

DISTINGUISHING BETWEEN ATOMS SECTION REVIEW ANSWERS Complete Guide

Distinguishing between atoms section review answers is a critical concept in understanding the fundamental building blocks of matter. As students delve into chemistry and atomic theory, mastering how to differentiate between atoms, their properties, and their behaviors becomes essential. This article provides a comprehensive review of the key concepts related to distinguishing between atoms, offering detailed explanations, helpful tips, and review answers to common questions. Whether you are preparing for exams or simply seeking to deepen your understanding, this guide will clarify the essential differences and help improve your grasp of atomic science.

Understanding the Basics of Atoms

What Is an Atom?

An atom is the smallest unit of ordinary matter that retains the properties of an element. It consists of a nucleus made up of protons and neutrons, surrounded by electrons orbiting in electron clouds. Atoms are the fundamental building blocks of all matter, from the air we breathe to the rocks we see.

Components of an Atom

- Protons: Positively charged particles in the nucleus.
- Neutrons: Neutral particles that contribute to atomic mass.
- Electrons: Negatively charged particles orbiting the nucleus.

Atomic Number and Atomic Mass

- Atomic Number: Number of protons in an atom's nucleus; unique to each element.
- Atomic Mass: The total mass of protons and neutrons in the nucleus.

Differences Between Atoms of Different Elements

Identifying Elements by Atomic Number

The primary way to distinguish between atoms of different elements is by their atomic number. For example:

- Hydrogen has an atomic number of 1.
- Carbon has an atomic number of 6.
- Oxygen has an atomic number of 8.

Atoms of different elements have unique numbers of protons, which makes their identity distinct.

Isotopes: Variations of the Same Element

Atoms of the same element can have different numbers of neutrons, resulting in isotopes. For example:

- Carbon-12 (6 protons, 6 neutrons)
- Carbon-14 (6 protons, 8 neutrons)

While isotopes of the same element share chemical properties, their atomic masses differ, and this helps in distinguishing between isotopes.

Reviewing Common Questions and Answers on Distinguishing Atoms

Q1: How do you determine the difference between two atoms of different elements?

Answer:

The main difference is their atomic number. The atomic number indicates how many protons are in the nucleus, which defines the element. For instance, if one atom has 6 protons and another has 8 protons, they are carbon and oxygen, respectively.

Q2: How can isotopes be distinguished from one another?

Answer:

Isotopes of the same element have the same number of protons but different numbers of neutrons. They can be distinguished based on their atomic mass or mass number. Techniques such as mass spectrometry can precisely identify different isotopes.

Q3: Why do atoms of different elements have different chemical properties?

Answer:

Because they have different numbers of protons (atomic number), which affects their electron configuration and how they interact chemically. The number of electrons in the outer shell (valence electrons) determines reactivity.

Techniques for Distinguishing Between Atoms

Spectroscopic Methods

Spectroscopy allows scientists to identify elements based on the unique spectral lines emitted or absorbed by atoms. Each element produces a characteristic spectrum, acting like a fingerprint.

Mass Spectrometry

Mass spectrometry measures the mass-to-charge ratio of ions, enabling precise identification of isotopes and distinguishing atoms with similar properties.

Elemental Analysis

Using chemical tests and instrumentation, scientists can determine the elemental composition of a sample, helping to differentiate between atoms of different elements.

Common Mistakes and How to Avoid Them

- Confusing isotopes with different elements: Remember, isotopes are variants of the same element; they share the same atomic number but have different atomic masses.
- Ignoring the role of electrons: Electron configuration influences chemical behavior; understanding it helps distinguish atoms in reactions.
- Assuming atomic mass equals mass number: Atomic mass is an average that accounts for isotopic distribution; the mass number is specific to one isotope.

Practice Questions for Review

- What is the atomic number of an atom with 8 protons?

Answer: 8 (Oxygen)

- How many neutrons does Carbon-14 have if its atomic number is 6?

Answer: 8 neutrons ($14 - 6 = 8$)

- Which method can be used to distinguish isotopes of the same element?

Answer: Mass spectrometry

- Why are atoms of different elements chemically different?

Answer: Because they have different numbers of protons, which affects their electron configuration and reactivity.

