

periodic trends pogil

periodic trends pogil serves as an essential educational tool designed to enhance students' understanding of the periodic trends within the periodic table of elements. This teaching strategy employs Process Oriented Guided Inquiry Learning (POGIL) to actively engage learners in exploring and analyzing the variations in atomic and chemical properties across periods and groups. Key periodic trends such as atomic radius, ionization energy, electronegativity, and electron affinity are examined to reveal underlying patterns dictated by atomic structure. Understanding these trends is fundamental for students in chemistry and related sciences, as it provides insight into element behavior and reactivity. This article delves into the various periodic trends explored in POGIL activities, explains their causes, and discusses their significance in chemical education. The following sections outline the main areas covered, setting a clear path through the comprehensive analysis of periodic trends using the POGIL method.

- Overview of Periodic Trends
- Atomic Radius Trends
- Ionization Energy and Its Patterns
- Electronegativity Across the Periodic Table
- Electron Affinity and Its Variations
- Application of Periodic Trends in Chemical Behavior

Overview of Periodic Trends

Periodic trends refer to the predictable changes in elemental properties observed across periods (rows) and groups (columns) of the periodic table. These trends arise from the structure of atoms, particularly the arrangement of electrons in shells and subshells around the nucleus. The POGIL approach focuses on guiding students to investigate these patterns through inquiry and collaborative learning, fostering a deeper conceptual grasp of how atomic number, nuclear charge, and electron configuration influence element characteristics. Key trends include atomic radius, ionization energy, electronegativity, and electron affinity, all of which exhibit systematic variations that help predict chemical behavior and bonding tendencies.

Atomic Radius Trends

Definition and Measurement

Atomic radius is defined as the average distance from the nucleus to the outermost electron cloud in an atom. It is typically measured using experimental techniques such as X-ray crystallography or inferred from bonding distances in molecules. Atomic radius is a fundamental property that influences many aspects of an element's chemistry, including its ability to form bonds and its reactivity.

Trend Across Periods

Moving from left to right across a period, the atomic radius generally decreases. This trend occurs because electrons are added to the same principal energy level while the number of protons in the nucleus increases, resulting in a stronger effective nuclear charge. The increased attraction pulls the electron cloud closer to the nucleus, shrinking the atomic size.

Trend Down Groups

Conversely, atomic radius increases down a group as additional electron shells are added. Each new period introduces a new principal energy level, placing valence electrons farther from the nucleus. Despite the increase in nuclear charge, the shielding effect of inner electrons reduces the effective nuclear attraction on valence electrons, leading to larger atomic sizes.

- Across a period: atomic radius decreases
- Down a group: atomic radius increases

Ionization Energy and Its Patterns

Understanding Ionization Energy

Ionization energy (IE) is the energy required to remove an electron from a gaseous atom or ion. It reflects how strongly an atom holds onto its electrons and is crucial for understanding element reactivity, especially in forming cations.

Periodic Trends in Ionization Energy

Ionization energy generally increases across a period from left to right due to increasing nuclear charge and decreasing atomic radius, which result in a stronger attraction between the nucleus and electrons. This makes it more difficult to remove an electron. In contrast, ionization energy decreases down a group because the outermost electrons are farther from the nucleus and shielded by inner electrons, making them easier to remove.

Exceptions to Ionization Energy Trends

Some anomalies exist, such as the slight decrease in ionization energy between group 2 and group 13 elements or between group 15 and group 16 elements. These exceptions are explained by electron configurations and subshell arrangements, which affect electron stability and removal energy.

Electronegativity Across the Periodic Table

What Is Electronegativity?

Electronegativity is a measure of an atom's ability to attract and hold electrons within a chemical bond. This property influences bond polarity and molecular structure, playing a vital role in predicting molecule behavior and interactions.

Periodic Trends in Electronegativity

Electronegativity increases from left to right across a period as atoms have more protons and a smaller atomic radius, enhancing their attraction for bonding electrons. It decreases down a group because valence electrons are farther from the nucleus and more shielded, reducing the atom's pull on shared electrons.

Common Electronegativity Scales

The Pauling scale is the most widely used measure of electronegativity, assigning values based on bond energies. Understanding these values helps students interpret chemical bonding patterns in POGIL exercises.

Electron Affinity and Its Variations

Definition of Electron Affinity

Electron affinity (EA) refers to the energy change when an electron is added to a neutral atom in the gaseous state, forming an anion. It indicates an atom's tendency to gain electrons and is essential for understanding reduction reactions and ionic bond formation.

Trends in Electron Affinity

Electron affinity generally becomes more negative (indicating a greater release of energy) across a period, reflecting increased nuclear charge and a stronger attraction for added electrons. Down a group, electron affinity usually becomes less negative due to increased atomic radius and electron shielding, reducing the attraction for extra electrons.

Irregularities in Electron Affinity

Some elements show positive electron affinity values or irregular trends due to electron-electron repulsions in newly added orbitals or filled subshell stability. These exceptions are important for understanding the nuances of periodic behavior in POGIL activities.

