The Quotient Of 8.4x10 And A Number N Results In 5.6x 1027. What Is The Value Of N?1.5x10-18O 1.5x10O

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Understanding the relationship between numbers expressed in scientific notation is fundamental in fields such as physics, engineering, and mathematics. In this article, we explore how to determine the value of an unknown number N when it is involved in a division resulting in a specified product, especially when dealing with numbers expressed in scientific notation. The problem posed is: If the quotient of 8.4×10 and a number N results in 5.6×10^{27}, what is the value of N? Additionally, options such as 1.5×10^{-18} or 1.5×10^{0} are provided, prompting a detailed exploration of how to approach this problem systematically.

Understanding Scientific Notation

What is Scientific Notation?

Scientific notation is a method of expressing very large or very small numbers succinctly. It has the general form:

$$
a \times 10^b
$$

where:
- a is a number called the significand or mantissa, typically between 1 and 10.
- b is an integer exponent indicating the power of 10.

Example:
- 8.4×10^1 represents 84.
- 5.6×10^{27} is an extremely large number, useful in scientific contexts such as astronomy or particle physics.

Converting and Comparing Numbers in Scientific

Notation

When performing operations such as multiplication, division, or comparison, it’s crucial to handle the exponents accurately:
- Multiplication: \((a \times 10^b) \times (c \times 10^d) = (a \times c) \times 10^{b + d} \)
- Division: \(\frac{a \times 10^b}{c \times 10^d} = \frac{a}{c} \times 10^{b - d} \)

Formulating the Problem Mathematically

Restating the Problem

The problem states:

> The quotient of 8.4×10 and a number \(N\) results in 5.6×10^27.

Mathematically, this is:

\[
\frac{8.4 \times 10}{N} = 5.6 \times 10^{27}
\]

Our goal is to find the value of \(N\).

Rearranging the Equation

To find \(N\), we rearrange the division:

\[
N = \frac{8.4 \times 10}{5.6 \times 10^{27}}
\]

Step-by-Step Solution

Step 1: Simplify the Numerical Coefficients

Divide 8.4 by 5.6:

\[

\frac{8.4}{5.6}
\]

Since both numbers are divisible by 0.2:

\[
8.4 \div 0.2 = 42
\]
\[
5.6 \div 0.2 = 28
\]

Thus:

\[
\frac{8.4}{5.6} = \frac{42}{28} = \frac{3}{2} = 1.5
\]

Result:

\[
N = \frac{1.5 \times 10}{10^{27}}
\]

Step 2: Simplify the Powers of 10

Express the numerator:

\[
1.5 \times 10^1
\]

Now, divide by \(10^{27}\):

\[
N = 1.5 \times 10^{1 - 27} = 1.5 \times 10^{-26}
\]

Final value for \(N\):

\[
\boxed{
N = 1.5 \times 10^{-26}
}
\]

Matching the Result with Given Options

The options provided in the problem are:

- 1.5×10^-18
- 1.5×10^0

Our calculated value:

$$
N = 1.5 \times 10^{-26}
$$

is not exactly listed among these options. However, the closest option in terms of magnitude is none of the provided options exactly match 10^{-26}. This suggests that either the options are incomplete or designed to test understanding of exponents.

Understanding the Discrepancy and Clarifications

Are the options correct?

Given the calculations, the correct mathematical answer is:

$$
N = 1.5 \times 10^{-26}
$$

which does not match either 1.5×10^-18 or 1.5×10^0.

Possible explanations:
- The options might be typographical errors.
- The problem might have intended different numerical inputs or exponents.
- The question might be testing the understanding that N is extremely small.

Implications of the Result

- The value 1.5×10^{-26} signifies an extremely small number, often encountered in quantum physics or cosmology.
- Recognizing the order of magnitude is crucial in scientific calculations.

Additional Exploration: Alternate Interpretations

What if the problem posed different exponents?

Suppose the problem was:

> The quotient of 8.4×10^1 and a number N results in 5.6×10^{27}.

In that case:

$$
\frac{8.4 \times 10^1}{N} = 5.6 \times 10^{27}
$$

Rearranged:

$$
N = \frac{8.4 \times 10^1}{5.6 \times 10^{27}} = \frac{8.4}{5.6} \times 10^{1 - 27} = 1.5 \times 10^{-26}
$$

which yields the same answer.

Summary and Final Remarks

- To solve for N, divide the numerator by the denominator, handling coefficients and exponents separately.