- What do spectral lines tell us about atoms?

Answer: They serve as fingerprints, indicating the presence of specific elements.

Summary of Key Points

- The primary identifier of an atom is its atomic number, which distinguishes one element from another.
- Isotopes are atoms of the same element with different numbers of neutrons; they differ in atomic mass.
- Techniques such as spectroscopy and mass spectrometry are essential tools for distinguishing between atoms and isotopes.
- Understanding the electron configuration helps explain chemical properties and reactions.
- Accurate review answers reinforce comprehension and prepare students for exams.

Conclusion

Mastering the skill of distinguishing between atoms is fundamental for anyone studying chemistry. By focusing on atomic number, isotopic variations, and advanced analytical techniques, students can accurately identify and differentiate atoms of various elements. Reviewing common questions and answers enhances understanding and builds confidence. Whether in academic settings or real-world applications, the ability to distinguish between atoms plays a vital role in scientific discovery and technological development. Keep practicing with review questions, stay curious, and deepen your knowledge of atomic science to excel in your studies.

Distinguishing Between Atoms Section Review Answers is a fundamental topic in chemistry that

plays a crucial role in understanding the building blocks of matter. This section often appears in exams, quizzes, and textbook exercises, aiming to assess students' grasp of atomic structure, properties, and the differences among various types of atoms. Mastering this topic not only helps in scoring well but also deepens one's conceptual clarity about the microscopic world. In this comprehensive review, we will explore the key concepts, common questions, strategies for distinguishing between atoms, and how to approach review answers effectively.

Understanding the Basics: What Are Atoms?

Before delving into distinguishing features, it's essential to revisit what atoms are and their significance.

Definition of an Atom

- The smallest unit of matter that retains the chemical properties of an element.
- Composed of subatomic particles: protons, neutrons, and electrons.
- Atoms differ based on the number of protons, known as the atomic number.

Features of Atoms

- Neutral charge overall, with equal numbers of protons and electrons in a typical atom.
- The nucleus contains protons and neutrons; electrons orbit in various energy levels.
- Atomic mass is approximately the sum of protons and neutrons.

Understanding these basics sets the foundation for distinguishing between types of atoms, such as isotopes, ions, and atoms of different elements.

Key Areas to Focus on in Distinguishing Atoms

When reviewing answers about atoms, certain features and parameters are repeatedly tested. Recognizing these helps in accurately differentiating one atom from another.

1. Atomic Number and Atomic Mass

- Atomic Number (Z): Number of protons in the nucleus; unique to each element.
- Atomic Mass: Average mass of all isotopes of an element, considering their abundance.

In review answers:

- Check if the atomic number matches the element in question.
- Look for clues about isotopic variations; isotopes differ in atomic mass but not in atomic number.

Tips:

- When asked to distinguish atoms, focus on the atomic number first.
- For isotope differences, focus on atomic mass and neutron count.

2. Isotopes vs. Ions

- Isotopes: Atoms of the same element with different neutron counts.
- Ions: Atoms or molecules with a net electric charge due to loss or gain of electrons.

Features in review answers:

- Isotopes have the same atomic number but different mass numbers.
- Ions have the same atomic number but different electron counts, resulting in positive or negative charges.

Distinguishing tips:

- Isotopes: same number of protons and electrons (if neutral).
- Ions: different number of electrons from protons.

3. Electron Configuration and Valence Electrons

- Electron configurations determine chemical reactivity.
- Valence electrons are key in distinguishing atoms' chemical properties.

In review answers:

- Look for mentions of electron shell configuration.
- Differences in valence electrons help differentiate similar elements.

4. Physical and Chemical Properties

- Atomic size, melting point, and reactivity might be used in questions.
- These properties can help identify or distinguish atoms, especially in compounds.

In review answers:

- Note any references to the element's position in the periodic table.
- Use properties like electronegativity and ionization energy as clues.

Common Types of Questions and How to Approach Them

Understanding typical question formats can enhance review answer accuracy.

1. Multiple Choice Questions (MCQs)

- Usually ask to identify which statement correctly describes a particular atom or set of atoms.

Approach:

- Eliminate options that clearly mismatch atomic number or properties.
- Focus on keywords like ?isotope,? ?cation,? ?anion,? or specific atomic numbers.

