a}_y + (-2 - 7)\hat{a}_z = 11\hat{a}_x + 4\hat{a}_y - 9\hat{a}_z$$

(b). $|\vec{R}_{AB}| = \sqrt{(11)^2 + 4^2 + (-9)^2} = 14.76m$

(c). $\vec{F}_{AB} = Q_A Q_B \vec{R}_{AB} / 4\pi\epsilon_0 |\vec{R}_{AB}|^3 = (-20 \times 10^{-6} \times 50 \times 10^{-6} (11\hat{a}_x + 4\hat{a}_y - 9\hat{a}_z)) / (4\pi \times (10^{-9}/36\pi) |14.76|^3)$
 $\Rightarrow \vec{F}_{AB} = 30.76\hat{a}_x + 11.184\hat{a}_y - 25.16\hat{a}_z mN$

(d). $\vec{F}_{AB} = Q_A Q_B \vec{R}_{AB} / 4\pi\epsilon_0 |\vec{R}_{AB}|^3 = (-20 \times 10^{-6} \times 50 \times 10^{-6} (11\hat{a}_x + 4\hat{a}_y - 9\hat{a}_z)) / (4\pi \times 8.85 \times 10^{-12} |14.76|^3)$
 $\Rightarrow \vec{F}_{AB} = 30.72\hat{a}_x + 11.169\hat{a}_y - 25.13\hat{a}_z mN$

D2.2(a). $Q_A = -0.3\mu C$ located at A(25,-30,15) in cm , $Q_B = 0.5\mu C$ located at B(-10,8,12)

Find \vec{E} at the origin O(0,0,0).

Let \vec{E} at the origin is denoted by \vec{E}_o and it will be the sum of \vec{E}_A (\vec{E} due to Q_A located at point A)
and \vec{E}_B (\vec{E} due to Q_B located at point B)

$$\vec{E}_A = Q_A \vec{R}_{OA} / 4\pi\epsilon_0 |\vec{R}_{OA}|^3$$

$$\vec{R}_{OA} = (0 - 25)\hat{a}_x + (0 - (-30))\hat{a}_y + (0 - 15)\hat{a}_z = (-25\hat{a}_x + 30\hat{a}_y - 15\hat{a}_z)cm$$

$$|\vec{R}_{OA}| = \sqrt{(-25)^2 + (30)^2 + (-15)^2} = 41.83cm$$

$$\vec{E}_A = (-0.3 \times 10^{-6}) \times (-25\hat{a}_x + 30\hat{a}_y - 15\hat{a}_z) \times 10^{-2} / 4\pi \times 8.85 \times 10^{-12} \times |41.83 \times 10^{-2}|^3 = -368.55(-25\hat{a}_x + 30\hat{a}_y - 15\hat{a}_z)$$

$$\vec{E}_B = Q_B \vec{R}_{OB} / 4\pi\epsilon_0 |\vec{R}_{OB}|^3$$

$$\vec{R}_{OB} = (0 - (-10))\hat{a}_x + (0 - 8)\hat{a}_y + (0 - 12)\hat{a}_z = (10\hat{a}_x - 8\hat{a}_y - 12\hat{a}_z)cm$$

$$|\vec{R}_{OB}| = \sqrt{(10)^2 + (-8)^2 + (-12)^2} = 17.55cm$$

$$\vec{E}_B = (0.5 \times 10^{-6}) \times (10\hat{a}_x - 8\hat{a}_y - 12\hat{a}_z) \times 10^{-2} / 4\pi \times 8.85 \times 10^{-12} \times |17.55 \times 10^{-2}|^3 = 8317.36(10\hat{a}_x - 8\hat{a}_y - 12\hat{a}_z)$$

$$\vec{E}_o = \vec{E}_A + \vec{E}_B = (-368.55(-25\hat{a}_x + 30\hat{a}_y - 15\hat{a}_z)) + 8317.36(10\hat{a}_x - 8\hat{a}_y - 12\hat{a}_z) = (92.3\hat{a}_x - 77.6\hat{a}_y - 94.2\hat{a}_z)KV/m$$

(b). Find \vec{E} at the point P(15,20,50).

