

accurate vs precise chemistry

Accurate vs. Precise Chemistry: A Critical Examination

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Abstract: This article delves into the crucial distinction between accuracy and precision in chemistry, two concepts often conflated but fundamentally different. We explore the sources of error affecting both accuracy and precision, discuss their impact on experimental results, and highlight the importance of understanding and minimizing these errors to achieve reliable and meaningful chemical data. We will examine both the challenges and opportunities presented by striving for high accuracy and precision in various chemical contexts.

1. Introduction: The Foundation of Reliable Chemistry

The bedrock of any credible chemical investigation rests on the reliability of its data. This reliability depends critically on the accuracy and precision of the measurements performed. While often used interchangeably, accuracy and precision are distinct concepts representing different aspects of measurement quality. Understanding the difference between accurate vs precise chemistry is paramount for anyone involved in chemical experimentation, analysis, or research.

1. Defining Accuracy and Precision

Accuracy: Accuracy refers to how close a measured value is to the true or accepted value. A highly accurate measurement exhibits minimal systematic error, meaning the deviation from the true value is consistently small. In accurate vs precise chemistry discussions, accuracy is paramount for obtaining reliable results.

Precision: Precision, on the other hand, describes the reproducibility of measurements. A precise measurement shows minimal random error, meaning repeated measurements yield very similar results, regardless of their closeness to the true value. High precision indicates a consistent experimental procedure and minimal sources of random variation.

1. Sources of Error Affecting Accurate vs. Precise Chemistry

Both accuracy and precision are susceptible to various sources of error. Understanding these errors is critical to improving the quality of chemical measurements.

Systematic Errors (affecting accuracy): These errors consistently bias results in one direction.

Examples include:

Instrumental errors: Faulty calibration of instruments, malfunctioning equipment.

Method errors: Imperfect experimental techniques, inappropriate procedures.

Personal errors: Consistent biases in observation or recording data.

Random Errors (affecting precision): These errors introduce unpredictable variations in measurements. Examples include:

Environmental fluctuations: Temperature, pressure, humidity changes.

Random variations in materials: Slight differences in purity or composition of reagents.

Human error: Inconsistent execution of experimental steps.

1. Challenges in Achieving High Accuracy and Precision in Accurate vs Precise Chemistry

Striving for both high accuracy and precision presents significant challenges:

Complex chemical systems: Many chemical processes are inherently complex, involving multiple variables that are difficult to control and quantify.

Trace analysis: Detecting and measuring minute quantities of substances requires highly sensitive and precise instrumentation, prone to various systematic and random errors.

Matrix effects: The presence of interfering substances in a sample can significantly impact both accuracy and precision.

Sample heterogeneity: Inhomogeneous samples can lead to inconsistent measurements and reduced precision.

1. Opportunities Presented by Accurate vs. Precise Chemistry

Despite the challenges, achieving high accuracy and precision opens up many opportunities:

Improved quality control: Accurate and precise measurements are crucial for quality control in various industries, ensuring product consistency and safety.

Advanced materials development: Precise control over chemical reactions and compositions is vital for creating new materials with desired properties.

Environmental monitoring: Accurate measurements are essential for monitoring pollutants and assessing environmental risks.

Medical diagnostics: Accurate and precise chemical assays are crucial for diagnosing and treating diseases.

1. Strategies for Improving Accuracy and Precision in Accurate vs Precise Chemistry

Several strategies can be employed to enhance both accuracy and precision:

Proper calibration and maintenance of instruments: Regular calibration and maintenance of equipment are crucial for minimizing instrumental errors.

Careful experimental design: Well-designed experiments minimize sources of error and maximize the information obtained.

Use of appropriate statistical methods: Statistical analysis helps quantify and assess the uncertainties associated with measurements.

Standard reference materials: Comparison with certified reference materials helps validate the accuracy of measurements.

Blind sample analysis: Analyzing samples without prior knowledge of their composition helps eliminate bias.

Robust analytical methods: Employing validated and robust analytical methods minimizes both systematic and random errors.