2. Short Answer Questions

- May ask to compare two atoms or explain differences.

Approach:

- Clearly state differences in atomic number, isotopic composition, or charge.
- Use proper terminology and provide concise explanations.

3. Diagram-Based Questions

- Require drawing or interpreting atomic diagrams or electron configurations.

Approach:

- Ensure diagrams accurately reflect electron shells and valence electrons.
- Label parts clearly and compare configurations explicitly.

Strategies for Reviewing Answers Effectively

Proper review techniques can help reinforce understanding and correct misconceptions.

1. Cross-Check Key Parameters

- Verify atomic number, mass number, and charge.
- Confirm if the answer correctly identifies isotopes, ions, or elements.

2. Use Periodic Table as a Reference

- Cross-reference the element's position to confirm properties.
- Check atomic number and typical electron configurations.

3. Clarify Terminology

- Ensure correct usage of terms like isotope, ion, neutral atom, valence electrons.
- Misuse of terminology often indicates misunderstanding.

4. Practice with Variations

- Review different types of questions to build a well-rounded understanding.
- Practice distinguishing between similar atoms, such as isotopes of the same element.

Pros and Cons of Different Review Techniques

Understanding the advantages and limitations of review methods helps in selecting the most effective strategies.

- Flashcards
- Pros: Quick recall, reinforces terminology and key facts.
- Cons: Limited in explaining complex differences.

- Practice Questions
 - Pros: Simulates exam conditions, enhances application skills.
 - Cons: May require access to good question banks.
- Concept Maps
 - Pros: Visualizes relationships between concepts like isotopes, ions, and atomic structure.
 - Cons: Time-consuming to create; may be overwhelming initially.
- Peer Discussions
 - Pros: Clarifies doubts, exposes multiple perspectives.
 - Cons: Depends on availability of knowledgeable peers.

Conclusion and Final Tips

Distinguishing between atoms is a nuanced skill that combines understanding of atomic structure, properties, and terminology. When reviewing answers, always verify the key parameters such as atomic number, mass number, charge, and electron configuration. Practice differentiating isotopes, ions, and neutral atoms through various question formats, and utilize periodic table references for accuracy. Developing a systematic approach to reviewing answers ensures not only better grades but also a deeper understanding of fundamental chemistry concepts. Remember, mastery comes with consistent practice and attention to detail?so keep revisiting these concepts, and over time, distinguishing between atoms will become an intuitive process.

QuestionAnswer How can you differentiate between atoms of different elements based on their properties? Atoms of different elements have unique numbers of protons, which determine their atomic number, and differ in their mass number and chemical properties, allowing us to distinguish between them. What role does atomic number play in distinguishing between atoms? The atomic number, representing the number of protons in an atom, is unique for each element and serves as the primary identifier to distinguish one atom type from another. How do isotopes of the same element differ, and how can they be distinguished? Isotopes of the same element have the same number of protons but different numbers of neutrons, resulting in different mass numbers. They can be distinguished using techniques like mass spectrometry. Why is the atomic mass important in differentiating atoms? Atomic mass reflects the total number of protons and neutrons in an atom, helping to identify specific isotopes and distinguish between atoms of the same element with different neutron counts. What are some common methods used to identify and distinguish atoms in a laboratory setting? Methods like spectroscopy, mass spectrometry, and X-ray crystallography are used to analyze atomic properties and distinguish between different atoms and isotopes. How does electron configuration assist in differentiating atoms? Electron configuration describes the distribution of electrons in an atom's energy levels, which determines its chemical behavior and

helps differentiate atoms based on their electronic structure. Can atoms of different elements have similar physical properties? How are they distinguished then? While some atoms of different elements may have similar physical properties, they are distinguished by their atomic number and unique spectral lines, which provide definitive identification.

Related keywords: atomic structure, atomic theory, atomic models, elements, periodic table, atomic number, atomic mass, isotopes, electron configuration, atomic review

Chemistry Unit 7 Chemical Reactions Rearranging Atoms

chemistry unit 7 chemical reactions rearranging atoms is a fundamental concept in understanding how substances interact and transform during chemical processes. This unit explores the core principles behind chemical reactions, focusing on how atoms are rearranged to form new substances. Grasping these mechanisms is essential for students studying chemistry, as it provides insights into the conservation of mass, reaction types, and the underlying principles that govern the behavior of matter at the atomic level.

