

# What Is The Mass Of Sulfur In 2.0 Moles Of $\text{Al}_2(\text{SO}_4)_3$ ? A. 192.42 GB. 32.07 GC. 64.14 GD. 160.35 G

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Understanding the mass of sulfur in compounds like aluminum sulfate ( $\text{Al}_2(\text{SO}_4)_3$ ) is essential for students, chemists, and anyone interested in chemical calculations. When dealing with chemical formulas and molar calculations, knowing how to determine the amount of specific elements within a compound makes it easier to perform reactions, analyze samples, and understand material compositions. This article explores how to find the mass of sulfur in 2.0 moles of aluminum sulfate, explains related concepts, and offers insights into chemical calculations, ensuring you grasp each step thoroughly.

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## Introduction to Aluminum Sulfate ( $\text{Al}_2(\text{SO}_4)_3$ ) and Its Composition

Aluminum sulfate, with the chemical formula  $\text{Al}_2(\text{SO}_4)_3$ , is a chemical compound widely used in water purification, paper manufacturing, and as a mordant in dyeing. Its molecular structure includes aluminum cations and sulfate anions. To understand how much sulfur is present in a given amount of aluminum sulfate, one must first comprehend its molecular composition and how to interpret the chemical formula.

## Breakdown of the Chemical Formula

- $\text{Al}_2(\text{SO}_4)_3$  indicates:
  - 2 aluminum (Al) atoms
  - 3 sulfate ( $\text{SO}_4$ ) groups
- Each sulfate group ( $\text{SO}_4$ ) contains:
  - 1 sulfur (S) atom
  - 4 oxygen (O) atoms

This composition means that in one mole of  $\text{Al}_2(\text{SO}_4)_3$ , there are:

- 3 moles of sulfate groups
- 3 moles of sulfur atoms (since each sulfate contains one S atom)

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## Calculating the Molar Mass of $\text{Al}_2(\text{SO}_4)_3$

Before calculating the mass of sulfur in a specific amount of aluminum sulfate, it's important to understand the molar mass of the compound itself. The molar mass (molecular weight) is calculated by summing the atomic masses of all atoms in the molecule.

### Atomic Masses of Relevant Elements

| Element       | Atomic Mass (g/mol) |
|---------------|---------------------|
| Aluminum (Al) | 26.98               |
| Sulfur (S)    | 32.07               |
| Oxygen (O)    | 16.00               |

### Step-by-Step Molar Mass Calculation

1. Calculate the mass contribution from aluminum:

-  $2 \text{ Al atoms} \times 26.98 \text{ g/mol} = 53.96 \text{ g}$

2. Calculate the mass contribution from sulfate groups:

- 3  $\text{SO}_4$  groups:  
- S:  $3 \times 32.07 \text{ g} = 96.21 \text{ g}$   
- O:  $3 \times 4 \times 16.00 \text{ g} = 192.00 \text{ g}$

3. Sum all contributions:

- Total molar mass = Aluminum + Sulfate groups  
- Total molar mass =  $53.96 \text{ g} + 96.21 \text{ g} + 192.00 \text{ g} = 342.17 \text{ g/mol}$

This molar mass indicates that one mole of  $\text{Al}_2(\text{SO}_4)_3$  weighs approximately 342.17 grams.

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## Determining the Mass of Sulfur in 2.0 Moles of



Now that the molar mass of the compound is known, we can proceed to find the mass of sulfur in 2.0 moles of aluminum sulfate.

## Step 1: Identify the moles of sulfur in the given amount of compound

Since each mole of  $\text{Al}_2(\text{SO}_4)_3$  contains 3 moles of sulfur atoms, for 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ :

- Moles of sulfur =  $2.0 \text{ mol} \times 3 = 6.0 \text{ mol}$

## Step 2: Calculate the mass of sulfur

Using the atomic mass of sulfur:

- Mass of sulfur = moles  $\times$  atomic mass
- Mass of sulfur =  $6.0 \text{ mol} \times 32.07 \text{ g/mol} = 192.42 \text{ grams}$

Therefore, in 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ , there are approximately 192.42 grams of sulfur.

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## Clarification of Answer Choices

The question presents multiple options for the mass of sulfur:

- A. 192.42 GB
- B. 32.07 GC
- C. 64.14 GD
- D. 160.35 G

Based on the calculations, the correct answer aligns with 192.42 grams, which matches option A.

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## Additional Key Points in Chemical Calculations

- Understanding Molar Ratios: Moles of elements in compounds can be deduced from the chemical formula. For example,  $\text{Al}_2(\text{SO}_4)_3$  always contains 3 moles of sulfur per mole of compound.
- Using Atomic Masses: Atomic masses are crucial for molar mass calculations. Always use accurate atomic weights, typically from periodic table data.
- Mass Conversion: Moles  $\times$  Atomic or Molecular mass gives the mass in grams, an essential conversion in chemistry.
- Application in Real-World Chemistry: These calculations are fundamental in lab settings, industrial processes, and chemical engineering.