1. Conclusion

The distinction between accurate vs precise chemistry is fundamental to obtaining reliable chemical data. While both accuracy and precision are desirable, the specific requirements may vary depending on the context. A thorough understanding of the sources of error, coupled with the implementation of appropriate strategies, is critical for achieving high-quality results in all areas of chemistry. By focusing on both accuracy and precision, we can advance scientific knowledge, improve technological innovation, and protect public health and the environment.

FAQs

1. Can a measurement be precise but not accurate? Yes, repeated measurements can be very close to each other (precise) but far from the true value (inaccurate) due to systematic errors.
1. Can a measurement be accurate but not precise? Less common, but possible. A single measurement could be close to the true value by chance, but repeated measurements would likely show significant variation.
1. How does statistical analysis help in accurate vs precise chemistry? Statistical analysis allows for the quantification of error, identification of outliers, and assessment of the overall

uncertainty in measurements.

1. What is the role of quality control in ensuring accurate vs precise chemistry? Quality control procedures ensure that measurements are accurate and precise by regularly checking equipment calibration, validating methods, and analyzing control samples.
1. How does the choice of analytical method affect accuracy and precision? The chosen method significantly influences accuracy and precision; some methods are inherently more precise or accurate than others for specific analytes.
1. What is the significance of using standard reference materials? Standard reference materials provide a benchmark against which the accuracy of measurements can be validated.
1. How can we minimize human error in chemical measurements? Careful training, standardized procedures, and meticulous record-keeping minimize human error.
1. What are the consequences of inaccurate or imprecise chemical data? Inaccurate or imprecise data can lead to flawed conclusions, inefficient processes, compromised safety, and economic losses.
1. How can advancements in technology improve accuracy and precision in chemistry? Advancements in instrumentation, automation, and data analysis techniques continuously improve the accuracy and precision of chemical measurements.

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accurate vs precise chemistry: *The Values of Precision* M. Norton Wise, 2020-09-01 The Values of Precision examines how exactitude has come to occupy such a prominent place in Western culture. What has been the value of numerical values? Beginning with the late eighteenth century

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accurate vs precise chemistry: College Physics for AP® Courses Irna Lyublinskaya, Douglas Ingram, Gregg Wolfe, Roger Hinrichs, Kim Dirks, Liza Pujji, Manjula Devi Sharma, Sudhi Oberoi, Nathan Czuba, Julie Kretchman, John Stoke, David Anderson, Erika Gasper, 2015-07-31 This introductory, algebra-based, two-semester college physics book is grounded with real-world examples, illustrations, and explanations to help students grasp key, fundamental physics concepts. ... This online, fully editable and customizable title includes learning objectives, concept questions, links to labs and simulations, and ample practice opportunities to solve traditional physics application problems.--Website of book.

accurate vs precise chemistry: Data Analysis for Chemistry D. Brynn Hibbert, J. Justin Gooding, 2006 Annotation. Definitions, Questions, and Useful Functions: Where to Find Things and What To Do1. Introduction2. Describing Data3. Hypothesis Testing4. Analysis of Variance5. Calibration.

accurate vs precise chemistry: Exploring Chemical Analysis Daniel C. Harris, 2012-04 'Exploring Chemical Analysis' teaches students how to understand analytical results and how to use quantitative manipulations, preparing them for the problems they will encounter.

accurate vs precise chemistry: Accuracy in Trace Analysis , 1975

accurate vs precise chemistry: Basic Concepts of Chemistry Leo J. Malone, Theodore O. Dolter, 2011-12-27 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. 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. WileyPLUS sold separately from text.

accurate vs precise chemistry: Accuracy in Trace Analysis Philip D. LaFleur, 1975

accurate vs precise chemistry: Pharmaceutical Calculations Michalakakis Savva, 2019-10-17 Pharmaceutical Calculations: A Conceptual Approach, is a book that combines conceptual and procedural understanding for students and will guide you to master prerequisite skills to carry out accurate compounding and dosage regimen calculations. It is a book that makes the connection between basic sciences and pharmacy. It describes the most important concepts in pharmaceutical sciences thoroughly, accurately and consistently through various commentaries and activities to make you a scientific thinker, and to help you succeed in college and licensure exams. Calculation of the error associated with a dose measurement can only be carried out after understanding the concept of accuracy versus precision in a measurement. Similarly, full appreciation of drug