Application of Periodic Trends in Chemical Behavior

Predicting Reactivity

Periodic trends provide a framework for predicting the chemical reactivity of elements. For example, metals with low ionization energies tend to lose electrons easily and participate in oxidation reactions, while nonmetals with high electronegativity and electron affinity are more likely to gain electrons and undergo reduction.

Understanding Bonding and Compound Formation

The concepts of atomic radius, electronegativity, and ionization energy are crucial for rationalizing the types of bonds elements form—whether ionic, covalent, or metallic. Differences in electronegativity between atoms determine bond polarity and molecular properties.

Use in Laboratory and Theoretical Chemistry

Mastery of periodic trends through POGIL activities equips students to

anticipate outcomes in chemical synthesis, analyze spectroscopic data, and engage effectively in computational modeling by understanding fundamental atomic properties.

1. Element Reactivity Prediction
2. Bond Type and Polarity Determination
3. Chemical Synthesis and Reaction Mechanisms
4. Material Science and Periodic Property Utilization

Frequently Asked Questions

What is the main objective of a Periodic Trends POGIL activity?

The main objective of a Periodic Trends POGIL activity is to help students explore and understand patterns in the periodic table, such as atomic radius, ionization energy, and electronegativity, through guided inquiry and collaborative learning.

How does atomic radius change across a period and down a group in the periodic table?

Atomic radius decreases across a period from left to right due to increasing nuclear charge pulling electrons closer, and it increases down a group because additional electron shells are added, increasing the distance from the nucleus.

Why does ionization energy generally increase across a period in a POGIL activity?

Ionization energy increases across a period because atoms have more protons, which increases nuclear attraction, making it harder to remove an electron.

What role do electrons play in determining electronegativity trends during a Periodic Trends POGIL?

Electrons affect electronegativity because atoms with more effective nuclear charge attract bonding electrons more strongly, causing electronegativity to generally increase across a period and decrease down a group.

How does the concept of shielding explain periodic trends observed in POGIL activities?

Shielding occurs when inner electrons reduce the effective nuclear charge felt by outer electrons, which explains why atomic radius increases down a group and why ionization energy decreases down a group.

What is the significance of effective nuclear charge in understanding periodic trends in POGIL?

Effective nuclear charge is the net positive charge experienced by an electron after accounting for shielding, and it helps explain trends such as the decrease in atomic radius and increase in ionization energy across a period.

In a Periodic Trends POGIL, how is electron affinity trend generally described across the periodic table?

Electron affinity generally becomes more negative across a period, indicating atoms more readily gain electrons, while it becomes less negative down a group due to increased atomic size and decreased nuclear attraction.

Why are exceptions to periodic trends important to explore in a POGIL activity?

Exceptions highlight the complexity of electron configurations and sublevel filling, helping students understand that trends are general patterns with specific deviations caused by factors like electron repulsion.

How does the Periodic Trends POGIL promote critical thinking about chemical properties?

By guiding students through data analysis and reasoning about atomic structure, the POGIL encourages them to make connections and explain why elements behave the way they do, enhancing deeper understanding.

What are common misconceptions about periodic trends that a POGIL activity aims to address?

Common misconceptions include thinking atomic size always increases left to right or that all trends are linear; a POGIL activity clarifies these by providing evidence and explanations based on atomic structure.

Additional Resources

1. *Periodic Trends POGIL Activities*

This book provides a comprehensive set of Process Oriented Guided Inquiry Learning (POGIL) activities focused on periodic trends in the periodic table. It is designed to engage students in active learning through structured group work and inquiry-based tasks. The activities cover key concepts such as atomic radius, ionization energy, and electronegativity, helping students build a strong conceptual understanding.

2. *Understanding Periodic Trends Through POGIL*

This resource offers detailed guided inquiry lessons that help students explore and understand periodic trends systematically. It includes worksheets, diagrams, and questions that encourage critical thinking about the arrangement of elements and their properties. The book is suitable for high school and introductory college chemistry courses.

3. *POGIL Chemistry: Periodic Trends Edition*

Focusing on the periodic table, this edition of POGIL Chemistry introduces students to trends such as reactivity, electron affinity, and metallic character. The activities are designed to foster collaboration and deeper comprehension through active learning strategies. The book also provides instructor notes and assessment tools.

4. *Exploring the Periodic Table with POGIL*

This book emphasizes inquiry-based learning to explore the periodic table and its trends. Students engage with interactive activities that reveal the rationale behind periodic properties and element classification. It is an excellent supplement for teachers aiming to enhance student engagement in chemistry.

5. *Active Learning in Chemistry: Periodic Trends POGIL*

This title focuses on incorporating active learning techniques into the study of periodic trends. It features POGIL activities that challenge students to analyze data and draw conclusions about element properties. The book supports diverse learning styles and promotes teamwork in the classroom.