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## Practical Applications of Calculating Sulfur Mass in Aluminum Sulfate

Knowing the mass of sulfur in aluminum sulfate is important in various practical contexts:

- Water Treatment: Aluminum sulfate is used as a coagulant, and precise knowledge of its composition helps optimize dosing.
- Environmental Monitoring: Understanding sulfur content aids in assessing environmental impacts or pollutant levels.
- Chemical Manufacturing: Accurate calculations ensure quality control and proper formulation of products.
- Educational Purposes: Learning how to perform such calculations enhances problem-solving skills in chemistry.

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## Summary of Key Points

1. The molar mass of  $\text{Al}_2(\text{SO}_4)_3$  is approximately 342.17 g/mol.
2. Each mole of  $\text{Al}_2(\text{SO}_4)_3$  contains 3 moles of sulfur.
3. In 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ , there are 6.0 moles of sulfur.
4. The mass of sulfur in 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$  is approximately 192.42 grams.
5. The correct answer from the options provided is A. 192.42 GB.

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## Conclusion

Calculating the mass of sulfur in a given amount of aluminum sulfate involves understanding the compound's molecular structure, molar mass, and elemental

composition. By breaking down the chemical formula and applying molar mass calculations, we find that 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$  contain approximately 192.42 grams of sulfur. This knowledge is vital in many chemical applications, from laboratory experiments to industrial processes, and underscores the importance of mastering chemical calculations for accurate and effective chemical science.

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Keywords: sulfur mass in aluminum sulfate,  $\text{Al}_2(\text{SO}_4)_3$  molar mass, chemical calculations, molar ratio of sulfur, molar mass of aluminum sulfate, sulfur in chemical compounds, chemistry homework help, molar mass calculation, chemical formula analysis

## Frequently Asked Questions

### **What is the molar mass of aluminum sulfate, $\text{Al}_2(\text{SO}_4)_3$ ?**

The molar mass of  $\text{Al}_2(\text{SO}_4)_3$  is approximately 342.15 g/mol.

### **How many moles of sulfur are present in 2.0 moles of $\text{Al}_2(\text{SO}_4)_3$ ?**

There are 6.0 moles of sulfur in 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ , since each formula unit contains 3 sulfur atoms.

### **What is the total mass of sulfur in 2.0 moles of $\text{Al}_2(\text{SO}_4)_3$ ?**

The total mass of sulfur is approximately 192.42 grams.

### **How do you calculate the mass of sulfur in a given amount of $\text{Al}_2(\text{SO}_4)_3$ ?**

Multiply the moles of  $\text{Al}_2(\text{SO}_4)_3$  by the moles of sulfur per formula unit (3), then multiply by the molar mass of sulfur (32.07 g/mol).

### **What are the options for the mass of sulfur in 2.0 moles of $\text{Al}_2(\text{SO}_4)_3$ ?**

The options are A. 192.42 GB, B. 32.07 GC, C. 64.14 GD, D. 160.35 G.

**Which answer choice correctly represents the mass of sulfur in 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ ?**

The correct answer is A. 192.42 GB.

**Why is 192.42 grams the correct mass for sulfur in this calculation?**

Because 3 moles of sulfur per mole of  $\text{Al}_2(\text{SO}_4)_3$  times 2.0 moles gives 6 moles of sulfur, and 6 moles multiplied by 32.07 g/mol equals 192.42 g.

**What is the significance of the options GB, GC, GD, and G in the answer choices?**

They are likely formatting or labeling options for the answer choices, indicating different units or categories.

**Can you verify the calculation for the mass of sulfur in 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ ?**

Yes. 3 moles of sulfur per mole of  $\text{Al}_2(\text{SO}_4)_3$ , so 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$  contain 6.0 moles of sulfur. Multiplying 6.0 mol by 32.07 g/mol gives 192.42 grams.

**What is the importance of understanding the composition of compounds like  $\text{Al}_2(\text{SO}_4)_3$  in chemistry?**

It helps in calculating the quantities of elements involved, essential for reactions, formulations, and understanding chemical properties.

## **Additional Resources**

What Is The Mass Of Sulfur In 2.0 Moles Of  $\text{Al}_2(\text{SO}_4)_3$ ? This question is a classic example of stoichiometry in chemistry, involving the calculation of the mass of a specific element within a compound based on the amount in moles. It provides an excellent opportunity to explore how to interpret chemical formulas, understand molar relationships, and perform mass calculations accurately. In this article, we will thoroughly analyze this problem, explain the relevant concepts, and walk through the step-by-step process to find the correct answer.

# Understanding the Problem

Before diving into calculations, it's crucial to understand what the question asks. The problem states: "What is the mass of sulfur in 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ ?" The options given are different numerical values, but our task is to determine the correct mass based on chemical principles.

Key points to consider:

- The compound in question is aluminum sulfate,  $\text{Al}_2(\text{SO}_4)_3$ .
- The quantity of the compound is given in moles (2.0 moles).
- The focus is on sulfur (S), which is part of the sulfate ion ( $\text{SO}_4$ ).

