

PROBLEMS/SOLUTIONS

1. The mixing ratio of oxygen in the atmosphere is 20.95%. Calculate the concentration in mol L⁻¹ and in g m⁻³ at P° (101 325 Pa, 1.00 atm) and 25°C.

Solution

The mixing ratio for O₂ (g) is 20.95% (Table 2.1). Use the 'Ideal Gas' law (PV = nRT) to calculate the total number of moles of gas in 1.00 L for the given conditions. Constants are given in Appendices B.1 and C.1.

T = 25°C (298 K), P = 1.01325 x 10⁵ Pa, R = 8.315 J K⁻¹ mol⁻¹, and V = 1.00 L = 1.00 x 10⁻³ m³

The total number of moles of gas in 1.00 L is

$$\begin{aligned} n &= PV/RT \\ n &= 0.04089 \text{ mol} \end{aligned}$$

The number of moles of oxygen can be calculated from the mole fraction (which is the same as the mixing ratio).

$$\% \text{ O}_2 = 20.95, \text{ mole fraction} = 0.2095$$

The number of moles of O₂ in 1.00 L is: 0.2095 x 0.04089 = 0.00857 mol

The concentration of O₂ (g) is: 8.57 x 10⁻³ mol L⁻¹.

The concentration of O₂ (g) in units of g m⁻³ is determined as follows:

1 m³ = 1000 L, therefore, 1000 L contains 8.57 moles of O₂ (g). (M.M. of O₂ is 31.9988 g mol⁻¹)

$$31.9988 \text{ g mol}^{-1} \times 8.57 \text{ mol m}^{-3} = 274 \text{ g m}^{-3}$$

The O₂ (g) concentration can be expressed as either 8.57 x 10⁻³ mol L⁻¹ or 274 g m⁻³.

2. Calculate the atmospheric pressure at the stratopause. What are the concentrations (mol m⁻³) of dioxygen and dinitrogen at this altitude? How do these concentrations compare with the corresponding values at sea level?

Solution

Use Equation 2.3 to calculate the pressure at 50 km (stratopause).

$$P_h = P^\circ e^{-\bar{M}_a g h}$$

R = 8.315 J K⁻¹ mol⁻¹, P° = 101 325 Pa, g = 9.81 m s⁻², $\bar{M}_a = 0.02896 \text{ kg mol}^{-1}$ (average molar mass of air), h = 50 km (50 000 m) and T = -2°C (271 K). Note: these last two parameters are the approximate altitude and temperature at the stratopause.

Solutions Manual For Environmental Chemistry

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Press, 2008-11-30 **Solutions Manual - Fundamentals of Environmental Chemistry Third Edition** Taylor & Francis Group, 2009-09-18 *Solutions Manual for Fundamentals of Environmental Chemistry* Harshavardhan D. Bapat, 2000-08

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Solutions Manual Clair Nathan Sawyer, McCarty, Gene F. Parkin, 1994 **A Laboratory Manual for Environmental Chemistry** R. Gopalan, R. Wilfred Sugumar, 2013-12-30 The present book is meant for the students who opt for a course in Environmental Chemistry with laboratory work as a component of the course Spread in 72 experiments the analyses of soil water and air have been described in a simple manner so that most of these experiments can be conducted even by the beginners in this subject The principles involved preparation of the reagents and the procedures are described for each experimental method The authors hope that this manual would prove to be useful in laboratories where soil water and air are

routinely tested

Environmental Chemodynamics Louis J. Thibodeaux, 1996-02-15 What happens to a chemical once it enters the natural environment How do its physical and chemical properties influence its transport persistence and partitioning in the biosphere How do natural forces influence its distribution How are the answers to these questions useful in making toxicological and epidemiological forecasts Environmental Chemodynamics Second Edition introduces readers to the concepts tools and techniques currently used to answer these and other critical questions about the fate and transport of chemicals in the natural environment Like its critically acclaimed predecessor its main focus is on the mechanisms and rates of movement of chemicals across the air soil soil water and water air interfaces and on how natural processes work to mobilize chemicals near and across interfaces information vital to performing human and ecological risk assessments Also consistent with the first edition Environmental Chemodynamics Second Edition is organized to accommodate readers of every level of experience The first section is devoted to theoretical underpinnings and includes discussions of mass balance thermodynamics transport science concepts and more The second section concentrates on practical aspects including the movement between bed sediment and water movement between soil and air and intraphase chemical behavior This revised and updated edition of Louis J Thibodeaux's 1979 classic features new or expanded coverage of Equilibrium models for environmental compartments Dry deposition of particles and vapors onto water and soil surfaces Chemical profiles in rivers and estuaries particles and porous media Fate and transport in the atmospheric boundary layer and within subterranean media Chemical exchange between water column and bed sediment Intraphase chemical transport and fate This Second Edition of Environmental Chemodynamics also includes twice as many references and 50% more exercises and practice problems