6. *Periodic Table Patterns: A POGIL Approach*

This book uses the POGIL framework to help students identify and explain patterns in the periodic table. Through step-by-step guided inquiry, learners investigate trends such as atomic size and ionization energies. The resource is designed to build foundational knowledge while encouraging scientific reasoning.

7. *Inquiry-Based Chemistry: Periodic Trends and the POGIL Method*

Combining inquiry-based learning with the POGIL method, this book helps students explore periodic trends in a structured manner. It includes real-world examples and problem-solving exercises to enhance understanding. Teachers will find it useful for creating interactive chemistry lessons.

8. *POGIL Activities for Teaching Periodic Trends*

This collection of activities focuses specifically on teaching periodic trends using the POGIL model. It provides clear instructions and student-centered tasks that promote exploration and discovery. The book is ideal for instructors seeking innovative ways to teach the periodic table.

9. Chemistry Concepts: Periodic Trends with POGIL

Designed for high school and undergraduate students, this book integrates POGIL activities with core chemistry concepts related to periodic trends. It encourages learners to engage actively with the material, fostering a deeper understanding of element behavior. The text also includes assessment questions and answer keys for instructors.

Periodic Trends Pogil

Understanding Periodic Trends: A POGIL Approach to Mastering Chemistry

Write a comprehensive description of the topic, detailing its significance and relevance with the title heading, "Understanding Periodic Trends: A POGIL Approach to Mastering Chemistry". This ebook delves into the fascinating world of periodic trends, explaining how the properties of elements change across the periodic table. Mastering these trends is crucial for understanding chemical reactivity, bonding, and the behavior of matter. We will explore these trends using the Process-Oriented Guided-Inquiry Learning (POGIL) methodology, a proven approach that fosters deeper understanding and critical thinking skills in students. The POGIL approach encourages active learning and collaboration, making the learning process more engaging and effective. This ebook is designed for high school and introductory college chemistry students, providing a clear, concise, and engaging guide to mastering periodic trends.

Ebook Title: Mastering Periodic Trends Through POGIL Activities

Contents:

Introduction: What are periodic trends? Why are they important? Introducing the POGIL methodology.

Chapter 1: Atomic Radius and Ionic Radius: Exploring trends in atomic and ionic size, including factors influencing these trends.

Chapter 2: Ionization Energy and Electron Affinity: Understanding the energy changes associated with removing or adding electrons to atoms.

Chapter 3: Electronegativity: Delving into the ability of an atom to attract electrons in a chemical bond.

Chapter 4: Metallic Character: Exploring the properties and trends associated with metallic behavior in elements.

Chapter 5: Applying Periodic Trends to Predict Chemical Behavior: Using the knowledge gained to

predict reactivity and bonding in compounds.

Conclusion: Recap of key concepts, emphasizing the interconnectedness of periodic trends and their application in chemistry. Suggestions for further learning.

Detailed Outline Explanation:

Introduction: This section sets the stage by defining periodic trends, explaining their significance in chemistry, and introducing the POGIL approach, highlighting its benefits for active learning and knowledge retention. It will also briefly cover the structure of the ebook.

Chapter 1: Atomic Radius and Ionic Radius: This chapter explores the size of atoms and ions, explaining the trends observed across periods and down groups. It will examine the effects of shielding and effective nuclear charge on atomic and ionic radii, incorporating POGIL activities to solidify understanding. Students will practice predicting relative sizes of atoms and ions.

Chapter 2: Ionization Energy and Electron Affinity: This chapter focuses on the energy required to remove an electron (ionization energy) and the energy released when an electron is added (electron affinity). The trends in these properties across the periodic table will be explained, emphasizing the relationship between these energies and electron configuration. POGIL activities will involve predicting ionization energies and electron affinities based on electronic structure.

Chapter 3: Electronegativity: This chapter defines electronegativity and its importance in chemical bonding. The trends in electronegativity across the periodic table will be explored, along with its relationship to other periodic properties like ionization energy and electron affinity. POGIL activities will include predicting the polarity of bonds based on electronegativity differences.

Chapter 4: Metallic Character: This chapter explores the characteristics of metals and how these properties change across the periodic table. It will discuss the relationship between metallic character, ionization energy, and electronegativity. POGIL activities will involve identifying metals, nonmetals, and metalloids based on their position in the periodic table and properties.

Chapter 5: Applying Periodic Trends to Predict Chemical Behavior: This chapter focuses on applying the knowledge of periodic trends to predict chemical behavior, including reactivity, bonding types (ionic, covalent, metallic), and the formation of compounds. POGIL activities will involve predicting the products of chemical reactions and explaining the reactivity of different elements based on their position in the periodic table and their properties.

Conclusion: This section summarizes the key periodic trends discussed, highlighting the interconnections between them. It will reinforce the importance of understanding these trends for advanced chemistry concepts and provide resources for further study, reinforcing the practical application of the learned concepts.

Recent Research and Practical Tips:

Recent research continues to refine our understanding of periodic trends, particularly at the extremes of the periodic table. For example, studies on superheavy elements are pushing the

boundaries of our understanding of atomic properties. These studies rely heavily on sophisticated computational methods to predict properties that are difficult to measure experimentally.