Understanding Chemical Reactions

What Are Chemical Reactions?

Chemical reactions are processes where substances called reactants are transformed into new substances called products. These changes involve breaking old chemical bonds and forming new ones, leading to the rearrangement of atoms. The key characteristic of a chemical reaction is that the atoms themselves are conserved; they are simply rearranged to create different molecules.

The Conservation of Atoms in Reactions

One of the fundamental principles in chemistry is the law of conservation of mass, which states that atoms are neither created nor destroyed during a chemical reaction. Instead, they are rearranged. This means that the total number of each type of atom remains constant before and after the reaction, though they may be distributed differently among the products.

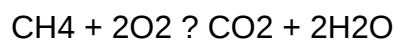
Types of Chemical Reactions and Atom Rearrangement

1. Combustion Reactions

In combustion reactions, a substance reacts with oxygen to produce energy, often in the form of

heat and light. These reactions typically involve rearranging atoms to form oxides.

- Example: Combustion of methane (CH₄):

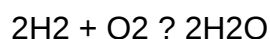


- Atoms of carbon and hydrogen are rearranged with oxygen to produce carbon dioxide and water.

2. Synthesis Reactions

Synthesis reactions involve combining two or more reactants to form a single, more complex product. These reactions are characterized by the rearrangement of atoms from simpler substances into more complex molecules.

- Example: Formation of water:

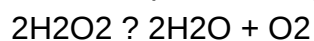


- Atoms of hydrogen and oxygen are rearranged to form water molecules.

3. Decomposition Reactions

Decomposition reactions are the reverse of synthesis reactions, where a single compound breaks down into simpler substances. This involves rearranging atoms within a compound to produce multiple products.

- Example: Decomposition of hydrogen peroxide:

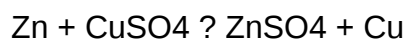


- Atoms within hydrogen peroxide are rearranged to produce water and oxygen gas.

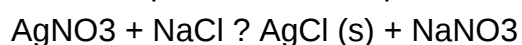
4. Displacement and Double Displacement Reactions

In displacement reactions, an element displaces another in a compound, leading to atom rearrangement. Double displacement reactions involve the exchange of ions between two compounds.

- Example of displacement: Zinc displacing copper:



- Atoms of zinc displace copper atoms, rearranging the compounds.
- Example of double displacement: Precipitation reaction:



- Ions are exchanged, leading to the formation of new compounds.

Balancing Chemical Equations: Tracking Atom Rearrangement

Why Balance Equations?

Balancing chemical equations ensures that the number of atoms for each element is the same on both sides of the reaction. This reflects the conservation of atoms principle, confirming that atoms are merely rearranged, not created or destroyed.

Steps to Balance Equations

- Write the unbalanced equation with correct formulas.
- Count the number of atoms of each element on both sides.
- Use coefficients to balance each element, starting with the most complex molecules.
- Repeat the process until all elements are balanced.
- Check to ensure mass and atom counts match on both sides.

Atomic Perspective of Rearrangement

Role of Electron Sharing and Transfer

Atoms rearrange during reactions through processes like covalent bonding (sharing electrons) or ionic bonding (transfer of electrons). These processes allow atoms to achieve more stable electronic configurations, often following the octet rule.

Understanding Bond Formation and Breakage

- Bond Breakage: Requires energy to overcome attractive forces between atoms.
- Bond Formation: Releases energy as atoms reach a more stable state.
- The rearrangement of atoms involves these processes, which are fundamental to chemical reactions.

Real-World Applications of Atom Rearrangement

Industrial Processes

Many industrial processes, including the manufacturing of pharmaceuticals, plastics, and fuels, rely on controlled chemical reactions that involve precise atom rearrangement.

Environmental Chemistry

Understanding how atoms rearrange during reactions is crucial in environmental chemistry, such as in pollutant breakdown, water treatment, and greenhouse gas mitigation.

Biological Systems

Biochemical reactions, like cellular respiration and photosynthesis, are complex examples of atom rearrangement, vital for life processes.

