

# 17 • Acid-Base Equilibria

1.  $\text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{OH}^-$ ,  $K_w = [\text{H}^+][\text{OH}^-] = 10^{-14}$   
 $\text{pH} = -\log[\text{H}^+]$ ,  $\text{pH} + \text{pOH} = 14$ ,  $[\text{H}^+] = 10^{-\text{pH}}$   
 Convert between  $\text{pH}$ ,  $\text{pOH}$ ,  $[\text{H}^+]$ , &  $[\text{OH}^-]$

2. Acid Ionization Constant ( $K_a$ ):



$$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$$



$$K_a = \frac{[\text{H}^+][\text{F}^-]}{[\text{HF}]}$$

3. Typical question: Given  $K_a$  and the starting concentrations of acid, find concentrations for  $\text{pH}$  of  $[\text{H}^+]$  at equilibrium.



Find the  $\text{pH}$  of 0.10M acetic acid.

4. Polyprotic Acids:  $\text{H}_3\text{PO}_4$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{H}_2\text{C}_2\text{O}_4$ , etc. The 1<sup>st</sup> dissociation is strong for  $\text{H}_2\text{SO}_4$ . When using Hess's Law with a polyprotic acid:  $K_{a(\text{total})} = K_{a1} \times K_{a2}$   
 Calculating  $\text{pH}$ , use  $K_{a1}$

5. Brønsted-Lowry Definitions:  
 Acids =  $\text{H}^+$  donors; Bases =  $\text{H}^+$  acceptors  
 Conjugate acid-base pairs.

6. Base Ionization Constant ( $K_b$ ):



$$K_b = \frac{[\text{BH}^+][\text{OH}^-]}{[\text{B}]}$$



$$K_b = \frac{[\text{HF}][\text{OH}^-]}{[\text{F}^-]}$$

7. Salt solts can have  $\text{pH} \neq 7$  (hydrolysis):  
 ions from weak acids  $\rightarrow$  basic solutions  
 $\text{C}_2\text{H}_3\text{O}_2^- + \text{H}_2\text{O} \rightleftharpoons \text{HC}_2\text{H}_3\text{O}_2 + \text{OH}^-$   
 ions from weak bases  $\rightarrow$  acidic solutions  
 $\text{NH}_4^+ + \text{H}_2\text{O} \rightleftharpoons \text{NH}_3 + \text{H}^+$

8.  $K_a \times K_b = K_w = 10^{-14}$   
 only applies for conjugate acids & bases!  
 Example:  $K_a \text{ HC}_2\text{H}_3\text{O}_2 = 1.8 \times 10^{-5}$   
 $K_b \text{ C}_2\text{H}_3\text{O}_2^- = 10^{-14} / 1.8 \times 10^{-5}$

## BUFFER'S GUIDE

9. Percent Ionization =  
 $\frac{[\text{H}^+]_{\text{equilibrium}}}{[\text{HA}]_{\text{initial}}} \times 100$
10. Acid Strength: lower the  $K_a$  stronger acids:  $\text{HCl}$ ,  $\text{HBr}$ ,  $\text{HI}$ ,  $\text{HNO}_3$ ,  $\text{HClO}_4$ , and  $\text{H}_2\text{SO}_4$  (removed of the first  $\text{H}^+$  only)

Ex: binary acids: acid strength increases with increasing electronegativity of the "other element". (NOTE: Size predominates over electronegativity in determining acid strength.)



Ox: Oxacids: Acid strength increases with increasing:

- (i) electronegativity
- (ii) number of bonded oxygen atoms
- (iii) oxidation state of the "central atom".



is very acidic

$\text{NaOH}$  is very basic

Acid strength also increases with decreasing radii of the "central atom".

Example:

$\text{HOCl}$  (bond between Cl and OH is covalent—making  $\text{HOCl}$  acidic)

$\text{HCl}$  (bond between Cl and OH is ionic—making  $\text{HCl}$  basic)

11. Lewis Acids and Bases:

(This applies to coordinate covalent bonds.)

Lewis Acid—electron pair acceptor

Lewis Base—electron pair donor

"Have Pair, ... Be A Base" = Lewis Base

Ex: examples: ion formation, metal ions are Lewis acids, and ligands are Lewis bases.



$\text{Ca}^{2+}$  acts as an acid,  $\text{NH}_3$  acts as a base.

12. Strong Basic: anions like  $\text{NH}_2^-$

hydride ions,  $\text{H}^-$ , methoxide ions,  $\text{CH}_3\text{O}^-$

Based on a list by Alfred Reed, Inorganic 92

# Acid Base Equilibria Bluffer S Guide Answer

**Bryan M. Ham,Aihui MaHam**



## Acid Base Equilibria Bluffer S Guide Answer:

Chemical Principles Study Guide/Solutions Manual John Krenos, Joseph Potenza, Carl Hoeger, 2007-01-18 Written for general chemistry courses Chemical Principles helps students develop chemical insight by showing the connection between chemical principles and their applications

