What Is The Correct Formula For The Compound That Forms Between Strontium And Sulfur?what Is The Correct

What Is The Correct Formula For The Compound That Forms Between Strontium And Sulfur?what Is The Correct is a question that often arises in the context of inorganic chemistry, particularly when studying the chemical bonding and compound formation of alkaline earth metals with non-metals. Understanding how strontium interacts with sulfur to form a stable compound involves a clear grasp of valence electron configurations, ion formation, and the principles of chemical nomenclature. In this comprehensive article, we will explore the details of the compound formed between strontium and sulfur, determine its correct chemical formula, and provide insights into the underlying chemical principles.

Introduction to Strontium and Sulfur

Before delving into the specifics of the compound's formula, it is essential to understand the individual characteristics of strontium and sulfur.

Strontium (Sr)

- Position in the Periodic Table: Strontium is an alkaline earth metal located in Group 2 (Group IIA) of the periodic table.
- Atomic Number: 38
- Electron Configuration: [Kr] $5s^2$
- Valence Electrons: 2 (in the 5s subshell)
- Common Ionic State: Strontium typically forms a +2 charge (Sr^{2+}) by losing its two valence electrons.

Sulfur (S)

- Position in the Periodic Table: Non-metal, Group 16 (Group VIA)
- Atomic Number: 16
- Electron Configuration: [Ne] $3s^2$ $3p^4$
- Valence Electrons: 6 (in the 3s and 3p orbitals)
- Common Ionic and Covalent Behavior: Sulfur can gain 2 electrons to complete its octet, forming S^{2-} ions, or it may share electrons in covalent compounds.

Formation of the Compound: Strontium and Sulfur

The interaction between strontium and sulfur involves the transfer or sharing of electrons to achieve stable electron configurations, leading to the formation of compounds.

Valence Electron Considerations

- As an alkaline earth metal, strontium has two valence electrons that it readily loses to attain a noble gas configuration.
- Sulfur, with six valence electrons, can accept two electrons to complete its octet.

Type of Bonding

- The most common interaction between such metals and non-metals involves ionic bonding, where electrons are transferred from the metal to the non-metal.
- In this case, strontium donates electrons, forming Sr^{2+} cations.
- Sulfur accepts electrons, forming S^{2-} anions.

Determining the Correct Formula

The key to writing the correct chemical formula lies in balancing the charges of the ions formed to produce a neutral compound.

Step 1: Identify the Ions

- Strontium Ion: Sr^{2+}
- Sulfide Ion: S^{2-}

Step 2: Balance the Charges

- Since Sr^{2+} and S^{2-} both carry a charge of 2, they combine in a 1:1 ratio to balance out the charges.

Step 3: Write the Empirical Formula

- The ions combine in a ratio of 1:1, leading to the formula SrS.

Step 4: Confirm the Formula

- The compound formed is an ionic compound called strontium sulfide.
- The formula SrS indicates one strontium ion for every sulfide ion.

Additional Details on the Compound

Physical and Chemical Properties of Strontium Sulfide (SrS)

- Appearance: Usually a white or yellowish crystalline solid.
- Solubility: Slightly soluble in water; more soluble in acids.
- Uses: Used in phosphors, luminescent materials, and in the production of strontium compounds for fireworks and pyrotechnics.

Chemical Behavior

- Strontium sulfide reacts with acids to produce hydrogen sulfide gas or other sulfur-containing compounds.
- It is relatively stable under normal conditions but must be handled carefully due to its reactivity.

Understanding the Nomenclature

The naming of ionic compounds follows specific rules:

- The cation (positively charged ion) is named first, using the element name.
- The anion (negatively charged ion) is named second, with its suffix changed to "-ide" if it is a simple monoatomic ion.
- For SrS, the name is strontium sulfide.

Common Misconceptions and Clarifications

Mistake: Assuming Covalent Bonding

- While sulfur can form covalent compounds, in the case of reaction with strontium, ionic bonding predominates because of the significant difference in electronegativities.

Misconception: Multiple Formulas

- Some might believe that the compound could have other formulas such as Sr_2S or SrS_2, but these are incorrect because:
- Sr_2S would imply an ionic ratio of 2:1, which would give a total charge of +4 from two Sr^{2+} ions and −2 from S^{2-}, leading to a net +2 charge — not neutral.
- SrS_2 would imply a ratio of 1:2, with charges +2 and −4, which is not neutral.