Conclusion: The Significance of Atom Rearrangement in Chemistry

The concept of **chemistry unit 7 chemical reactions rearranging atoms** underscores the dynamic nature of matter at the atomic level. Recognizing how atoms are conserved yet rearranged during reactions enables chemists to predict reaction products, balance equations, and understand the energy changes involved. Whether in industrial manufacturing, environmental management, or biological systems, mastering the principles of atom rearrangement is essential for advancing scientific knowledge and technological innovation. By studying these processes, students gain a deeper appreciation of the fundamental laws that govern the universe at its most basic level.

Understanding Chemistry Unit 7: Chemical Reactions and Rearranging Atoms is fundamental to grasping how substances transform and interact at the molecular level. This unit delves into the intricate processes that underpin chemical reactions, emphasizing the ways atoms are rearranged during these transformations. Whether you're a student preparing for exams or a chemistry enthusiast seeking a deeper understanding, exploring how atoms are conserved and reorganized provides valuable insight into the fundamental principles that govern matter.

Introduction to Chemical Reactions and Atomic Rearrangement

Chemical reactions are the cornerstone of chemistry, describing how substances interact to form new products. At their core, these reactions involve breaking and forming chemical bonds, which inherently involves the rearrangement of atoms. Understanding how atoms are conserved and redistributed during reactions helps chemists predict product formation, balance equations, and comprehend reaction mechanisms.

Key Concepts:

- Conservation of atoms
- Types of chemical reactions
- Bond-breaking and bond-forming processes
- Reaction mechanisms

The Principle of Conservation of Mass and Atoms

Before diving into the specifics of atomic rearrangement, it's crucial to understand the principle of conservation of mass. This foundational idea states that in a chemical reaction, matter cannot be created or destroyed. Instead, atoms are simply rearranged, leading to different substances.

- Law of Conservation of Mass: Total mass of reactants equals total mass of products.
- Atoms are conserved: The number and types of atoms remain unchanged during reactions, only their arrangements change.

This principle ensures that chemical equations are balanced, with the same number of each type of atom on both sides of the equation.

Types of Chemical Reactions Involving Atomic Rearrangement

Chemical reactions can be broadly classified based on how atoms are rearranged. Recognizing these types helps in understanding the underlying atomic processes.

1. Combustion Reactions

- Involves oxygen reacting with a fuel
- Produces carbon dioxide and water
- Example: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- Atoms are rearranged from methane and oxygen to form new compounds

2. Synthesis (Combination) Reactions

- Two or more reactants combine to form a single product
- Example: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- Atoms from different reactants are rearranged to form a new compound

3. Decomposition Reactions

- A single compound breaks down into simpler substances
- Example: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
- Atoms are rearranged during the breakdown process

4. Displacement (Single and Double) Reactions

- Involve the exchange of atoms between compounds
- Single displacement: $\text{A} + \text{BC} \rightarrow \text{AC} + \text{B}$
- Double displacement: $\text{AB} + \text{CD} \rightarrow \text{AD} + \text{CB}$
- Atoms are rearranged as elements swap places

5. Redox Reactions

- Involve transfer of electrons, leading to oxidation and reduction
- Atoms undergo changes in oxidation states, with electrons moving accordingly
- Atoms are rearranged through electron transfer

How Atoms Are Rearranged During Chemical Reactions

Understanding the process of atomic rearrangement requires examining the mechanisms at the molecular level. This involves breaking existing bonds and forming new ones, which results in the reorganization of atoms.

Bond Breaking and Bond Formation

- Bond breaking: Requires energy to overcome the attraction between atoms
- Bond formation: Releases energy as atoms form new bonds
- The net energy change determines whether a reaction is exothermic or endothermic

Step-by-Step Process of Atomic Rearrangement

- Reactant molecules collide: Successful collisions have enough energy and proper orientation
- Bonds break: Old bonds between atoms are broken, producing reactive fragments or ions
- Intermediate species form: Reactive atoms or groups of atoms (radicals, ions)

- New bonds form: Atoms rearranged into the products' structure
- Product molecules are stabilized: Final compounds are formed with new arrangements of atoms