**Chemical Principles Student's Study Guide & Solutions Manual** John Krenos, Joseph Potenza, Loretta Jones, Lynn Koplitz, Thomas Spence, 2004-03-19 This combination manual is designed to help students avoid common mistakes and understand the material better The solutions manual section includes detailed answers and explanations to the odd numbered exercises in the text

**Chemistry** Neil D. Jespersen, Alison Hyslop, 2021-11-02 Chemistry The Molecular Nature of Matter 8th Edition continues to focus on the intimate relationship that exists between structure at the atomic molecular level and the observable macroscopic properties of matter Key revisions in this edition focus on three areas The deliberate inclusion of more updated real world examples that relate common real world student experiences to the science of chemistry Simultaneously examples and questions have been updated to align them with career concepts relevant to the environmental engineering biological pharmaceutical and medical sciences Providing students with transferable skills with a focus on integrating metacognition and three dimensional learning into the text When students know what they know they are better able to learn and incorporate the material Providing a total solution through New WileyPLUS by fully integrating the enhanced etext with online assessment answer specific responses and additional practice resources The 8th edition continues to emphasize the importance of applying concepts to problem solving to achieve high level learning and increase retention of chemistry knowledge Problems are arranged in an intuitive confidence building order

Basic Concepts of Chemistry, 9e Study Guide and Solutions Manual Leo J. Malone, Theodore O. Dolter, 2012-01-03 The 9th edition of Malone s Basic Concepts of Chemistry provides many new and advanced features that continue to address general chemistry topics with an emphasis on outcomes assessment New and advanced features include an objectives grid at the end of each chapter which ties the objectives to examples within the sections assessment exercises at the end each section and relevant chapter problems at the end of each chapter A new Math Check allows quick access to the needed basic skill The first chapter now includes brief introductions to several fundamental chemical concepts and Chapter Synthesis Problems have been added to the end of each chapter to bring key concepts into one encompassing problem Every concept in the text is clearly illustrated with one or more step by step examples Making it Real essays have been updated to present timely and engaging real world applications emphasizing the relevance of the material they are learning This edition continues the end of chapter Student Workshop activities to cater to the many different learning styles and to engage users in the practical aspect of the material discussed in the chapter

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understanding the fundamental principles of biochemistry Designed for students researchers and professionals it serves as a quick and accessible guide to navigate through the core elements of biochemistry facilitating a deeper comprehension of the molecular processes that underlie life

**A-level Chemistry Complete Guide (Yellowreef)** Thomas Bond,Chris Hughes,2019-09-06 first to provide exam data mining in study guide allow students to focus on most examined concepts cut study time and increase efficiency an expert guide to lead one abstract knowledge and wisdom provides exact accurate complete and independent self education the only guide currently that covers Planning Questions advanced trade book also suitable for Cambridge GCE AL H1 H2 Cambridge International A AS Level Cambridge Pre University Books available for other subjects including Physics Chemistry Biology Mathematics Economics English Primary level Secondary level GCE O level GCE A level iGCSE Cambridge A level Hong Kong DSE visit [www.yellowreef.com](http://www.yellowreef.com) for sample chapters and more

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**GO TO Objective NEET 2021 Chemistry Guide 8th Edition** Disha Experts, [Pp/Chemistry](#) BarCharts, Inc.,2008-06-18

Study and Problem Solving Guide to Accompany Principles of Modern Chemistry, [Oxtoby/Nachtrieb](#) Wade A. Freeman,1986

**The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry** Marcy Osgood,Karen A. Ocorr,2008-04-04 The Absolute Ultimate Guide combines an innovative study guide with a reliable solutions manual in one convenient printed volume

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**Laboratory Guide to Enzymology** Geoffrey A. Holdgate,Antonia Turberville,Alice Lanne,2024-03-05 LABORATORY GUIDE TO ENZYMOLOGY An accessible guide to understanding the foundations of enzymology at its application in drug discovery Enzymes are highly specialized proteins necessary for performing specific biochemical reactions essential for life in all organisms In disease the functioning of these enzymes can become altered and therefore enzymes represent a large class of key targets for drug discovery In order to successfully target dysfunctional enzymes pharmaceutically the unique mechanism of each enzyme must be

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Enables students to progressively build and apply new skills and knowledge Designed to be completed in one semester this text enables students to fully grasp and apply the core concepts of analytical chemistry and aqueous chemical equilibria Moreover the text enables readers to master common instrumental methods to perform a broad range of quantitative analyses Author Brian Tissue has written and structured the text so that readers progressively build their knowledge beginning with the most fundamental concepts and then continually applying these concepts as they advance to more sophisticated theories and applications Basics of Analytical Chemistry and Chemical Equilibria is clearly written and easy to follow with plenty of examples to help readers better understand both concepts and applications In addition there are several pedagogical features that enhance the learning experience including Emphasis on correct IUPAC terminology You Try It spreadsheets throughout the text challenging readers to apply their newfound knowledge and skills Online tutorials to build readers skills and assist them in working with the text s spreadsheets Links to analytical methods and instrument suppliers Figures illustrating principles of analytical chemistry and chemical equilibria End of chapter exercises Basics of Analytical Chemistry and Chemical Equilibria is written for undergraduate students who have completed a basic course in general