This problem exemplifies the application of molar ratios and atomic masses to find the mass of a particular element within a compound.

## Breaking Down the Chemical Formula

Understanding the structure of  $\text{Al}_2(\text{SO}_4)_3$  is fundamental to solving this problem.

### Chemical Composition

- Aluminum (Al): 2 atoms per formula unit.
- Sulfate groups ( $\text{SO}_4$ ): 3 groups per formula unit.

Each sulfate group ( $\text{SO}_4$ ) contains:

- 1 sulfur atom (S)
- 4 oxygen atoms (O)

Therefore, in  $\text{Al}_2(\text{SO}_4)_3$ :

- Total sulfur atoms: 3 (from three sulfate groups)
- Total oxygen atoms:  $3 \times 4 = 12$

### Molecular Weight of $\text{Al}_2(\text{SO}_4)_3$

Calculating the molar mass helps in understanding the scale:

- Aluminum (Al): approximately 26.98 g/mol
- Sulfur (S): approximately 32.07 g/mol
- Oxygen (O): approximately 16.00 g/mol

Molar mass:

- Aluminum:  $2 \times 26.98 = 53.96$  g/mol
- Sulfate groups:  $3 \times (32.07 + 4 \times 16.00)$
- Each sulfate:  $32.07 + 64.00 = 96.07$  g/mol
- Total for 3 sulfate groups:  $3 \times 96.07 = 288.21$  g/mol

Total molar mass of  $\text{Al}_2(\text{SO}_4)_3$ :  
 $53.96 + 288.21 \approx 342.17 \text{ g/mol}$

This value confirms the weight of one mole of the compound.

## Calculating the Mass of Sulfur

The core of the problem involves determining how much sulfur is present in the given amount of compound.

### The Relationship Between Moles and Mass

- Each mole of  $\text{Al}_2(\text{SO}_4)_3$  contains 3 moles of sulfur atoms.
- Therefore, in 1 mole of  $\text{Al}_2(\text{SO}_4)_3$ , there are 3 moles of sulfur.

For 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ :

- Total moles of sulfur =  $2.0 \times 3 = 6.0$  moles

### Mass of Sulfur in the Given Moles

Using atomic mass:

- Mass of sulfur in 6.0 moles =  $6.0 \text{ moles} \times 32.07 \text{ g/mol} = 192.42 \text{ g}$

This calculation directly yields the mass of sulfur in the specified amount of compound.

## Analyzing the Multiple Choice Options

The options given are:

- A. 192.42 GB
- B. 32.07 GC
- C. 64.14 GD
- D. 160.35 G

Based on our calculation:

- The correct mass of sulfur in 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$  is 192.42 grams.

This matches option A: 192.42 GB (assuming 'GB' here signifies grams, although the notation is unconventional).

## Clarifying the Notation and Potential

# Confusions

It's worth noting that the options include suffixes like GB, GC, GD, and G. Typically, in chemistry, the unit for mass is grams (g). The notation "GB," "GC," etc., is unusual; perhaps these are references or typographical errors. Since all options end with "G," it's reasonable to interpret these as grams, with the preceding abbreviations possibly being distractors or formatting artifacts.

Assuming:

- GB = grams
- GC, GD, and G are just options with different numerical values

The key takeaway:

- The only option matching our calculated value is 192.42 G, which aligns with the first option's numerical value.

Conclusion:

- The correct answer is the one with the numerical value 192.42 grams, which corresponds to option A: 192.42 GB.

## Summary of Key Concepts

- Chemical formulas indicate the number of atoms of each element.
- Molar masses allow the conversion between moles and grams.
- The molar ratio from the formula determines the number of moles of an element per mole of compound.
- Multiplying the moles of element by its atomic mass yields the element's mass.

## Pros and Cons of the Approach

Pros:

- Clear step-by-step methodology ensures accurate calculations.
- Reinforces understanding of chemical formulas and stoichiometry.
- Useful for solving similar problems involving compound composition.

Cons:

- Assumes familiarity with atomic masses and molar calculations.
- Potential confusion over notation in options (GB, GC, etc.).
- Does not account for experimental uncertainties or measurement errors.

## Final Thoughts

Understanding how to calculate the mass of a specific element within a compound is fundamental in chemistry. It combines knowledge of chemical formulas, atomic weights, and molar ratios. For the problem at hand, the straightforward calculation shows that in 2.0 moles of  $\text{Al}_2(\text{SO}_4)_3$ , there are 192.42 grams of sulfur, making option A the correct choice. Mastery of these concepts is essential for students and professionals working in chemical analysis, research, and industry applications.

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If you have further questions or need additional explanations on related topics, feel free to ask!

## **What Is The Mass Of Sulfur In 2.0 Moles Of $\text{Al}_2(\text{SO}_4)_3$ A 192.42 G B 32.07 G C 64.14 G D 160.35 G**

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