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accurate vs precise chemistry: NBS Special Publication , 1978

accurate vs precise chemistry: Analytical Methods for Safeguards and Accountability Measurements of Special Nuclear Materials H. Thomas Yolken, John E. Bullard, 1978

accurate vs precise chemistry: Fundamentals of Chemistry Laboratory Studies Frank Brescia, 2012-12-02 Fundamentals of Chemistry: Laboratory Studies focuses on the techniques involved in chemical laboratory operations. Divided into 13 parts, the manual gives information on weights and measures; the different states of matter; atomic and molecular weights; and electron charge. Giving support to these discussions are experiments that show the changes in weight and electron charge of metals, gases, and other materials when exposed to different conditions. The text also looks at experiments on the gravimetric and volumetric stoichiometry of chlorides, sulfates, acids, antimony, and oxalates. The manual also highlights studies conducted on potassium nitrate and chlorate, oxygen, hydrogen, and polymers. The guidebook ends with discussions on molecular geometry, kinetics, and chemical equilibrium. Experiments and illustrations of chemical reactions are presented. Taking into consideration the value of data presented, the manual is a great find for readers wanting to introduce an organized system in conducting laboratory experiments.

accurate vs precise chemistry: Catalog of National Bureau of Standards Publications, 1966-1976 United States. National Bureau of Standards, 1978

accurate vs precise chemistry: Catalog of National Bureau of Standards Publications, 1966-1976: pt. 1 Citations and abstracts. v. 2. pt. 1. Key word index (A through L). v. 2. pt. 2. Key word index (M through Z) United States. National Bureau of Standards. Technical Information and Publications Division, 1978

accurate vs precise chemistry: Introduction to Chemistry Tracy Poulsen, 2013-07-18 Designed for students in Nebo School District, this text covers the Utah State Core Curriculum for chemistry with few additional topics.

accurate vs precise chemistry: Chemistry in the Community (ChemCom) American Chemical Society, 2011-06-17 Touted as the most successful NSF-funded project published, Chemistry in the Community (ChemCom) by the American Chemical Society (ACS) offers a meaningful and memorable chemistry program for all levels of high school students. ChemCom covers traditional chemistry topics within the context of societal issues and real-world scenarios. Centered on decision-making activities where students are responsible for generating data in an investigating, analyzing that data and then applying their chemistry knowledge to solve the presented problem. The text is intensively laboratory-based, with all 39 of the investigations integrated within the text, not separate from the reading. With the ChemCom program, students learn more organic and biochemistry, more environmental and industrial chemistry, and more on the particulate nature of matter than other textbooks all within the relevance of solving problems that arise in everyday life. Meticulously updated to meet the needs of today's teachers and students, the new sixth edition of ChemCom adheres to the new science framework as well as the forthcoming next generation of science standards. Incorporating advances in learning and cognitive sciences, ChemCom's wide-ranging coverage builds upon the concepts and principles found in the National

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accurate vs precise chemistry: Ebook: Chemistry: The Molecular Nature of Matter and Change Silberberg, 2015-01-16 Ebook: Chemistry: The Molecular Nature of Matter and Change

accurate vs precise chemistry: Near Infrared Reflectance Spectroscopy (NIRS) , 1985

accurate vs precise chemistry: Agriculture Handbook , 1949 Set includes revised editions of some issues.

