Find The Number Of Moles In 6120 Ions Of NaCl. Round Your Answer To Two Decimal Places. Input Your Answer

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Introduction

Understanding the relationship between the number of particles (such as ions or molecules) and moles is fundamental in chemistry. When given a specific number of ions, such as 6120 ions of sodium chloride (NaCl), the goal is to determine how many moles this quantity represents. This process involves fundamental concepts like Avogadro's number and the mole concept, which connect microscopic particles to macroscopic quantities used in laboratory measurements.

Understanding Ions and Mole Concept

What Are Ions?

Ions are atoms or molecules that have gained or lost electrons, resulting in a net electric charge. In the case of sodium chloride, NaCl, it typically exists as ions in solution:

- Sodium ion (Na^+)
- Chloride ion (Cl^-)

What is a Mole?

The mole is a standard unit in chemistry used to express amounts of a chemical substance. One mole contains exactly **Avogadro's number** of particles, which is approximately 6.022×10^{23} particles.

Converting Ions to Moles

Step 1: Recognize the Given Data

The problem provides:

- Number of ions: 6120

Step 2: Recall Avogadro's Number

Avogadro's number (N_A) is:

6.022×10^{23} particles/mole

Step 3: Calculate the Number of Moles

The number of moles (n) corresponding to a certain number of particles (N) is given by:

$n = N / N_A$

Where:

- N = number of particles (ions)
- N_A = Avogadro's number

Step-by-Step Calculation

Step 1: Plug in the Values

$n = 6120 / (6.022 \times 10^{23})$

Step 2: Perform the Division

Calculating the division:

$n = 6120 / 6.022 \times 10^{23}$

1. First, divide 6120 by 6.022:

$6120 / 6.022 \approx 1017.84$

2. Now, express the result with the scientific notation:

$n \approx 1017.84 \times 10^{-23}$

Final Answer: Rounded to Two Decimal Places

Expressing the result in standard form with two decimal places:

$n \approx 1.02 \times 10^{-20}$ mol

Thus, the number of moles in 6120 ions of NaCl is approximately **1.02×10^{-20}** mol.

Understanding the Significance of the Result

Microscopic vs. Macroscopic Quantities

This calculation highlights the microscopic scale of individual ions relative to the macroscopic quantities chemists typically work with. The tiny value ($\sim 10^{-20}$ mol) emphasizes that a very small number of ions corresponds to an extremely small amount of substance in moles.

Practical Applications

In real laboratory settings, measurements are often in grams or molar concentrations rather than individual ions. However, understanding how to convert between particles and moles is vital for stoichiometry, solution preparation, and understanding chemical reactions at the atomic level.

Summary and Key Takeaways

- One mole contains 6.022×10^{23} particles (Avogadro's number).
- To find the number of moles from particles, divide the number of particles by Avogadro's number.
- For 6120 ions of NaCl, the number of moles is approximately 1.02×10^{-20}.
- This tiny value underscores the scale difference between microscopic particles and macroscopic amounts.

Conclusion

Converting a small number of ions into moles involves straightforward division by Avogadro's number. In this case, 6120 ions of NaCl correspond to approximately 1.02×10^{-20} mol. Mastery of these conversions is essential for students and professionals working in chemistry, as it bridges the microscopic world of atoms and ions with the macroscopic quantities measured in laboratories. Whether calculating solution concentrations or balancing chemical equations, understanding how to convert between particles and moles is a fundamental skill vital for accurate chemical analysis and experimentation.

Frequently Asked Questions

What is the number of moles in 6120 ions of NaCl? Round your answer to two decimal places.

1.00×10^{-19} moles

How do you convert ions to moles for NaCl?

Divide the number of ions by Avogadro's number (6.022×10^{23}) to find moles.

What is Avogadro's number?

Avogadro's number is 6.022×10^{23}, representing the number of particles in one mole.

Calculate the moles in 6120 NaCl ions.

Number of moles = $6120 / (6.022 \times 10^{23}) \approx 1.02 \times 10^{-21}$ moles.

Why is the number of ions important in chemistry calculations?

It helps determine quantities of substances at the atomic or molecular level for reactions and stoichiometry.

What is the significance of rounding to two decimal places in this context?

It provides a precise yet manageable figure suitable for practical and educational purposes.

Can you find the number of moles in 6120 NaCl ions using a simple formula?

Yes, moles = number of ions / Avogadro's number.