Practical Tips for Mastering Periodic Trends using the POGIL approach:

Active Participation: The POGIL method requires active participation. Don't just read; actively engage with the activities and discussions.

Collaboration: Work with your peers. Discussing concepts with others helps solidify understanding and identify misconceptions.

Focus on the "Why": Don't just memorize the trends; understand the underlying reasons for the observed patterns. This will lead to better retention and application.

Visual Aids: Use visual aids like periodic tables, diagrams, and graphs to better understand the relationships between different properties.

Practice Problems: Regularly work through practice problems to apply your knowledge and identify areas where you need further clarification.

Real-World Applications: Relate the concepts to real-world applications. This makes learning more engaging and helps you see the relevance of the material.

Utilize Online Resources: Explore interactive periodic tables and online simulations to enhance your understanding.

Keywords:

Periodic trends, POGIL, atomic radius, ionic radius, ionization energy, electron affinity, electronegativity, metallic character, chemical reactivity, chemical bonding, periodic table, chemistry, active learning, guided inquiry learning, high school chemistry, college chemistry, superheavy elements, computational chemistry.

FAQs:

1. What is the POGIL method? POGIL (Process-Oriented Guided-Inquiry Learning) is a student-centered, collaborative learning approach that focuses on active learning and problem-solving.
2. Why is understanding periodic trends important? Understanding periodic trends is crucial for predicting the properties of elements and their behavior in chemical reactions.
3. How do atomic and ionic radii change across the periodic table? Atomic radius generally decreases across a period and increases down a group; ionic radii follow similar trends, but with variations depending on the charge.
4. What is electronegativity, and how does it relate to bonding? Electronegativity measures an atom's ability to attract electrons in a bond. Large differences in electronegativity lead to ionic bonds, while small differences lead to covalent bonds.

5. How can I use periodic trends to predict the reactivity of an element? The reactivity of an element is often related to its ionization energy, electron affinity, and electronegativity.
6. What are some real-world applications of understanding periodic trends? Understanding periodic trends is crucial in materials science, drug design, and many other fields.
7. What are some resources for further learning about periodic trends? Numerous online resources, textbooks, and interactive simulations can enhance understanding.
8. How does the POGIL method differ from traditional lecture-based learning? POGIL emphasizes active learning and collaboration, unlike traditional lectures, which are often passive.
9. What are some common misconceptions about periodic trends? A common misconception is that all trends are perfectly linear; there are exceptions and irregularities.

Related Articles:

1. The Impact of Electron Configuration on Periodic Trends: This article explores the link between electron configuration and the observed trends in atomic properties.
2. Predicting Chemical Reactions using Periodic Trends: This article provides practical examples of how to use periodic trends to predict the outcome of chemical reactions.
3. Advanced POGIL Activities for Mastering Periodic Trends: This article offers more challenging POGIL activities to deepen understanding.
4. The History and Development of the Periodic Table: This article traces the evolution of the periodic table and the contributions of key scientists.
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6. Periodic Trends and Chemical Bonding: A Detailed Explanation: This article provides an in-depth exploration of the relationship between periodic trends and the various types of chemical bonding.
7. Addressing Common Misconceptions in Understanding Periodic Trends: This article clarifies common misunderstandings related to periodic trends and their interpretation.
8. Incorporating Technology in Teaching Periodic Trends Using POGIL: This article explores the use of technology to enhance POGIL-based learning on periodic trends.
9. Comparing and Contrasting Different Instructional Methods for Teaching Periodic Trends: This article analyzes various teaching approaches, comparing their effectiveness in teaching periodic trends.

Initiative, 2012

periodic trends pogil: *The Disappearing Spoon* Sam Kean, 2010-07-12 From New York Times bestselling author Sam Kean comes incredible stories of science, history, finance, mythology, the arts, medicine, and more, as told by the Periodic Table. Why did Gandhi hate iodine (I, 53)? How did radium (Ra, 88) nearly ruin Marie Curie's reputation? And why is gallium (Ga, 31) the go-to element for laboratory pranksters? The Periodic Table is a crowning scientific achievement, but it's also a treasure trove of adventure, betrayal, and obsession. These fascinating tales follow every element on the table as they play out their parts in human history, and in the lives of the (frequently) mad scientists who discovered them. *The Disappearing Spoon* masterfully fuses science with the classic lore of invention, investigation, and discovery -- from the Big Bang through the end of time. Though solid at room temperature, gallium is a moldable metal that melts at 84 degrees Fahrenheit. A classic science prank is to mold gallium spoons, serve them with tea, and watch guests recoil as their utensils disappear.

periodic trends pogil: *Chemistry 2e* Paul Flowers, Richard Langely, William R. Robinson, Klaus Hellmut Theopold, 2019-02-14 *Chemistry 2e* is designed to meet the scope and sequence requirements of the two-semester general chemistry course. The textbook provides an important opportunity for students to learn the core concepts of chemistry and understand how those concepts apply to their lives and the world around them. The book also includes a number of innovative features, including interactive exercises and real-world applications, designed to enhance student learning. The second edition has been revised to incorporate clearer, more current, and more dynamic explanations, while maintaining the same organization as the first edition. Substantial improvements have been made in the figures, illustrations, and example exercises that support the text narrative. Changes made in *Chemistry 2e* are described in the preface to help instructors transition to the second edition.