It is the same as part(a) but this time we have to calculate \vec{R}_{PA} and \vec{R}_{PB} and the rest of the problem is similar to part(a)

D2.3 (a).

$$\sum_{m=0}^5 ((1 + (-1)^m) / (m^2 + 1)) = (1 + (-1)^0) / (0^2 + 1) + (1 + (-1)^1) / (1^2 + 1) + (1 + (-1)^2) / (2^2 + 1) + (1 + (-1)^3) / (3^2 + 1) + (1 + (-1)^4) / (4^2 + 1) + (1 + (-1)^5) / (5^2 + 1) = 2 + 0 + 2/5 + 0 + 2/17 + 0 = 2.52$$

(b). Similar to the part(a)

D2.4 (a). $0.1 \leq (|x|, |y|, |z|) \leq 0.2$. given ranges of x,y and z co-ordinates doesnot constitute a cubical volume so $dv = 0 \Rightarrow Q = \int_{vol} \rho_v dv = 0$

(b). Differential volume in cylindrical co-ordinates is given by $dv = \rho d\rho d\phi dz$. we have $Q = \int_{vol} \rho_v dv$

$$\Rightarrow Q = \int_{vol} (\rho^2 z^2 \sin(0.6)\phi) \rho d\rho d\phi dz = \int_0^{0.1} \int_0^{2\pi} \int_0^{0.2} (\rho^2 z^2 \sin(0.6)\phi) \rho d\rho d\phi dz = \int_0^{0.1} \rho^2 d\rho \int_0^{2\pi} (\sin(0.6)\phi) d\phi \int_0^{0.2} z^2 dz$$

$$\Rightarrow Q = |\rho^3/4|_0^{0.1} \times |(-\cos(0.6\phi))/0.6|_0^{2\pi} \times |z^3/3|_0^{0.2} = | (0.1)^3/4 | \times | (-\cos(108^\circ) - (-\cos(0)))/0.6 | \times | (64 - 8)/3 |$$

$$\Rightarrow Q = | (0.1)^3/4 | \times | (1.31)/0.6 | \times | 56/3 | = 1.018mC$$

¹This document is prepared in L^AT_EX. (Email: ahmadsajjad01@com.net.pk)

Solution Thermodynamic 7th Chapter

Viktor Gutmann



Solution Thermodynamic 7th Chapter:

Lecture Notes On Solution Chemistry Viktor Gutmann, 1995-08-31 This book emphasises those features in solution chemistry which are difficult to measure but essential for the understanding of both the qualitative and the quantitative aspects Attention is paid to the mutual influences between solute and solvent even at extremely small concentrations of the former The described extension of the molecular concept leads to a broad view not by a change in paradigm but by finding the rules for the organizations both at the molecular and the supermolecular level of liquid and solid solutions **The Physical Chemistry of Biopolymer Solutions** Robert F. Steiner, Louise Garone, 1991 The book is concerned with the application of physical techniques to the study of the structure and interactions of biopolymers The treatment is confined to those procedures applicable to solutions The material has been tested on students in actual classes thereby permitting the elimination of ambiguities and potential points of difficulty Stress has been placed upon lucidity of treatment and difficult steps in derivations have been explained The mathematical exposition has been made as clear and simple as feasible Examples of actual data are given *Polymer Chemistry* Paul C. Hiemenz, Timothy P. Lodge, 2007-02-15 Highly recommended CHOICE New Edition Offers Improved Framework for Understanding Polymers Written by well established professors in the field Polymer Chemistry Second Edition provides a well rounded and articulate examination of polymer properties at the molecular level It focuses on fundamental principles based on underlying chemical structures polymer synthesis characterization and properties Consistent with the previous edition the authors emphasize the logical progression of concepts rather than presenting just a catalog of facts The book covers topics that appear prominently in current polymer science journals It also provides mathematical tools as needed and fully derived problems for advanced calculations This new edition integrates new theories and experiments made possible by advances in instrumentation It adds new chapters on controlled polymerization and chain conformations while expanding and updating material on topics such as catalysis and synthesis viscoelasticity rubber elasticity glass transition crystallization solution properties thermodynamics and light scattering Polymer Chemistry Second Edition offers a logical presentation of topics that can be scaled to meet the needs of introductory as well as more advanced courses in chemistry materials science and chemical engineering **The Experimental Determination of Solubilities** G. T. Hefter, R. P. T. Tomkins, 2003-11-14 Guidelines are provided on the reliability of various methods as well as information for selecting the appropriate technique Unique coverage of the whole range of solubility measurements Very useful for investigators interested in embarking upon solubility measurements *Equilibrium Statistical Physics (2nd Edition) - Solutions Manual* Birger Bergersen, Michael Plischke, 1994-12-30 This book contains solutions to the problems found in *Equilibrium Statistical Physics 2nd Edition* by the same authors **The Principles of Chemical Equilibrium** Kenneth George Denbigh, 1981-03-26 Sample Text **Aqueous Systems at Elevated Temperatures and Pressures** Roberto Fernandez-Prini, A.H. Harvey, D.A. Palmer, 2004-07-06 The International