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Mastering Chemistry: A Comprehensive Guide to Excellence Dominic Front, Unlock the secrets of the universe through the lens of chemistry with Mastering Chemistry A Comprehensive Guide to Excellence Delve into the intricate world of atoms molecules and reactions as you embark on a journey through ten meticulously crafted chapters designed to equip you with the knowledge and skills needed to master this fascinating science From the fundamental principles of atomic structure and chemical bonding to advanced topics such as quantum chemistry and nanotechnology this book covers it all Explore the wonders of the laboratory with detailed explanations of essential techniques and safety protocols ensuring your experiments are conducted with precision and care Whether you're a student navigating the complexities of organic chemistry or a seasoned professional seeking to expand your understanding of environmental chemistry Mastering Chemistry provides comprehensive coverage of key concepts real world applications and cutting edge research With clear explanations insightful examples and practical tips this book is your indispensable companion on the path to becoming truly amazing at chemistry Discover the power of chemistry to transform the world around you and unlock your full potential with Mastering Chemistry Embrace the beauty of this dynamic science and embark on a journey of discovery that will ignite your curiosity expand your horizons and propel you towards excellence

*Analytical Chemistry* Bryan M. Ham, Aihui MaHam, 2024-03-12 ANALYTICAL CHEMISTRY Detailed reference covering all aspects of working in laboratories including safety fundamentals of analytical techniques lab instrumentation and more A comprehensive study of analytical chemistry as it pertains to the laboratory analyst and chemist Analytical Chemistry begins with an introduction to the laboratory environment including safety glassware common apparatuses and lab basics and continues on to guide readers through the fundamentals of analytical techniques such as spectroscopy and chromatography and introduce examples of laboratory programs such as Laboratory Information Management Systems LIMS This newly updated and revised Second Edition of Analytical Chemistry offers expanded chapters with new figures and the latest developments in the field Included alongside this new edition is an updated companion teaching reference and toolkit program called ChemTech Conveniently available via either app or browser the ChemTech program contains exercises that highlight and review topics covered in the book and features useful calculators

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**Chemistry, Student Study Guide** John A. Olmsted, Gregory M. Williams, 2002-01-04 This third edition continues to innovate by providing students with an integrated and modern approach to the subject The text emphasizes the modern tools of chemistry while incorporating historical evidence and its unique molecular quantitative emphasis is further reinforced by an integrated media package developed by the authors Also of benefit is the just in time presentation of key content only providing details once they are needed While key topics and analytical techniques have been updated there is now an additional third chapter on chemical equilibrium The authors have also developed an expanded and more integrated problem solving emphasis that now incorporates a 4 step strategy throughout complete with text icons The whole is backed by a range of supplements including a new illustration program a tutorial CD interactive learningware an extensive Web CT component an instructor s resource CD and a solution CD

## **Acid Base Equilibria Bluffer S Guide Answer** Book Review: Unveiling the Magic of Language

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### **Table of Contents Acid Base Equilibria Bluffer S Guide Answer**

1. Understanding the eBook Acid Base Equilibria Bluffer S Guide Answer
  - The Rise of Digital Reading Acid Base Equilibria Bluffer S Guide Answer
  - Advantages of eBooks Over Traditional Books
2. Identifying Acid Base Equilibria Bluffer S Guide Answer
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Acid Base Equilibria Bluffer S Guide Answer
  - User-Friendly Interface
4. Exploring eBook Recommendations from Acid Base Equilibria Bluffer S Guide Answer
  - Personalized Recommendations
  - Acid Base Equilibria Bluffer S Guide Answer User Reviews and Ratings
  - Acid Base Equilibria Bluffer S Guide Answer and Bestseller Lists



5. Accessing Acid Base Equilibria Bluffer S Guide Answer Free and Paid eBooks
  - Acid Base Equilibria Bluffer S Guide Answer Public Domain eBooks
  - Acid Base Equilibria Bluffer S Guide Answer eBook Subscription Services
  - Acid Base Equilibria Bluffer S Guide Answer Budget-Friendly Options
6. Navigating Acid Base Equilibria Bluffer S Guide Answer eBook Formats
  - ePub, PDF, MOBI, and More
  - Acid Base Equilibria Bluffer S Guide Answer Compatibility with Devices
  - Acid Base Equilibria Bluffer S Guide Answer Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Acid Base Equilibria Bluffer S Guide Answer
  - Highlighting and Note-Taking Acid Base Equilibria Bluffer S Guide Answer
  - Interactive Elements Acid Base Equilibria Bluffer S Guide Answer
8. Staying Engaged with Acid Base Equilibria Bluffer S Guide Answer
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Acid Base Equilibria Bluffer S Guide Answer
9. Balancing eBooks and Physical Books Acid Base Equilibria Bluffer S Guide Answer
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Acid Base Equilibria Bluffer S Guide Answer
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Acid Base Equilibria Bluffer S Guide Answer
  - Setting Reading Goals Acid Base Equilibria Bluffer S Guide Answer
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Acid Base Equilibria Bluffer S Guide Answer
  - Fact-Checking eBook Content of Acid Base Equilibria Bluffer S Guide Answer
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

#### 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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