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D. Raff, 2013-08-26 From Reviews of the First Edition This splendid at times humorous and reasonably priced little book has much to commend it to undergraduate chemists and to other science students J G Farmer University of Edinburgh Complex environmental issues are presented in simple terms to help readers grasp the basics and solve relevant problems J Albaiges University of Barcelona The main strength of the book lies in its explanations of the calculation of quantitative relationships Each chapter includes 15-20 problems that are carefully chosen from a didactic standpoint for which the reader can find solutions at the end D Lenoir Institute for Ecological Chemistry What drew me to the first edition was the style the no nonsense down to earth explanations and the practical examples that litter the text The dry humor expressed in the footnotes is great and reminds me of other classic texts T Clough Lincoln University A practical approach to environmental chemistry Providing readers with the fundamentals of environmental chemistry and a toolbox for putting them into practice Elements of Environmental Chemistry Second Edition is a concise accessible and hands on volume designed for students and professionals working in the chemical and environmental sciences Tutorial in style this book fully incorporates real world problems and extensive end of chapter problem sets to immerse the reader in the field Chapters cover mass balance chemical kinetics carbon dioxide equilibria pesticide structures and much more Extensively revised updated and expanded this Second Edition includes new chapters on atmospheric chemistry climate change and polychlorinated biphenyls and dioxins and brominated flame retardants In addition new practice problems and a helpful tutorial on organic chemistry names and structures have been added to improve both the scope and accessibility of the book Principles and Applications of Aquatic Chemistry François M. M. Morel, Janet G. Hering, Laura Sigg, 2025-08-01 The definitive text for water chemistry professionals and students worldwide Principles and Applications of Aquatic Chemistry provides a solid foundation for understanding the chemistry of lakes oceans rivers estuaries and other natural waters Acclaimed for its user friendly pedagogy this classic textbook explains aquatic chemistry through the powerful application of the tableau system which provides a systematic way to organize complex chemical equilibrium problems Now in its second edition this title contains an entirely new introductory chapter and new coverage of ocean acidification advances in dissolution kinetics bioavailability of trace metals redox kinetics and updated thermodynamic data The use of computer programs to calculate chemical equilibrium in natural waters is illustrated Throughout this edition revised and streamlined material is supported by new real world examples and full color illustrations Accessible to those with diverse backgrounds in the sciences and engineering this essential textbook Covers the fundamentals of aquatic science including chemical thermodynamics acid base precipitation dissolution coordination reduction oxidation and adsorption reactions Explains the use of equilibrium calculations essential tools for understanding the chemical composition of aquatic systems and the fate of inorganic pollutants Provides quantitative treatments of the kinetics of chemical reactions in natural waters Features new and updated content that reflects advances in understanding the chemistry of natural waters Includes new end of chapter questions of various levels of

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 - The Rise of Digital Reading Solutions Manual For Environmental Chemistry
 - Advantages of eBooks Over Traditional Books
2. Identifying Solutions Manual For Environmental Chemistry
 - 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 Solutions Manual For Environmental Chemistry
 - User-Friendly Interface
4. Exploring eBook Recommendations from Solutions Manual For Environmental Chemistry

- Personalized Recommendations
- Solutions Manual For Environmental Chemistry User Reviews and Ratings
- Solutions Manual For Environmental Chemistry and Bestseller Lists
- 5. Accessing Solutions Manual For Environmental Chemistry Free and Paid eBooks
 - Solutions Manual For Environmental Chemistry Public Domain eBooks
 - Solutions Manual For Environmental Chemistry eBook Subscription Services
 - Solutions Manual For Environmental Chemistry Budget-Friendly Options
- 6. Navigating Solutions Manual For Environmental Chemistry eBook Formats
 - ePub, PDF, MOBI, and More
 - Solutions Manual For Environmental Chemistry Compatibility with Devices
 - Solutions Manual For Environmental Chemistry Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Solutions Manual For Environmental Chemistry
 - Highlighting and Note-Taking Solutions Manual For Environmental Chemistry
 - Interactive Elements Solutions Manual For Environmental Chemistry
- 8. Staying Engaged with Solutions Manual For Environmental Chemistry
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Solutions Manual For Environmental Chemistry
- 9. Balancing eBooks and Physical Books Solutions Manual For Environmental Chemistry
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Solutions Manual For Environmental Chemistry
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Solutions Manual For Environmental Chemistry
 - Setting Reading Goals Solutions Manual For Environmental Chemistry
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Solutions Manual For Environmental Chemistry

- Fact-Checking eBook Content of Solutions Manual For Environmental Chemistry
- 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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