- The correct and simplest ratio is 1:1, leading to SrS.

Summary of the Correct Formula

Ion	Symbol	Charge	Number in Formula
Strontium	Sr	+2	1
Sulfide	S	−2	1

Final Formula: SrS

This formula accurately reflects the ionic composition and charge balance of the compound formed between strontium and sulfur.

Conclusion

Understanding the correct formula for the compound between strontium and sulfur involves recognizing their typical ionization states and applying the principles of ionic bonding. Strontium, as an alkaline earth metal, forms Sr^{2+} ions, while sulfur gains two electrons to form S^{2-} ions. These ions combine in a 1:1 ratio to produce SrS, or strontium sulfide, an ionic compound with a simple and balanced chemical formula.

Knowing how to determine ionic formulas is fundamental in inorganic chemistry, and the case of strontium and sulfur serves as a classic example of applying basic principles of charge neutrality, valence electron counting, and nomenclature to arrive at the correct chemical formula. Whether for academic purposes, research, or industrial applications, understanding these concepts ensures accurate communication and comprehension of chemical compounds.

Key Takeaways:
- The correct chemical formula for the compound formed between strontium and sulfur is SrS.
- The formation involves ionic bonding, with Sr^{2+} and S^{2-} ions.
- The compound is called strontium sulfide.
- The ratio of ions is 1:1, ensuring charge neutrality.

By mastering these fundamental concepts, students and chemists can confidently determine chemical formulas of similar ionic compounds, enhancing their understanding of inorganic chemistry and material science.

Frequently Asked Questions

What is the correct chemical formula for the compound formed between strontium and sulfur?

The correct formula is SrS, which represents strontium sulfide.

How do you determine the correct formula for a compound between strontium and sulfur?

You determine the formula by balancing the charges: strontium has a +2 charge and sulfur has a −2 charge, so they combine in a 1:1 ratio, resulting in SrS.

Is the compound between strontium and sulfur ionic or covalent?

The compound is ionic because it involves a metal (strontium) and a non-metal (sulfur), forming an ionic bond.

What are the common oxidation states of strontium and sulfur in their compound?

Strontium typically has a +2 oxidation state, and sulfur in sulfides has a −2 oxidation state, leading to SrS.

Can the formula for strontium sulfide vary with different conditions?

No, the formula SrS is consistent because of the fixed oxidation states, although different sulfides can exist for other elements.

What is the name of the compound with the formula SrS?

The compound is called strontium sulfide.

How does the ionic bonding in SrS influence its properties?

The ionic bonding results in high melting points, solubility in water, and crystalline structures typical of ionic compounds.

Are there any other possible compounds between strontium and sulfur?

While SrS is the most common, other compounds like Sr2S3 can exist, but SrS is the primary and most stable form.

What is the significance of knowing the correct formula of strontium sulfide?

Knowing the correct formula is essential for understanding its chemical properties, reactivity, and applications in materials science and industry.

Additional Resources

What Is The Correct Formula For The Compound That Forms Between Strontium And Sulfur? What Is The Correct

Understanding the precise chemical formula of compounds is fundamental in inorganic chemistry, as it provides critical insight into their composition, structure, and properties. When it comes to the reaction between strontium and sulfur, identifying the correct chemical formula involves a detailed analysis of their ionic states, valency, and the principles governing compound formation. This article aims to thoroughly investigate the compound formed between strontium and sulfur, elucidate its correct chemical formula, and explore the underlying chemistry that dictates its composition.

Introduction to Strontium and Sulfur Chemistry

Strontium (Sr) and sulfur (S) are elements that belong to distinct regions of the periodic table and possess unique chemical behaviors. An understanding of their individual properties lays the foundation for predicting the nature of their compound.

Properties of Strontium

- Position in Periodic Table: Group 2 (alkaline earth metals), Period 5
- Electronic Configuration: [Kr] $5s^2$
- Common Oxidation State: +2
- Physical Characteristics: Soft, silvery-white metallic element; reactive, especially with acids and nonmetals

Properties of Sulfur

- Position in Periodic Table: Group 16 (chalcogens), Period 3
- Allotropic Forms: Rhombic, monoclinic, amorphous
- Common Oxidation States: −2, +4, +6
- Chemical Behavior: Nonmetal; tends to form covalent compounds, but can also form ionic compounds with metals

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Formation of Compounds Between Strontium and Sulfur

When strontium interacts with sulfur, the primary compound formed is an ionic sulfide, owing to the difference in their electronegativities and the nature of their bonding.

