

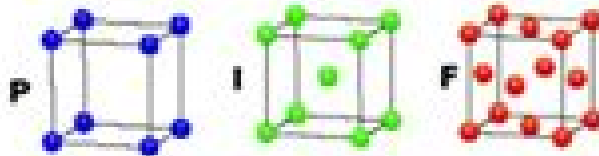
What are crystals?

Bravais Lattices and Space Groups

CUBIC

$$a = b = c$$

$$\alpha = \beta = \gamma = 90^\circ$$



TETRAGONAL

$$a = b \neq c$$

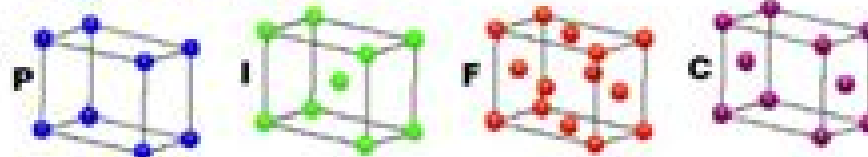
$$\alpha = \beta = \gamma = 90^\circ$$



ORTHORHOMBIC

$$a \neq b \neq c$$

$$\alpha = \beta = \gamma = 90^\circ$$



HEXAGONAL

$$a = b \neq c$$

$$\alpha = \beta = 90^\circ$$

$$\gamma = 120^\circ$$

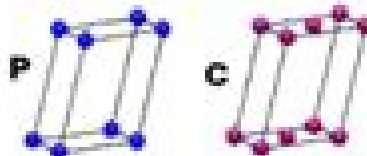


MONOCLINIC

$$a \neq b \neq c$$

$$\alpha = \gamma = 90^\circ$$

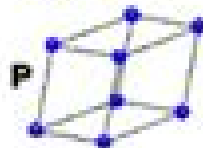
$$\beta \neq 120^\circ$$



TRICLINIC

$$a \neq b \neq c$$

$$\alpha \neq \beta \neq \gamma \neq 90^\circ$$



4 Types of Unit Cell

P = Primitive
I = Body-Centered
F = Face-Centered
C = Side-Centered

7 Crystal Classes
→ 14 Bravais Lattices

- 7 crystal systems
- 14 Bravais lattice systems
- Space group = Lattice identifier + known symmetry relationships
- Molecules within the crystal will most likely pack with symmetry

Point Groups Space Groups Crystals And Molecules

Ralph Walter Graystone Wyckoff



Point Groups Space Groups Crystals And Molecules:

Point Groups, Space Groups, Crystals, Molecules R. Mirman, 1999 This book is by far the most comprehensive treatment of point and space groups and their meaning and applications Its completeness makes it especially useful as a text since it gives the instructor the flexibility to best fit the class and goals The instructor not the author decides what is in the course And it is the prime book for reference as material is much more likely to be found in it than in any other book it also provides detailed guides to other sources Much of what is taught is folklore things everyone knows are true but almost no one knows why or has seen proofs justifications rationales or explanations Why are there 14 Bravais lattices and why these Are the reasons geometrical conventional or both What determines the Wigner Seitz cells How do they affect the number of Bravais lattices Why are symmetry groups relevant to molecules whose vibrations make them unsymmetrical And so on Here these analyses are given interrelated and in depth The understanding so obtained gives a strong foundation for application and extension Assumptions and restrictions are not merely made explicit but also emphasized In order to provide so much information details and examples and ways of helping readers learn and understand the book contains many topics found nowhere else or only in obscure articles from the distant past The treatment is often completely different from those elsewhere At least in the explanations and usually in many other ways the book is completely new and fresh It is designed to inform educate and make the reader think It strongly emphasizes understanding The book can be used at many levels by many different classes of readers from those who merely want brief explanations perhaps just of terminology who just want to skim to those who wish the most thorough understanding

Point Groups, Space Groups, Crystals, Molecules

Ronald Mirman, 1999-05-14 This book is by far the most comprehensive treatment of point and space groups and their meaning and applications Its completeness makes it especially useful as a text since it gives the instructor the flexibility to best fit the class and goals The instructor not the author decides what is in the course And it is the prime book for reference as material is much more likely to be found in it than in any other book it also provides detailed guides to other sources Much of what is taught is folklore things everyone knows are true but almost no one knows why or has seen proofs justifications rationales or explanations Why are there 14 Bravais lattices and why these Are the reasons geometrical conventional or both What determines the Wigner Seitz cells How do they affect the number of Bravais lattices Why are symmetry groups relevant to molecules whose vibrations make them unsymmetrical And so on Here these analyses are given interrelated and in depth The understanding so obtained gives a strong foundation for application and extension Assumptions and restrictions are not merely made explicit but also emphasized In order to provide so much information details and examples and ways of helping readers learn and understand the book contains many topics found nowhere else or only in obscure articles from the distant past The treatment is often completely different from those elsewhere At least in the explanations and usually in many other ways the book is completely new and fresh It is designed to inform educate and make the reader think It strongly emphasizes

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Table of Contents Point Groups Space Groups Crystals And Molecules

1. Understanding the eBook Point Groups Space Groups Crystals And Molecules
 - The Rise of Digital Reading Point Groups Space Groups Crystals And Molecules
 - Advantages of eBooks Over Traditional Books
2. Identifying Point Groups Space Groups Crystals And Molecules
 - 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 Point Groups Space Groups Crystals And Molecules
 - User-Friendly Interface
4. Exploring eBook Recommendations from Point Groups Space Groups Crystals And Molecules
 - Personalized Recommendations
 - Point Groups Space Groups Crystals And Molecules User Reviews and Ratings
 - Point Groups Space Groups Crystals And Molecules and Bestseller Lists
5. Accessing Point Groups Space Groups Crystals And Molecules Free and Paid eBooks

- Point Groups Space Groups Crystals And Molecules Public Domain eBooks
- Point Groups Space Groups Crystals And Molecules eBook Subscription Services
- Point Groups Space Groups Crystals And Molecules Budget-Friendly Options
- 6. Navigating Point Groups Space Groups Crystals And Molecules eBook Formats
 - ePub, PDF, MOBI, and More
 - Point Groups Space Groups Crystals And Molecules Compatibility with Devices
 - Point Groups Space Groups Crystals And Molecules Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Point Groups Space Groups Crystals And Molecules
 - Highlighting and Note-Taking Point Groups Space Groups Crystals And Molecules
 - Interactive Elements Point Groups Space Groups Crystals And Molecules
- 8. Staying Engaged with Point Groups Space Groups Crystals And Molecules
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Point Groups Space Groups Crystals And Molecules
- 9. Balancing eBooks and Physical Books Point Groups Space Groups Crystals And Molecules
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Point Groups Space Groups Crystals And Molecules
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Point Groups Space Groups Crystals And Molecules
 - Setting Reading Goals Point Groups Space Groups Crystals And Molecules
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Point Groups Space Groups Crystals And Molecules
 - Fact-Checking eBook Content of Point Groups Space Groups Crystals And Molecules
 - 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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