Illustrative Example: The Reaction of Hydrogen and Chlorine

- Reaction: $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
- Atomic rearrangement process:
- H-H and Cl-Cl bonds are broken
- Radicals or reactive species form temporarily
- New H-Cl bonds form, rearranging atoms into hydrochloric acid

Visualizing Atomic Rearrangement: Structural and Electron Models

Chemists use various models to understand how atoms rearrange during reactions:

- Structural formulas: Show how atoms are connected in molecules
- Ball-and-stick models: Visualize 3D arrangements
- Electron dot diagrams (Lewis structures): Highlight valence electrons involved in bonding
- Reaction mechanisms: Step-by-step illustrations showing bond-breaking and bond-forming events

These visual tools help in understanding the flow of atoms and electrons during reactions, making complex processes more accessible.

Balancing Chemical Equations: Ensuring Atom Conservation

An essential skill in understanding atomic rearrangement is balancing chemical equations. This process involves adjusting coefficients to ensure the same number of each atom appears on both sides of the equation, reflecting the conservation principle.

Steps for Balancing Equations:

- Write the unbalanced equation
- Count atoms of each element in reactants and products
- Adjust coefficients to balance atoms for each element
- Check that the total atom count matches on both sides
- Confirm that coefficients are in the simplest whole-number ratio

Example: Combustion of Ethane

Unbalanced: $\text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

Balanced: $\text{C}_2\text{H}_6 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$

Real-World Applications of Atomic Rearrangement in Chemistry

Understanding how atoms are rearranged during chemical reactions is vital across various fields:

- Industrial synthesis: Designing efficient production pathways for pharmaceuticals, plastics, and fuels
- Environmental chemistry: Tracking pollutant transformations and degradation pathways
- Biochemistry: Comprehending metabolic pathways involving complex atomic rearrangements
- Materials science: Developing new materials through controlled atomic restructuring

Conclusion: The Importance of Atomic Rearrangement in Chemistry

The study of chemistry unit 7 chemical reactions and rearranging atoms reveals the dynamic nature of matter at the molecular level. Recognizing that atoms are conserved yet constantly reorganized during reactions underscores the elegance and predictability of chemical processes. By mastering how atoms break and form bonds, balancing equations, and visualizing mechanisms, students and scientists deepen their understanding of the material world, enabling innovations across industry, medicine, and environmental management.

Understanding atomic rearrangement isn't just about memorizing reactions; it's about appreciating the fundamental dance of atoms that constructs the universe we observe. Whether in the laboratory or in nature, these processes drive the transformations that shape our world.

Question What is the main focus of Chemistry Unit 7 on chemical reactions? Chemistry Unit 7 primarily focuses on understanding how atoms rearrange during chemical reactions, including types of reactions, energy changes, and the conservation of atoms. How do atoms rearrange during a chemical reaction? Atoms rearrange during a chemical reaction by breaking old bonds and forming new bonds, resulting in different substances while conserving the total number of atoms involved. What is the significance of the conservation of atoms in chemical reactions? The conservation of atoms means that atoms are neither created nor destroyed during a chemical reaction; they are simply rearranged, which is fundamental to balancing chemical equations. Can you explain the difference between a synthesis and a decomposition reaction? A synthesis reaction involves two or more substances combining to form a new compound, while a decomposition reaction involves a single compound breaking down into simpler substances. What role do energy

changes play in chemical reactions involving atom rearrangement? Energy changes, such as absorption or release of heat, occur because breaking old bonds requires energy, and forming new bonds releases energy; these changes influence reaction spontaneity and stability. How do catalysts affect chemical reactions and atom rearrangement? Catalysts speed up chemical reactions by providing an alternative pathway with lower activation energy, facilitating faster atom rearrangement without being consumed in the process. What is an example of a chemical reaction that involves rearranging atoms? The combustion of methane ($\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$) involves the rearrangement of atoms to form new products from the reactants. Why is balancing chemical equations important in understanding atom rearrangement? Balancing chemical equations ensures the same number of each type of atom on both sides of the reaction, reflecting the conservation of atoms and accurately representing the atom rearrangement process.

Related keywords: chemical reactions, atom rearrangement, chemical equations, reaction types, balancing equations, reaction mechanisms, reactants, products, chemical bonding, conservation of mass

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