Association for the Properties of Water and Steam IAPWS has produced this book in order to provide an accessible up to date overview of important aspects of the physical chemistry of aqueous systems at high temperatures and pressures These systems are central to many areas of scientific study and industrial application including electric power generation industrial steam systems hydrothermal processing of materials geochemistry and environmental applications The authors goal is to present the material at a level that serves both the graduate student seeking to learn the state of the art and also the industrial engineer or chemist seeking to develop additional expertise or to find the data needed to solve a specific problem The wide range of people for whom this topic is important provides a challenge Advanced work in this area is distributed among physical chemists chemical engineers geochemists and other specialists who may not be aware of parallel work by those outside their own specialty The particular aspects of high temperature aqueous physical chemistry of interest to one industry may be irrelevant to another yet another industry might need the same basic information but in a very different form To serve all these constituencies the book includes several chapters that cover the foundational thermophysical properties such as gas solubility phase behavior thermodynamic properties of solutes and transport properties that are of interest across numerous applications The presentation of these topics is intended to be accessible to readers from a variety of backgrounds Other chapters address fundamental areas of more specialized interest such as critical phenomena and molecular level solution structure Several chapters are more application oriented addressing areas such as power cycle chemistry and hydrothermal synthesis As befits the variety of interests addressed some chapters provide more theoretical guidance while others such as those on acid base equilibria and the solubilities of metal oxides and hydroxides emphasize experimental techniques and data analysis Covers both the theory and applications of all Hydrothermal solutions Provides an accessible up to date overview of important aspects of the physical chemistry of aqueous systems at high temperatures and pressures The presentation of the book is understandable to readers from a variety of backgrounds

The Kirkwood-Buff Theory of Solutions Arieh Ben-Naim, 2023-10-01 The Kirkwood Buff Theory of Solutions With Selected Applications to Solvation and Proteins presents the Kirkwood Buff KB Theory of solution in a simple and didactic manner making it understandable to those with minimal background in thermodynamics Aside from the fact that the KB Theory may be the most important and useful theory of solutions it is also the most general theory that can be applied to all possible solutions including aqueous solutions of proteins and nucleic acids Introductory chapters give readers grounding in the necessary chemical thermodynamics and statistical mechanics but then move to a systematic derivation of Kirkwood Buff theory and its inversion Originally published in 1951 the KB theory was dormant for over 20 years It became extremely useful after the publication of the Inversion of the KB theory by the author Arieh Ben Naim in 1978 The book explains all necessary concepts in statistical mechanics featured in the theory in a simple and intuitive way Researchers will find the theory useful in solving any problem in mixtures or solutions in any phase Some examples of applications of the KB theory to water aqueous solutions

protein folding and self association of proteins are provided in the book Presents an authoritative accounting of the Kirkwood Buff KB Theory of solution as well as the derivation of the inversion of the Kirkwood Buff Theory Provides a grounding in the necessary chemical thermodynamics and statistical mechanics Features useful examples of the applications of KB Theory to water aqueous solutions protein folding and self association of proteins Written by world renowned expert Arieh Ben Naim who himself developed the inversion of Kirkwood Buff theory MTG MHT CET 10 Years Previous Year Solved Question Papers | MHT CET PYQs For 2024 Exam MTG Learning Media, 10 Years MHT CET Chapter wise Solutions is the best practice material for MHT CET aspirants This book has chapter wise solutions from the past 10 years papers of MHT CET engineering exams It also has 2 mock tests to provide final evaluation It is the perfect resource to familiarize with the MHT CET exam and cover all bases to avoid the element of surprise in the final exam **Atkins' Physical Chemistry** Peter Atkins, Julio de Paula, 2010 This volume features a greater emphasis on the molecular view of physical chemistry and a move away from classical thermodynamics It offers greater explanation and support in mathematics which remains an intrinsic part of physical chemistry Chemical Engineering License Problems and Solutions Dilip K. Das, Rajaram K. Prabhudesai, 2003-09-18 This is a review book for people planning to take the PE exam in Chemical Engineering Prepared specifically for the exam used in all 50 states It features 188 new PE problems with detailed step by step solutions The book covers all topics on the exam and includes easy to use tables charts and formulas It is an ideal desk Companion to DAS s Chemical Engineer License Review It includes sixteen chapters and a short PE sample exam as well as complete references and an index Chapters include the following topical areas material and energy balances fluid dynamics heat transfer evaporation distillation absorption leaching liq liq extraction psychrometry and humidification drying filtration thermodynamics chemical kinetics process control mass transfer and plant safety The ideal study guide this book brings all elements of professional problem solving together in one BIG BOOK Ideal desk reference Answers hundreds of the most frequently asked questions The first truly practical no nonsense problems and solution book for the difficult PE exam Full step by step solutions are included *Water in Crystalline Hydrates Aqueous Solutions of Simple Nonelectrolytes* Felix Franks, 2013-04-18 vi the information collected and discussed in this volume may help toward the achievement of such an objective I should like to express my debt of gratitude to the authors who have contributed to this volume Editing a work of this nature can strain long established personal relationships and I thank my various colleagues for bearing with me and responding sooner or later to one or several letters or telephone calls My special thanks once again go to Mrs Joyce Johnson who bore the main brunt of this seemingly endless correspondence and without whose help the editorial and referencing work would have taken several years F FRANKS Biophysics Division Unilever Research Laboratory Colworth Welwyn Colworth House Sharnbrook Bedford January 1973 Contents Contents of Volume 1 xv Contents of Volume 3 xvi Contents of Volume 4 xvii Chapter 1 The Solvent Properties of Water F Franks 1 Water the Universal Solvent the Study of Aqueous