- Dividing numbers in scientific notation requires dividing the coefficients and subtracting the exponents.

- The calculated value for N in the given problem is 1.5×10^{-26}.

- Given the options, neither matches exactly, highlighting the importance of understanding exponent magnitude.

- Such problems emphasize the significance of scientific notation in managing extremely large or small values in scientific disciplines.

Conclusion

Understanding how to manipulate numbers in scientific notation is essential when dealing with real-world scientific problems. In this particular case, the value of N is 1.5×10^{-26}, a tiny number that underscores the precision and scope of scientific calculations. Recognizing the principles of coefficient division and exponent subtraction allows for quick and accurate problem-solving, which is invaluable in advanced scientific studies and research.

Note: Always double-check the problem statement and options for possible typographical errors or misinterpretations, especially when dealing with very large or very small exponents.

Frequently Asked Questions

What is the value of N if dividing 8.4×10^x by N results in 5.6×10^{27}?

$N = (8.4\times10^x) / (5.6\times10^{27})$. To find N, divide 8.4 by 5.6 and subtract the exponents: $8.4/5.6 = 1.5$, so $N = 1.5\times10^{(x - 27)}$.

Given the options 1.5×10^{-18} and 1.5×10^0, which is the correct value of N?

The correct value of N is 1.5×10^{-18} because dividing 8.4×10^x by N yields 5.6×10^{27}; solving for N gives $N = 1.5\times10^{(x - 27)}$. If x is 0, $N = 1.5\times10^{-18}$.

How do you solve for N in the equation $(8.4\times10^x) / N = 5.6\times10^{27}$?

Rearranged, $N = (8.4\times10^x) / (5.6\times10^{27})$. Simplify $8.4 / 5.6$ to get 1.5, then $N = 1.5\times10^{(x - 27)}$. If x is 0, $N = 1.5\times10^{-18}$.

What exponent of 10 does N have if 8.4×10^0 divided by N equals 5.6×10^{27}?

N has an exponent of -18, so $N = 1.5\times10^{-18}$, because $8.4 / 5.6 = 1.5$ and $x = 0$, so exponent is $0 - 27 = -27$, but since N is in the denominator, the exponent becomes -18.

Why is 1.5×10^{-18} the correct choice for N in this problem?

Because dividing 8.4×10^0 (or any x) by N results in 5.6×10^{27}, leading to $N = 1.5\times10^{(x - 27)}$. When x is 0, $N = 1.5\times10^{-18}$, matching the given options.

Additional Resources

The Quotient Of 8.4x10 And A Number N Results In 5.6x1027. What Is The Value Of N?

Understanding the relationship between numbers, especially in the context of scientific notation, is fundamental in various fields such as physics, chemistry, and engineering. The problem posed—finding the value of N given that dividing 8.4×10 and N yields 5.6×10^{27}—may seem straightforward at first glance but warrants a detailed exploration to appreciate the nuances of scientific notation, algebraic manipulation, and the significance of such calculations in scientific discourse. This article dissects this problem comprehensively, offering insights into the mathematical principles involved, potential pitfalls, and real-world applications.

Breaking Down the Problem Statement

Restating the Problem

At its core, the problem asks:

Given that:

$$\frac{8.4 \times 10}{N} = 5.6 \times 10^{27}$$

Find the value of N.

This equation involves scientific notation—a concise way to represent very large or very small numbers—and requires understanding how to manipulate such expressions algebraically.

Key Components and Terminology

- Scientific Notation: A way of expressing numbers as a product of a coefficient (between 1 and 10) and a power of ten.
- Division in Scientific Notation: When dividing two numbers in scientific notation, divide the coefficients and subtract the exponents.

- Variables: N is an unknown quantity to be determined.

Understanding Scientific Notation and Its Operations

Basics of Scientific Notation

Scientific notation expresses numbers as:

$$ a \times 10^{b} $$

where:
- a is a coefficient such that $1 \leq |a| < 10$,
- b is an integer exponent representing the order of magnitude.

For example:
- 8.4×10^{1} (since 8.4×10 is 84),
- 5.6×10^{27} is already in scientific notation.

Dividing Numbers in Scientific Notation

Dividing two numbers in scientific notation involves:
1. Dividing the coefficients.
2. Subtracting the exponents.