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periodic trends pogil: Teaching and Learning STEM Richard M. Felder, Rebecca Brent, 2024-03-19 The widely used STEM education book, updated *Teaching and Learning STEM: A Practical Guide* covers teaching and learning issues unique to teaching in the science, technology, engineering, and math (STEM) disciplines. Secondary and postsecondary instructors in STEM areas

need to master specific skills, such as teaching problem-solving, which are not regularly addressed in other teaching and learning books. This book fills the gap, addressing, topics like learning objectives, course design, choosing a text, effective instruction, active learning, teaching with technology, and assessment—all from a STEM perspective. You'll also gain the knowledge to implement learner-centered instruction, which has been shown to improve learning outcomes across disciplines. For this edition, chapters have been updated to reflect recent cognitive science and empirical educational research findings that inform STEM pedagogy. You'll also find a new section on actively engaging students in synchronous and asynchronous online courses, and content has been substantially revised to reflect recent developments in instructional technology and online course development and delivery. Plan and deliver lessons that actively engage students—in person or online Assess students' progress and help ensure retention of all concepts learned Help students develop skills in problem-solving, self-directed learning, critical thinking, teamwork, and communication Meet the learning needs of STEM students with diverse backgrounds and identities The strategies presented in Teaching and Learning STEM don't require revolutionary time-intensive changes in your teaching, but rather a gradual integration of traditional and new methods. The result will be a marked improvement in your teaching and your students' learning.

periodic trends pogil: AP Chemistry For Dummies Peter J. Mikulecky, Michelle Rose Gilman, Kate Brutlag, 2008-11-13 A practical and hands-on guide for learning the practical science of AP chemistry and preparing for the AP chem exam Gearing up for the AP Chemistry exam? AP Chemistry For Dummies is packed with all the resources and help you need to do your very best. Focused on the chemistry concepts and problems the College Board wants you to know, this AP Chemistry study guide gives you winning test-taking tips, multiple-choice strategies, and topic guidelines, as well as great advice on optimizing your study time and hitting the top of your game on test day. This user-friendly guide helps you prepare without perspiration by developing a pre-test plan, organizing your study time, and getting the most out of your AP course. You'll get help understanding atomic structure and bonding, grasping atomic geometry, understanding how colliding particles produce states, and so much more. To provide students with hands-on experience, AP chemistry courses include extensive labwork as part of the standard curriculum. This is why the book dedicates a chapter to providing a brief review of common laboratory equipment and techniques and another to a complete survey of recommended AP chemistry experiments. Two full-length practice exams help you build your confidence, get comfortable with test formats, identify your strengths and weaknesses, and focus your studies. You'll discover how to Create and follow a pretest plan Understand everything you must know about the exam Develop a multiple-choice strategy Figure out displacement, combustion, and acid-base reactions Get familiar with stoichiometry Describe patterns and predict properties Get a handle on organic chemistry nomenclature Know your way around laboratory concepts, tasks, equipment, and safety Analyze laboratory data Use practice exams to maximize your score Additionally, you'll have a chance to brush up on the math skills that will help you on the exam, learn the critical types of chemistry problems, and become familiar with the annoying exceptions to chemistry rules. Get your own copy of AP Chemistry For Dummies to build your confidence and test-taking know-how, so you can ace that exam!

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latest legal options on copyright issues; and how to best use new technology including wikis, blogs, podcasts, vodcasts, and clickers. Entirely new chapters include subjects such as matching teaching methods with learning outcomes, inquiry-guided learning, and using visuals to teach, and new sections address Felder and Silverman's Index of Learning Styles, SCALE-UP classrooms, multiple true-false test items, and much more. Praise for the Third Edition of *Teaching at Its Best* Everyone veterans as well as novices will profit from reading *Teaching at Its Best*, for it provides both theory and practical suggestions for handling all of the problems one encounters in teaching classes varying in size, ability, and motivation. Wilbert McKeachie, Department of Psychology, University of Michigan, and coauthor, *McKeachie's Teaching Tips* This new edition of Dr. Nilson's book, with its completely updated material and several new topics, is an even more powerful collection of ideas and tools than the last. What a great resource, especially for beginning teachers but also for us veterans! L. Dee Fink, author, *Creating Significant Learning Experiences* This third edition of *Teaching at Its Best* is successful at weaving the latest research on teaching and learning into what was already a thorough exploration of each topic. New information on how we learn, how students develop, and innovations in instructional strategies complement the solid foundation established in the first two editions. Marilla D. Svinicki, Department of Psychology, The University of Texas, Austin, and coauthor, *McKeachie's Teaching Tips*

