

Magnesium Oxide

Percent Composition and Empirical Formula

Introduction

There is an official database that keeps track of the known chemical compounds that exist in nature or have been synthesized in the lab. The database is updated daily, and millions of different inorganic and organic compounds have been recognized. With millions of compounds—how is it possible to identify as many different compounds and tell them apart?

Concepts

- Percent composition
- Empirical formula
- Molecular formula
- Percent yield

Background

The composition of a chemical compound—what it is made of—can be described at least three different ways. The *percent composition* gives the percent by mass of each element in the compound, and is the simplest way experimentally to describe the composition of a substance. According to the law of definite proportions, which was first formulated in the early 1800s by Joseph Proust, the elements in a given compound are always present in the same proportion by mass, regardless of the source of the compound or how it is prepared. Calcium carbonate, for example, contains calcium, carbon and oxygen. It is present in eggshells and seashells, chalk and limestone, minerals and pearls. Whether the calcium carbonate comes from a mineral supplement or a seashore shell or from seashells at the ocean shore, the mass percentage of the three elements is always the same: 40% calcium, 12% carbon and 48% oxygen.

The *percent composition* of a compound tells us what elements are present in the compound and their mass ratios. In terms of understanding how elements come together to make a new compound, however, it is more interesting to know how many atoms of each kind of element are in a compound. Since all the atoms of a given element in a compound have the same average atomic mass, the elements that are present in a fixed mass ratio in a compound must also be present in a fixed-number ratio as well. The *empirical formula* describes the composition of a compound in terms of the simplest, whole-number ratio of atoms in a molecule or formula unit of the compound. The formula of calcium carbonate, for example, is CaCO_3 . The empirical formula gives the ratio of atoms in a compound and does not necessarily represent the actual number of atoms in a molecule or formula unit. It is possible, in fact, for many different compounds to share the same empirical formula.

The organic compounds acetylene and benzene, for example, have the same empirical formula, CH —one hydrogen atom for every carbon atom. These two compounds, however, have different properties and different molecular formulas— C_2H_2 for acetylene and C_6H_6 for benzene. Notice that in both cases the molecular formula is a simple multiple of the empirical formula. The *molecular formula* of a compound tells us the actual number of atoms in a single molecule of a compound. In order to find the molecular formula of a compound, whose empirical formula is known, the molar or molecular mass of the compound must also be known.

In this experiment, the percent composition and empirical formula of magnesium oxide, the main compound formed when magnesium metal combines with oxygen in air, will be determined. Heating magnesium in the presence of air causes the metal to ignite and burn—lots of light and heat are given off, and a new compound is obtained. According to the law of conservation of mass, the total mass of the products of a chemical reaction must equal the mass of the reactants. In the case of the combustion of magnesium, the following equation must be true:

$$\text{Mass of magnesium} + \text{Mass of oxygen} = \text{Mass of magnesium oxide}$$

If both the initial mass of magnesium and the final mass of the magnesium oxide are measured, the increase in mass must correspond to the mass of oxygen that combined with magnesium. The percent composition and empirical formula of magnesium oxide can then be calculated, based on the combining ratios of magnesium and oxygen in the reaction. Finally, once the formula of magnesium oxide is known, the amount of magnesium oxide that was produced can be compared against the maximum amount possible based on 100% conversion of the magnesium used in the experiment. This information can be used to calculate the *percent yield* of magnesium oxide in the reaction.

Experiment Overview

The purpose of this classic experiment is to determine the percent composition and empirical formula of magnesium oxide.

Quick Lab Percent Composition Magnesium Oxide Answers

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Quick Lab Percent Composition Magnesium Oxide Answers:

Merrill Chemistry Robert C. Smoot, Smoot, Richard G. Smith, Jack Price, 1998 **Power**, 1973 Chemical
Calculations, with Explanatory Notes, Problems, and Answers, Specially Adapted for Use in Colleges and Science Schools
Richard Lloyd Whiteley, 1898

Quick Lab Percent Composition Magnesium Oxide Answers: Bestsellers in 2023 The year 2023 has witnessed a noteworthy surge in literary brilliance, with numerous engrossing novels captivating the hearts of readers worldwide. Lets delve into the realm of popular books, exploring the fascinating narratives that have enthralled audiences this year. The Must-Read : Colleen Hoover's "It Ends with Us" This touching tale of love, loss, and resilience has gripped readers with its raw and emotional exploration of domestic abuse. Hoover skillfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can succeed. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This captivating historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids compelling storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This captivating coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens spins a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These popular novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of compelling stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and suspenseful novel that will keep you guessing until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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Table of Contents Quick Lab Percent Composition Magnesium Oxide Answers

1. Understanding the eBook Quick Lab Percent Composition Magnesium Oxide Answers
 - The Rise of Digital Reading Quick Lab Percent Composition Magnesium Oxide Answers
 - Advantages of eBooks Over Traditional Books
2. Identifying Quick Lab Percent Composition Magnesium Oxide Answers
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Quick Lab Percent Composition Magnesium Oxide Answers
 - User-Friendly Interface
4. Exploring eBook Recommendations from Quick Lab Percent Composition Magnesium Oxide Answers
 - Personalized Recommendations
 - Quick Lab Percent Composition Magnesium Oxide Answers User Reviews and Ratings
 - Quick Lab Percent Composition Magnesium Oxide Answers and Bestseller Lists
5. Accessing Quick Lab Percent Composition Magnesium Oxide Answers Free and Paid eBooks
 - Quick Lab Percent Composition Magnesium Oxide Answers Public Domain eBooks
 - Quick Lab Percent Composition Magnesium Oxide Answers eBook Subscription Services
 - Quick Lab Percent Composition Magnesium Oxide Answers Budget-Friendly Options
6. Navigating Quick Lab Percent Composition Magnesium Oxide Answers eBook Formats
 - ePub, PDF, MOBI, and More
 - Quick Lab Percent Composition Magnesium Oxide Answers Compatibility with Devices
 - Quick Lab Percent Composition Magnesium Oxide Answers Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Quick Lab Percent Composition Magnesium Oxide Answers
 - Highlighting and Note-Taking Quick Lab Percent Composition Magnesium Oxide Answers
 - Interactive Elements Quick Lab Percent Composition Magnesium Oxide Answers
8. Staying Engaged with Quick Lab Percent Composition Magnesium Oxide Answers

- Joining Online Reading Communities
- Participating in Virtual Book Clubs
- Following Authors and Publishers Quick Lab Percent Composition Magnesium Oxide Answers
- 9. Balancing eBooks and Physical Books Quick Lab Percent Composition Magnesium Oxide Answers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Quick Lab Percent Composition Magnesium Oxide Answers
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Quick Lab Percent Composition Magnesium Oxide Answers
 - Setting Reading Goals Quick Lab Percent Composition Magnesium Oxide Answers
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Quick Lab Percent Composition Magnesium Oxide Answers
 - Fact-Checking eBook Content of Quick Lab Percent Composition Magnesium Oxide Answers
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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