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Introduction to Geochemistry Kula C. Misra, 2012-05-21 This book is intended to serve as a text for an introductory course in geochemistry for undergraduate graduate students with at least an elementary level background in earth sciences chemistry and mathematics The text containing 83 tables and 181 figures covers a wide variety of topics ranging from atomic structure to chemical and isotopic equilibria to modern biogeochemical cycles which are divided into four interrelated parts Crystal Chemistry Chemical Reactions and biochemical reactions involving bacteria Isotope Geochemistry radiogenic and stable isotopes and The Earth Supersystem which includes discussions pertinent to the evolution of the solid Earth the atmosphere and the hydrosphere In keeping with the modern trend in the field of geochemistry the book emphasizes computational techniques by developing appropriate mathematical relations solving a variety of problems to illustrate application of the mathematical relations and leaving a set of questions at the end of each chapter to be solved by students However so as not to interrupt the flow of the text involved chemical concepts and mathematical derivations are separated in the form of boxes Supplementary materials are packaged into ten appendixes that include a standard state 298 15 K 1 bar thermodynamic data table and a listing of answers to selected chapter end questions Additional resources for this book can be found at www.wiley.com/go/misra_geochemistry

Water and Aqueous Solutions at Subzero Temperatures Felix Franks, 2013-11-11 This Volume the last of the series is devoted to water in its metastable forms especially at sub zero temperatures The past few years have witnessed an increasing interest in supercooled water and amorphous ice If the properties of liquid water in the normal temperature range are already eccentric then they become exceedingly so below the normal freezing point in the metastable temperature range Water can be supercooled to 39 C without too much effort and most of its physical properties show a remarkable temperature dependence under these conditions Although adequate explanations are still lacking the time has come to review available knowledge The study of amorphous ice that is the solid formed when water vapor is condensed on a very cold surface is of longer standing It has achieved renewed interest because it may serve as a model for the liquid state There is currently a debate whether or not a close structural relationship exists between amorphous ice and supercooled water The nucleation and growth of ice in supercooled water and aqueous solutions is also still one of those grey areas of research although these topics have received considerable attention from chemists and physicists over the past two decades Even now the relationships between degree of supercooling nucleation kinetics crystal growth kinetics cooling rate and solute concentration are somewhat obscure Nevertheless at the empirical level much progress has been made because these topics

are of considerable importance to biologists technologists atmospheric physicists and glaciologists

Polymer Chemistry
Timothy P. Lodge, Paul C. Hiemenz, 2020-07-14 A well rounded and articulate examination of polymer properties at the molecular level Polymer Chemistry focuses on fundamental principles based on underlying chemical structures polymer synthesis characterization and properties It emphasizes the logical progression of concepts and provide mathematical tools as needed as well as fully derived problems for advanced calculations The much anticipated Third Edition expands and reorganizes material to better develop polymer chemistry concepts and update the remaining chapters New examples and problems are also featured throughout This revised edition Integrates concepts from physics biology materials science chemical engineering and statistics as needed Contains mathematical tools and step by step derivations for example problems Incorporates new theories and experiments using the latest tools and instrumentation and topics that appear prominently in current polymer science journals The number of homework problems has been greatly increased to over 350 in all The worked examples and figures have been augmented More examples of relevant synthetic chemistry have been introduced into Chapter 2 Step Growth Polymers More details about atom transfer radical polymerization and reversible addition fragmentation chain transfer polymerization have been added to Chapter 4 Controlled Polymerization Chapter 7 renamed Thermodynamics of Polymer Mixtures now features a separate section on thermodynamics of polymer blends Chapter 8 still called Light Scattering by Polymer Solutions has been supplemented with an extensive introduction to small angle neutron scattering Polymer Chemistry Third Edition offers a logical presentation of topics that can be scaled to meet the needs of introductory as well as more advanced courses in chemistry materials science polymer science and chemical engineering