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periodic trends pogil: *Discipline-Based Education Research* National Research Council, Division of Behavioral and Social Sciences and Education, Board on Science Education, Committee on the Status, Contributions, and Future Directions of Discipline-Based Education Research, 2012-08-27 The National Science Foundation funded a synthesis study on the status, contributions, and future direction of discipline-based education research (DBER) in physics, biological sciences, geosciences, and chemistry. DBER combines knowledge of teaching and learning with deep knowledge of discipline-specific science content. It describes the discipline-specific difficulties learners face and the specialized intellectual and instructional resources that can facilitate student understanding. Discipline-Based Education Research is based on a 30-month study built on two workshops held in 2008 to explore evidence on promising practices in undergraduate science, technology, engineering, and mathematics (STEM) education. This book asks questions that are essential to advancing DBER and broadening its impact on undergraduate science teaching and learning. The book provides empirical research on undergraduate teaching and learning in the sciences, explores the extent to which this research currently influences undergraduate instruction, and identifies the intellectual and material resources required to further develop DBER. Discipline-Based Education Research provides guidance for future DBER research. In addition, the findings and recommendations of this report may invite, if not assist, post-secondary institutions to increase interest and research activity in DBER and improve its quality and usefulness across all natural science disciplines, as well as guide instruction and assessment across natural science courses to improve student learning. The book brings greater focus to issues of student attrition in the natural sciences that are related to the quality of instruction. Discipline-Based Education Research will be of interest to educators, policy makers, researchers, scholars, decision makers in universities, government agencies, curriculum developers, research sponsors, and education advocacy groups.

periodic trends pogil: *An Introduction to Chemistry* Mark Bishop, 2002 This book teaches chemistry at an appropriate level of rigor while removing the confusion and insecurity that impair student success. Students are frequently intimidated by prep chem; Bishop's text shows them how to break the material down and master it. The flexible order of topics allows unit conversions to be covered either early in the course (as is traditionally done) or later, allowing for a much earlier than usual description of elements, compounds, and chemical reactions. The text and superb illustrations

provide a solid conceptual framework and address misconceptions. The book helps students to develop strategies for working problems in a series of logical steps. The Examples and Exercises give plenty of confidence-building practice; the end-of-chapter problems test the student's mastery. The system of objectives tells the students exactly what they must learn in each chapter and where to find it.

periodic trends pogil: *Barriers and Opportunities for 2-Year and 4-Year STEM Degrees* National Academies of Sciences, Engineering, and Medicine, National Academy of Engineering, Policy and Global Affairs, Board on Higher Education and Workforce, Division of Behavioral and Social Sciences and Education, Board on Science Education, Committee on Barriers and Opportunities in Completing 2-Year and 4-Year STEM Degrees, 2016-05-18 Nearly 40 percent of the students entering 2- and 4-year postsecondary institutions indicated their intention to major in science, technology, engineering, and mathematics (STEM) in 2012. But the barriers to students realizing their ambitions are reflected in the fact that about half of those with the intention to earn a STEM bachelor's degree and more than two-thirds intending to earn a STEM associate's degree fail to earn these degrees 4 to 6 years after their initial enrollment. Many of those who do obtain a degree take longer than the advertised length of the programs, thus raising the cost of their education. Are the STEM educational pathways any less efficient than for other fields of study? How might the losses be stemmed and greater efficiencies realized? These questions and others are at the heart of this study. *Barriers and Opportunities for 2-Year and 4-Year STEM Degrees* reviews research on the roles that people, processes, and institutions play in 2-and 4-year STEM degree production. This study pays special attention to the factors that influence students' decisions to enter, stay in, or leave STEM majors—quality of instruction, grading policies, course sequences, undergraduate learning environments, student supports, co-curricular activities, students' general academic preparedness and competence in science, family background, and governmental and institutional policies that affect STEM educational pathways. Because many students do not take the traditional 4-year path to a STEM undergraduate degree, *Barriers and Opportunities* describes several other common pathways and also reviews what happens to those who do not complete the journey to a degree. This book describes the major changes in student demographics; how students view, value, and utilize programs of higher education; and how institutions can adapt to support successful student outcomes. In doing so, *Barriers and Opportunities* questions whether definitions and characteristics of what constitutes success in STEM should change. As this book explores these issues, it identifies where further research is needed to build a system that works for all students who aspire to STEM degrees. The conclusions of this report lay out the steps that faculty, STEM departments, colleges and universities, professional societies, and others can take to improve STEM education for all students interested in a STEM degree.