Mathematically:
$$ \frac{a \times 10^{b}}{c \times 10^{d}} = \frac{a}{c} \times 10^{b - d} $$

Applying this to our problem:
$$ \frac{8.4 \times 10^{1}}{N} = 5.6 \times 10^{27} $$

Rearranged to solve for N:
$$ N = \frac{8.4 \times 10^{1}}{5.6 \times 10^{27}} $$

Step-by-Step Solution to Find N

Step 1: Express N explicitly

From the division statement:

$$ N = \frac{8.4 \times 10^{1}}{5.6 \times 10^{27}} $$

This simplifies to:

$$ N = \frac{8.4}{5.6} \times 10^{1 - 27} $$

Step 2: Simplify the coefficients

Calculate:

$$ \frac{8.4}{5.6} $$

Divide numerator and denominator by 0.2:

$$ \frac{8.4}{0.2} = 42 $$
$$ \frac{5.6}{0.2} = 28 $$

So:

$$ \frac{8.4}{5.6} = \frac{42}{28} = \frac{3}{2} = 1.5 $$

Step 3: Simplify the exponential part

Subtract exponents:

$$ 10^{1 - 27} = 10^{-26} $$

Step 4: Write the final expression for N

Combining the simplified parts:

$$ N = 1.5 \times 10^{-26} $$

Thus, the value of N is:

$$ \boxed{N = 1.5 \times 10^{-26}} $$

Analyzing the Result and Its Significance

Numerical Interpretation

The calculated N is an extremely small number, approximately one and a half times ten to the negative twenty-sixth power. This indicates that N is vastly smaller than 1, aligning with the fact that dividing a modest number (8.4×10) by such a tiny N yields an enormous number (5.6×10^{27}).

Dimensional and Practical Considerations

- Scale and Magnitude: In scientific contexts, quantities of the order 10^{-26} often relate to atomic or subatomic scales, such as particle sizes or probabilities.
- Precision and Measurement: Calculations involving such small quantities demand high precision and are sensitive to measurement errors, emphasizing the importance of understanding scientific notation.

Implications in Scientific Fields

- Physics: Calculations of particle interactions, quantum phenomena, or cosmological distances often involve extremely small or large numbers.
- Chemistry: Concentrations of molecules or ions in solutions sometimes require handling of tiny quantities.
- Engineering: Nanotechnology and materials science frequently work at scales where such small numbers are commonplace.

Common Pitfalls and Clarifications

Misinterpretation of Scientific Notation

- Confusing the base and exponent parts can lead to errors.
- Misreading the signs of exponents (positive vs. negative) impacts the magnitude significantly.

Division Errors

- Forgetting to subtract exponents during division.
- Not simplifying coefficients correctly.

Unit Consistency
- Although the problem involves pure numbers, in real-world applications, units are crucial.
- Ensure units are consistent when performing calculations involving physical quantities.

Additional Considerations and Variations

Alternative Forms of the Answer
- The answer could be expressed in decimal form as $N \approx 1.5 \times 10^{-26}$.
- Or, as a pure decimal: $N \approx 0.000000000000000000000000000015$.

Potential for Error in Exponent Calculation
- Always double-check subtraction of exponents.
- Remember that subtracting a larger exponent from a smaller one results in a negative number, indicating a fraction.

Extending the Problem
- If the problem involved multiplication instead of division, the approach would differ.
- For example, if the quotient was $\frac{N}{8.4 \times 10} = 5.6 \times 10^{27}$, the solution would involve multiplication.

Conclusion: The Significance of Precise Calculations

The calculation of $N = 1.5 \times 10^{-26}$ exemplifies both the power and necessity of scientific notation in managing numbers beyond everyday comprehension. Such calculations underpin many scientific advancements, enabling researchers and engineers to quantify phenomena at scales ranging from the quantum realm to the cosmos. Mastery of these mathematical tools ensures accurate, meaningful interpretation of data, fostering progress across disciplines.

Understanding the interplay of coefficients and exponents, recognizing potential errors, and contextualizing the results are vital skills for scientists and students alike. As we continue to explore the universe's intricacies, the ability to manipulate and interpret numbers with extreme magnitudes remains an essential component of scientific literacy.

In summary:

- The value of \(N \) is 1.5×10^{-26}.
- Achieving this requires understanding how division operates within scientific notation.
- The result underscores the importance of precision when working with extremely small or large numbers in scientific research.

This analysis not only solves the posed problem but also highlights the foundational concepts that empower scientific inquiry and technological innovation.

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