Valence and Oxidation States

- Strontium commonly exhibits a +2 oxidation state because it has two valence electrons that it readily loses to attain a noble gas configuration.
- Sulfur, in metallic compounds, often assumes a −2 oxidation state, especially when forming sulfides with alkaline earth metals.

This complementary valency suggests that strontium can combine with sulfur in a 1:1 molar ratio to form a stable ionic compound.

General Rules for Writing Ionic Formulas

- The total positive charge must balance the total negative charge.
- The simplest whole-number ratio of ions is used to write the empirical formula.

Applying these principles, for strontium and sulfur:

- Sr^{2+} (strontium ion)
- S^{2-} (sulfide ion)

The charges balance perfectly in a 1:1 ratio, leading to the empirical formula SrS.

Determining the Correct Chemical Formula

The question "What is the correct formula for the compound that forms between strontium and sulfur?" hinges on understanding their bonding and oxidation states.

Evidence Supporting SrS as the Primary Compound

- Stability: SrS is known to be a stable ionic compound.
- Precedent in Chemistry: Similar alkaline earth metal sulfides (e.g., calcium sulfide, BaS) follow analogous formulas.
- Crystallography: X-ray diffraction studies confirm the SrS structure as a simple binary sulfide with a 1:1 ratio.
- Chemical Synthesis: Laboratory synthesis typically yields SrS when strontium reacts with sulfur under controlled conditions.

Possible Variants or Higher Sulfides?

While in some elements, higher sulfides exist (e.g., TiS_2, FeS_2), these are typically compounds where sulfur is present in different oxidation states or forms polyatomic sulfide ions (like S_2^{2-}). For alkaline earth metals like strontium, the formation of higher sulfides with different ratios is rare and less stable.

- Strontium Disulfide (SrS_2): Not commonly observed; when sulfur forms S_2^{2-} ions, compounds with different ratios can exist, but these are not typical for strontium.
- Other Possible Sulfide Ratios: For example, Sr_2S_3 would imply a different ratio but is not a standard or stable compound in typical conditions.

Conclusion: Based on chemical principles and experimental evidence, the most stable and commonly occurring compound between strontium and sulfur is SrS.

Structural and Physical Characteristics of SrS

The compound SrS crystallizes in the sodium chloride (NaCl) structure, which is typical for many ionic sulfides involving divalent cations and sulfide anions.

Crystal Structure Features

- Type: Face-centered cubic (FCC) lattice
- Coordination Number: 6 for both Sr^{2+} and S^{2-}
- Properties: High melting points, insoluble in water, and exhibits ionic bonding characteristics

Applications of SrS

- Phosphors in cathode-ray tubes and fluorescent lamps
- Components in laser technology
- Potential use in phosphorescent and optoelectronic devices

Additional Considerations in Compound Formation

While SrS is the primary and most stable sulfide of strontium, understanding the context of compound formation involves additional factors.

Conditions Affecting Compound Formation

- Temperature: Elevated temperatures favor formation of stable SrS.
- Atmosphere: An inert atmosphere prevents oxidation or side reactions.
- Stoichiometry: Precise molar ratios are necessary for pure SrS synthesis.

Potential for Mixed or Defective Compounds

In real-world applications and synthesis, compounds may contain defects,

vacancies, or mixed valency, but these do not alter the fundamental formula.

Summary and Final Remarks

The investigation into the compound formed between strontium and sulfur reveals a straightforward, well-understood chemistry rooted in ionic bonding principles. The dominant and most stable compound formed is SrS.

Key Points:

- Strontium typically exists as Sr^{2+} in compounds.
- Sulfur tends to form S^{2-} ions when reacting with metals.
- The ionic compound SrS results from a 1:1 ratio of Sr^{2+} and S^{2-} ions.
- The empirical formula is SrS.
- SrS adopts a sodium chloride-type crystal structure, emphasizing its ionic nature.
- Other sulfides involving strontium are rare or unstable under standard conditions.

Conclusion

Through comprehensive analysis rooted in periodic trends, valency considerations, and empirical data, it is clear that the correct formula for the compound that forms between strontium and sulfur is SrS. This formula accurately reflects the ionic nature, charge balance, and structural characteristics of the compound. Recognizing this fundamental compound is essential for understanding the chemistry of alkaline earth metal sulfides and their applications across various technological fields.

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