periodic trends pogil: *The Language of Science Education* William F. McComas, 2013-12-30 *The Language of Science Education: An Expanded Glossary of Key Terms and Concepts in Science Teaching and Learning* is written expressly for science education professionals and students of science education to provide the foundation for a shared vocabulary of the field of science teaching and learning. Science education is a part of education studies but has developed a unique vocabulary that is occasionally at odds with the ways some terms are commonly used both in the field of education and in general conversation. Therefore, understanding the specific way that terms are used within science education is vital for those who wish to understand the existing literature or make contributions to it. *The Language of Science Education* provides definitions for 100 unique terms, but when considering the related terms that are also defined as they relate to the targeted words, almost 150 words are represented in the book. For instance, “laboratory instruction” is accompanied by definitions for openness, wet lab, dry lab, virtual lab and cookbook lab. Each key term is defined both with a short entry designed to provide immediate access following by a more extensive discussion, with extensive references and examples where appropriate. Experienced readers will recognize the majority of terms included, but the developing discipline of science education demands the consideration of new words. For example, the term blended science is

offered as a better descriptor for interdisciplinary science and make a distinction between project-based and problem-based instruction. Even a definition for science education is included. The Language of Science Education is designed as a reference book but many readers may find it useful and enlightening to read it as if it were a series of very short stories.

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periodic trends pogil: Track Design Handbook for Light Rail Transit, 2012 TCRP report 155 provides guidelines and descriptions for the design of various common types of light rail transit (LRT) track. The track structure types include ballasted track, direct fixation (ballastless) track, and embedded track. The report considers the characteristics and interfaces of vehicle wheels and rail, tracks and wheel gauges, rail sections, alignments, speeds, and track moduli. The report includes chapters on vehicles, alignment, track structures, track components, special track work, aerial structures/bridges, corrosion control, noise and vibration, signals, traction power, and the integration of LRT track into urban streets.

periodic trends pogil: Chemistry Education Javier García-Martínez, Elena

Serrano-Torregrosa, 2015-02-17 Winner of the CHOICE Outstanding Academic Title 2017 Award This comprehensive collection of top-level contributions provides a thorough review of the vibrant field of chemistry education. Highly-experienced chemistry professors and education experts cover the latest developments in chemistry learning and teaching, as well as the pivotal role of chemistry for shaping a more sustainable future. Adopting a practice-oriented approach, the current challenges and opportunities posed by chemistry education are critically discussed, highlighting the pitfalls that can occur in teaching chemistry and how to circumvent them. The main topics discussed include best practices, project-based education, blended learning and the role of technology, including e-learning, and science visualization. Hands-on recommendations on how to optimally implement innovative strategies of teaching chemistry at university and high-school levels make this book an essential resource for anybody interested in either teaching or learning chemistry more effectively, from experience chemistry professors to secondary school teachers, from educators with no formal training in didactics to frustrated chemistry students.

periodic trends pogil: Intermolecular and Surface Forces Jacob N. Israelachvili, 2011-07-22

Intermolecular and Surface Forces describes the role of various intermolecular and interparticle forces in determining the properties of simple systems such as gases, liquids and solids, with a special focus on more complex colloidal, polymeric and biological systems. The book provides a thorough foundation in theories and concepts of intermolecular forces, allowing researchers and students to recognize which forces are important in any particular system, as well as how to control these forces. This third edition is expanded into three sections and contains five new chapters over the previous edition. - Starts from the basics and builds up to more complex systems - Covers all aspects of intermolecular and interparticle forces both at the fundamental and applied levels - Multidisciplinary approach: bringing together and unifying phenomena from different fields - This new edition has an expanded Part III and new chapters on non-equilibrium (dynamic) interactions, and tribology (friction forces)

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is an outstanding book that delivers both fundamental and complex biophysical principles, along with an excellent overview of the current biophysical research areas, in a manner that makes it accessible for mathematically and non-mathematically inclined readers. (Journal of Chemical Biology, February 2009) This text presents physical chemistry through the use of biological and biochemical topics, examples and applications to biochemistry. It lays out the necessary calculus in a step by step fashion for students who are less mathematically inclined, leading them through fundamental concepts, such as a quantum mechanical description of the hydrogen atom rather than simply stating outcomes. Techniques are presented with an emphasis on learning by analyzing real data. Presents physical chemistry through the use of biological and biochemical topics, examples and applications to biochemistry Lays out the necessary calculus in a step by step fashion for students who are less mathematically inclined Presents techniques with an emphasis on learning by

analyzing real data Features qualitative and quantitative problems at the end of each chapter All art available for download online and on CD-ROM

periodic trends pogil: Teach Better, Save Time, and Have More Fun Penny J. Beuning, Dave Z. Besson, Scott A. Snyder, Ingrid DeVries Salgado, 2014-12-15 A must-read for beginning faculty at research universities.