What assumptions are made when converting ions to moles?

Assumes ions are discrete particles and that Avogadro's number accurately relates particles to moles.

What is the final answer for the number of moles in 6120 NaCl ions rounded to two decimal places?

Approximately 1.02×10^{-21} moles.

Additional Resources

Find The Number Of Moles In 6120 Ions Of NaCl is a fundamental question in chemistry that bridges the microscopic world of atoms and ions with the macroscopic quantities we measure and observe. Understanding how to convert between individual particles (such as ions or molecules) and moles is essential for students, educators, and professionals working with chemical reactions, solutions, and stoichiometry. This guide will walk you through the process step-by-step, ensuring you grasp the core concepts and can confidently perform similar calculations in your studies or laboratory work.

Introduction: The Importance of Moles in Chemistry

In chemistry, the concept of a mole is central to quantifying the amount of substance. One mole contains exactly 6.022×10^{23} particles (atoms, ions, molecules, etc.), a number known as Avogadro's number. Whether you're working with ions like Na^+ and Cl^- in solution or molecules in a compound, understanding how to relate particles to moles allows for precise calculations, essential for balancing reactions, preparing solutions, and analyzing chemical systems.

Understanding the Problem

The specific problem at hand is:

> Find the number of moles in 6120 ions of NaCl, rounded to two decimal places.

At first glance, it might seem straightforward: since 6120 is a small number, simply dividing by Avogadro's number should give us the moles. However, it is crucial to understand what the ions represent and how they relate to the total number of moles in a sample.

Step 1: Clarify the Relationship Between Ions and Molecules

NaCl is an ionic compound composed of sodium ions (Na^+) and chloride ions (Cl^-). In the context of this problem:

- Each NaCl molecule dissociates into 2 ions: one Na^+ and one Cl^-.
- When the problem mentions ions, it refers to individual Na^+ or Cl^- particles, not the entire NaCl molecules.

Important note: The number of ions (6120) given in the problem could refer to either the total number of ions (both Na^+ and Cl^- combined) or the number of NaCl molecules. Since the problem states "6120 ions of NaCl," it most logically refers to individual ions, not molecules.

Step 2: Determine the Number of Molecules Corresponding to the Ions

Given:

- Total ions = 6120

If each NaCl molecule dissociates into 2 ions, then:

- The total number of molecules = Total ions / 2

This is because:

- 1 molecule produces 2 ions.
- To find the number of molecules, divide the total number of ions by 2.

Calculations:

Number of molecules = 6120 ions / 2 = 3060 molecules

Step 3: Convert Molecules to Moles

Now, to find the number of moles, we use Avogadro's number (6.022×10^{23}):

$$
\text{Number of moles} = \frac{\text{Number of molecules}}{\text{Avogadro's number}}
$$

Plugging in the values:

$$
\text{Number of moles} = \frac{3060}{6.022 \times 10^{23}}
$$

Calculations:

$$
\text{Number of moles} \approx 5.084 \times 10^{-21}
$$

Step 4: Round to Two Decimal Places

Since the result is in scientific notation and extremely small, rounding to two decimal places essentially results in 0.00 because:

$$
5.084 \times 10^{-21} \approx 0.00
$$

However, for completeness and accurate reporting, the precise value is:

Answer: 0.00

Final Answer

The number of moles in 6120 ions of NaCl is approximately 0.00 mol when rounded to two decimal places.

Additional Considerations

- Significance of the Result: The tiny value indicates that a small number of ions corresponds to an extremely small quantity of substance, which is typical at the atomic or ionic scale.
- Real-world Applications: In laboratory settings, such small amounts are often handled via mole calculations when dealing with large quantities of ions or molecules, not individual particles.
- Alternative Approaches: For larger quantities, the same principles apply, just with larger numbers, making calculations more practical.

Summary of the Calculation Process

1. Identify what the ions represent: Each NaCl molecule dissociates into 2 ions.
2. Calculate total molecules: Divide total ions by 2.
3. Convert molecules to moles: Divide the total molecules by Avogadro's number.
4. Round appropriately: To two decimal places for the final answer.

Final Notes

Understanding the conversion from ions to moles is fundamental in chemistry. Remember to clarify whether the problem involves individual ions or molecules, and always consider the dissociation of ionic compounds. With practice, these conversions become routine, enabling precise calculations necessary for research, education, and industry applications.

Input Your Answer: 0.00

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