accurate vs precise chemistry: *Illustrated Guide to Home Chemistry Experiments* Robert Bruce Thompson, 2012-02-17 For students, DIY hobbyists, and science buffs, who can no longer get real chemistry sets, this one-of-a-kind guide explains how to set up and use a home chemistry lab, with step-by-step instructions for conducting experiments in basic chemistry -- not just to make pretty colors and stinky smells, but to learn how to do real lab work: Purify alcohol by distillation Produce hydrogen and oxygen gas by electrolysis Smelt metallic copper from copper ore you make yourself Analyze the makeup of seawater, bone, and other common substances Synthesize oil of wintergreen from aspirin and rayon fiber from paper Perform forensics tests for fingerprints, blood, drugs, and poisons and much more From the 1930s through the 1970s, chemistry sets were among the most popular Christmas gifts, selling in the millions. But two decades ago, real chemistry sets began to disappear as manufacturers and retailers became concerned about liability. The Illustrated Guide to Home Chemistry Experiments steps up to the plate with lessons on how to equip your home chemistry lab, master laboratory skills, and work safely in your lab. The bulk of this book consists of 17 hands-on chapters that include multiple laboratory sessions on the following topics: Separating Mixtures Solubility and Solutions Colligative Properties of Solutions Introduction to Chemical Reactions & Stoichiometry Reduction-Oxidation (Redox) Reactions Acid-Base Chemistry Chemical Kinetics Chemical Equilibrium and Le Chatelier's Principle Gas Chemistry Thermochemistry and Calorimetry Electrochemistry Photochemistry Colloids and Suspensions Qualitative Analysis Quantitative Analysis Synthesis of Useful Compounds Forensic Chemistry With plenty of full-color illustrations and photos, *Illustrated Guide to Home Chemistry Experiments* offers introductory level sessions suitable for a middle school or first-year high school chemistry laboratory course, and more advanced sessions suitable for students who intend to take the College Board Advanced Placement (AP) Chemistry exam. A student who completes all of the laboratories in this book will have done the equivalent of two full years of high school chemistry lab work or a first-year college general chemistry laboratory course. This hands-on introduction to real chemistry -- using real equipment, real chemicals, and real quantitative experiments -- is ideal for the many thousands of young people and adults who want to experience the magic of chemistry.

accurate vs precise chemistry: Basic Concepts Of Analytical Chemistry S M Khopkar, 1998 Analytical Chemistry Has Made Significant Progress In The Last Two Decades. Several Methods Have Come To The Forefront While Some Classical Methods Have Been Relegated. An Attempt Has Been Made In This Edition To Strike A Balance Between These Two Extremes, By Retaining Most Significant Methods And Incorporating Some Novel Techniques. Thus An Endeavour Has Been Made To Make This Book Up To Date With Recent Methods. The First Part Of This Book Covers The Classical Volumetric As Well As Gravimetric Methods Of Analysis. The Separation Methods Are Prerequisite For Dependable Quantitative Methods Of Analysis. Therefore Not Only Solvent Extraction Separations But Also Chromatographic Methods Such As Adsorption, Partition, Ion-Exchange, Exclusion And electro Chromatography Have Been Included. To Keep Pace With Modern Developments The Newly Discovered Techniques Such As Ion Chromatography, Super-Critical Fluid Chromatography And Capillary Electrophoresis Have Been Included. The Next Part Of The Book Encompasses The Well Known Spectroscopic Methods Such As Uv, Visible, Ir, Nmr, And Esr Techniques And Also Atomic Absorption And Plasma Spectroscopy And Molecular Luminescences Methods. Novel Analytical Techniques Such As Auger, Esca And Photo Acoustic Spectroscopy Of Surfaces Are Also Included. The Final Part Of This Book Covers Thermal And Radioanalytical Methods Of Analysis. The Concluding Chapters On Electroanalytical Techniques Include

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accurate vs precise chemistry: Calibration and Validation of Analytical Methods Mark Stauffer, 2018-04-25 This book seeks to introduce the reader to current methodologies in analytical calibration and validation. This collection of contributed research articles and reviews addresses current developments in the calibration of analytical methods and techniques and their subsequent validation. Section 1, Introduction, contains the Introductory Chapter, a broad overview of analytical calibration and validation, and a brief synopsis of the following chapters. Section 2 Calibration Approaches presents five chapters covering calibration schemes for some modern analytical methods and techniques. The last chapter in this section provides a segue into Section 3, Validation Approaches, which contains two chapters on validation procedures and parameters. This book is a valuable source of scientific information for anyone interested in analytical calibration and validation.