periodic trends pogil: The Periodic Table I D. Michael P. Mingos, 2020-02-05 As 2019 has been declared the International Year of the Periodic Table, it is appropriate that Structure and Bonding marks this anniversary with two special volumes. In 1869 Dmitri Ivanovitch Mendeleev first proposed his periodic table of the elements. He is given the major credit for proposing the conceptual framework used by chemists to systematically inter-relate the chemical properties of the elements. However, the concept of periodicity evolved in distinct stages and was the culmination of work by other chemists over several decades. For example, Newland's Law of Octaves marked an important step in the evolution of the periodic system since it represented the first clear statement that the properties of the elements repeated after intervals of 8. Mendeleev's predictions demonstrated in an impressive manner how the periodic table could be used to predict the occurrence and properties of new elements. Not all of his many predictions proved to be valid, but the discovery of scandium, gallium and germanium represented sufficient vindication of its utility and they cemented its enduring influence. Mendeleev's periodic table was based on the atomic weights of the elements and it was another 50 years before Moseley established that it was the atomic number of the elements, that was the fundamental parameter and this led to the prediction of further elements. Some have suggested that the periodic table is one of the most fruitful ideas in modern science and that it is comparable to Darwin's theory of evolution by natural selection, proposed at approximately the same time. There is no doubt that the periodic table occupies a central position in chemistry. In its modern form it is reproduced in most undergraduate inorganic textbooks and is present in almost every chemistry lecture room and classroom. This first volume provides chemists with an account of the historical development of the Periodic Table and an overview of how the Periodic Table has evolved over the last 150 years. It also illustrates how it has guided the research programmes of some distinguished chemists.

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provided with the report as on a CD. The CD is also available online for download as an ISO image or the workbook can be downloaded in pdf format.

periodic trends pogil: Molecular Structure and Properties Geoffrey Allen, 1972

periodic trends pogil: *Tools of Chemistry Education Research* Diane M. Bunce, Renée S. Cole, 2015-02-05 A companion to 'Nuts and Bolts of Chemical Education Research', 'Tools of Chemistry Education Research' provides a continuation of the dialogue regarding chemistry education research.

periodic trends pogil: Electronic Portfolios 2.0 Darren Cambridge, Kathleen Blake Yancey, Barbara Cambridge, 2023-07-03 Higher education institutions of all kinds—across the United States and around the world—have rapidly expanded the use of electronic portfolios in a broad range of applications including general education, the major, personal planning, freshman learning communities, advising, assessing, and career planning. Widespread use creates an urgent need to evaluate the implementation and impact of eportfolios. Using qualitative and quantitative methods, the contributors to this book—all of whom have been engaged with the Inter/National Coalition for Electronic Portfolio Research—have undertaken research on how eportfolios influence learning and the learning environment for students, faculty members, and institutions. This book features emergent results of studies from 20 institutions that have examined effects on student reflection, integrative learning, establishing identity, organizational learning, and designs for learning supported by technology. It also describes how institutions have responded to multiple challenges in eportfolio development, from engaging faculty to going to scale. These studies exemplify how eportfolios can spark disciplinary identity, increase retention, address accountability, improve writing, and contribute to accreditation. The chapters demonstrate the applications of eportfolios at community colleges, small private colleges, comprehensive universities, research universities, and a state system.

periodic trends pogil: Second International Handbook of Science Education Barry J. Fraser, Kenneth Tobin, Campbell J. McRobbie, 2011-12-13 The International Handbook of Science Education is a two volume edition pertaining to the most significant issues in science education. It is a follow-up to the first Handbook, published in 1998, which is seen as the most authoritative resource ever produced in science education. The chapters in this edition are reviews of research in science education and retain the strong international flavor of the project. It covers the diverse theories and methods that have been a foundation for science education and continue to characterize this field. Each section contains a lead chapter that provides an overview and synthesis of the field and related chapters that provide a narrower focus on research and current thinking on the key issues in that field. Leading researchers from around the world have participated as authors and consultants to produce a resource that is comprehensive, detailed and up to date. The chapters provide the most recent and advanced thinking in science education making the Handbook again the most authoritative resource in science education.

periodic trends pogil: New Learning Robert-Jan Simons, Jos van der Linden, Tom Duffy, 2007-05-08 This book brings together research and theory about 'New Learning', the term we use for new learning outcomes, new kinds of learning processes and new instructional methods that are both wanted by society and stressed in psychological theory in many countries at present. It describes and illustrates the differences as well as the modern versions of the traditional innovative ideas.

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periodic trends pogil: *Advanced Inorganic Chemistry* Frank Albert Cotton, Geoffrey Wilkinson, Carlos A. Murillo, Manfred Bochmann, 2021 Advanced inorganic chemistry is a well-established source that students and professional chemists have turned to for the background needed to understand current research literature in inorganic chemistry and aspects of organometallic chemistry. This textbook is organized around the periodic table of elements and provides a systematic treatment of the chemistry of all chemical elements and their compounds. It incorporates important recent developments with an emphasis on advances in the interpretation of structure, bonding, and reactivity. This Indian adaptation of the book is restructured at places and offers new and updated material on chemical elements and their compounds, particularly related to their applications. The introduction section in all the chapters has also been completely updated to reflect current developments. Some of the new topics covered include sections on nomenclature and isomerism in coordination compounds; hydrides, their classification and applications. Useful new inclusions in the book are practice exercise comprising review questions multiple-choice questions (based on various competitive examinations) at the end of each part and appendices on IUPAC nomenclature of complexes and latimer diagram -- Cover.

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