Principles of Extractive Metallurgy Terkel Rosenqvist, 2004 Rather than simply describing the processes and reactions involved in metal extraction this book concentrates on fundamental principles to give readers an understanding of the possibilities for future developments in this field It includes a review of the basics of thermodynamics kinetics and engineering principles that have special importance for extractive metallurgy to ensure that readers have the background necessary for maximum achievement The various metallurgical unit processes such as roasting reduction smelting and electrolysis are illustrated by existing techniques for the extraction of the most common metals Each chapter includes a bibliography of recommended reading to aid in further study The appendices include tables and graphs of thermodynamic qualities for most substances of metallurgical importance these are ideal for calculating heat enthalpy balances and chemical equilibrium constants SI Units are used consistently throughout the text

Structure and Dynamics of Solutions Hideyuki Ohtaki, H. Yamatera, 2013-10-22 Recent advances in the study of structural and dynamic properties of solutions have provided a molecular picture of solute solvent interactions Although the study of thermodynamic as well as electronic properties of solutions have played a role in the development of research on the rate and mechanism of chemical reactions such macroscopic and microscopic properties are insufficient for a deeper understanding of fast chemical and biological reactions

In order to fill the gap between the two extremes it is necessary to know how molecules are arranged in solution and how they change their positions in both the short and long range This book has been designed to meet these criteria It is possible to develop a sound microscopic picture for reaction dynamics in solution without molecular level knowledge of how reacting ionic or neutral species are solvated and how rapidly the molecular environment is changing with time A variety of actual examples is given as to how and when modern molecular approaches can be used to solve specific solution problems The following tools are discussed x ray and neutron diffraction EXAFS and XANES molecular dynamics and Monte Carlo computer simulations Raman infrared NMR fluorescence and photoelectron emission spectroscopic methods conductance and viscosity measurements high pressure techniques and statistical mechanics methods Static and dynamic properties of ionic solvation molecular solvation ion pair formation ligand exchange reactions and typical organic solvents are useful for bridging the gap between classical thermodynamic studies and modern single molecule studies in the gas phase The book will be of interest to solution physical inorganic analytical and structural chemists as well as to chemical kineticists

Modeling, Analysis and Optimization of Process and Energy Systems F. Carl Knopf, 2011-12-14 Energy costs impact the profitability of virtually all industrial processes Stressing how plants use power and how that power is actually generated this book provides a clear and simple way to understand the energy usage in various processes as well as methods for optimizing these processes using practical hands on simulations and a unique approach that details solved problems utilizing actual plant data Invaluable information offers a complete energy saving approach essential for both the chemical and mechanical engineering curricula as well as for practicing engineers

HVAC Solutions: Solving the Problems They Don't Teach You Charles Nehme, In the world of HVAC theory can only get you so far I ve spent over three decades traveling the globe consulting on some of the most intricate and demanding mechanical electrical and plumbing MEP projects imaginable From the icy pressures of industrial facilities to the precise needs of large scale commercial developments I ve seen firsthand how real world challenges often defy textbook solutions The problems I ve encountered the intermittent electrical faults that no one can find the subtle airflow issues that cause major comfort complaints the client communication breakdowns that sour a project are the very things that standard training often overlooks This book is a direct response to that gap It s not a dry technical manual filled with formulas and diagrams you ve already seen Instead it s a distillation of the practical wisdom unconventional diagnostic methods and hard won lessons I ve gathered throughout my career I ve written it for every professional who has ever stood in front of a system that just wouldn t cooperate wondering what they were missing My goal is to empower you with the insights you need to move beyond simple troubleshooting and become a master problem solver

Neutron and Synchrotron Radiation for Condensed Matter Studies Jose Baruchel, Jean-Louis Hodeau, Mogens S. Lehmann, Jean-Rene Regnard, Claire Schlenker, 1994-04-07 The present volume is the third and last in the series based on the HERCULES Course on Neutron and Synchrotron Radiation for Condensed Matter Studies It covers selected applications of

neutron and synchrotron radiation to soft condensed matter introduction plus 7 chapters and biology introduction plus 10 chapters The fields are extremely wide so only some selected topics representative of recent interest and developments are reported The authors were selected for their scientific expertise and teaching skills An index covering the content of all three volumes is included

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