accurate vs precise chemistry: Analytical Chemistry Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug, 2013-10-07 The 7th Edition of Gary Christian's Analytical Chemistry focuses on more in-depth coverage and information about Quantitative Analysis (aka Analytical Chemistry) and related fields. The content builds upon previous editions with more enhanced content that deals with principles and techniques of quantitative analysis with more examples of analytical techniques drawn from areas such as clinical chemistry, life sciences, air and water pollution, and industrial analyses.

accurate vs precise chemistry: Treatise on Analytical Chemistry: Analytical chemistry in industry. v Izaak Maurits Kolthoff, Philip Juliber Elving, 1959

accurate vs precise chemistry: Publications United States. National Bureau of Standards, 1977

accurate vs precise chemistry: Publications of the National Bureau of Standards United States. National Bureau of Standards, 1976

accurate vs precise chemistry: Publications of the National Bureau of Standards ... Catalog United States. National Bureau of Standards, 1977

accurate vs precise chemistry: Publications of the National Institute of Standards and Technology ... Catalog National Institute of Standards and Technology (U.S.), 1977

accurate vs precise chemistry: Clinical Chemistry N.C. den Boer, 2012-12-06 The XIIIth International and the VIIth European Congress of Clinical Chemistry took place at the Netherlands Congress Centre in The Hague, from June 28th to July 3rd 1987. The Organizing Committee and the Scientific Committee for these combined congresses aimed to present the state-of-the-science as well as the state-of-the-art for those fields of clinical chemistry which show a strong progress and which will most probably inflict a great part of all clinical chemists. Clinical Chemistry, an Overview comprises almost all papers which were presented during the congress in 5 plenary lectures and 97 lectures during 24 symposia. The invited speakers, being experts in their fields of clinical chemistry, succeeded very well in presenting an overview over the newest developments in connection to the knowledge already known, thereby demonstrating the progress made in clinical chemistry during the last years. The Editors take great pleasure in thanking once more the members of the Scientific Committee and of the International Scientific Advisory Board in creating an excellent scientific programme for this congress. The Editors also take great pleasure in thanking all those whose efforts have made possible the publication of this book. We are most grateful to all speakers who also prepared a manuscript for publication. The Editors also appreciate the most helpful and

encouraging attitude of Plenum Press Publishers Corporation.

accurate vs precise chemistry: *Publications of the National Bureau of Standards, 1976 Catalog* United States. National Bureau of Standards, 1977

accurate vs precise chemistry: More Modern Chemical Techniques Ralph Levinson, 2001 This book identifies some applications of important chemical techniques in use today which illustrate how chemistry is using state-of-the-art technology to push back the frontiers.

accurate vs precise chemistry: Chemical Fate and Transport in the Environment Harold F. Hemond, Elizabeth J. Fechner, 2022-08-03 *Chemical Fate and Transport in the Environment*, Fourth Edition explains the fundamental principles of mass transport, chemical partitioning, and chemical/biological transformations of pollutants and naturally occurring chemicals in surface waters, in the subsurface (which includes soil and groundwater), and in the atmosphere. Each of these three major environmental media is introduced by a descriptive overview, followed by presentations of the governing physical, chemical, and biological processes. The text emphasizes intuitively based mathematical models for chemical equilibria, transformations, and transport in the environment. This book serves as a primary text for graduate and senior undergraduate courses in environmental science and engineering, provides relevant scientific knowledge for students of public health and environmental policy, and is a useful reference for environmental practitioners. This fourth edition builds on the third edition, which won a 2015 Textbook Excellence Award (Texty) from The Text and Academic Authors Association. This updated textbook expands the discussion of global climate change, presents concepts of stationarity and sustainability, provides additional coverage of wastewater treatment and air pollution abatement technologies, and includes information on additional anthropogenic pollutants such as plastics, PFAS, and nanoparticles. Tables, figures, and references are updated, and worked examples and practice exercises are included for each chapter. - Illustrates the interconnections, similarities, and contrasts among three major environmental media: surface waters, the subsurface (which includes soil and groundwater), and the atmosphere - Discusses and builds upon fundamental concepts, teaching students to realistically address environmental problems and preparing students for more advanced studies - Each chapter includes many worked examples and extensive practice exercises; a solutions manual is available for instructors

accurate vs precise chemistry: Albright's Chemical Engineering Handbook Lyle Albright, 2008-11-20 Taking greater advantage of powerful computing capabilities over the last several years, the development of fundamental information and new models has led to major advances in nearly every aspect of chemical engineering. Albright's Chemical Engineering Handbook represents a reliable source of updated methods, applications, and fundamental concepts that will continue to play a significant role in driving new research and improving plant design and operations. Well-rounded, concise, and practical by design, this handbook collects valuable insight from an exceptional diversity of leaders in their respective specialties. Each chapter provides a clear review of basic information, case examples, and references to additional, more in-depth information. They explain essential principles, calculations, and issues relating to topics including reaction engineering, process control and design, waste disposal, and electrochemical and biochemical engineering. The final chapters cover aspects of patents and intellectual property, practical communication, and ethical considerations that are most relevant to engineers. From fundamentals to plant operations, Albright's Chemical Engineering Handbook offers a thorough, yet succinct guide to day-to-day methods and calculations used in chemical engineering applications. This handbook will serve the needs of practicing professionals as well as students preparing to enter the field.

accurate vs precise chemistry: The Maillard Reaction Sian E Fayle, Juliet A. Gerrard, 2007-10-31 It is almost 100 years since the Maillard reaction was first described. Despite decades of research since then, the products of the reaction and the mechanistic pathways leading to their formation are only gradually being unravelled. Combining comprehensive information regarding the various methods that can be employed in the analysis of Maillard products with a discussion of the advantages and limitations of those methods, this unique book provides a 'one-stop' text from which

methods of analysis may be obtained. It will be useful for both new and experienced researchers who are involved in solving the mysteries and complexities of Maillard chemistry.

accurate vs precise chemistry: Validation in Chemical Measurement Paul De Bièvre, Helmut Günzler, 2005-12-06 The validation of analytical methods is based on the characterisation of a measurement procedure (selectivity, sensitivity, repeatability, reproducibility). This volume collects 31 outstanding papers on the topic, mostly published in the period 2000-2003 in the journal Accreditation and Quality Assurance. They provide the latest understanding, and possibly the rationale why it is important to integrate the concept of validation into the standard procedures of every analytical laboratory. In addition, this anthology considers the benefits to both: the analytical laboratory and the user of the measurement results.

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accurate vs precise chemistry: Industrial & Engineering Chemistry, 1928

accurate vs precise chemistry: Cambridge IGCSE Chemistry Coursebook with CD-ROM

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accurate vs precise chemistry: Kirk-Othmer Concise Encyclopedia of Chemical Technology, 2 Volume Set Kirk-Othmer, 2007-07-16 This is an easily-accessible two-volume encyclopedia summarizing all the articles in the main volumes Kirk-Othmer Encyclopedia of Chemical Technology, Fifth Edition organized alphabetically. Written by prominent scholars from industry, academia, and research institutions, the Encyclopedia presents a wide scope of articles on chemical substances, properties, manufacturing, and uses; on industrial processes, unit operations in chemical engineering; and on fundamentals and scientific subjects related to the field.

accurate vs precise chemistry: The Environmental Chemistry of Aluminum, Second

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Accurate's background screening solutions help you hire the talent you need to take your organization to the next level. Comprehensive services such as employment verification, ...

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Organise a chat to discuss your employment screening requirements with one of Accurate Background's screening specialists.

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If you believe there are inaccurate or incomplete results on your report, you may file a dispute. Please provide as much detail as possible so we may address this as soon as possible for you.

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