

What Is The Result Of This Numerical Calculation Using The Correct number Of Significant Figures? (55".0100

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When performing numerical calculations in science and engineering, maintaining the correct number of significant figures is essential to convey the precision of measurements and calculations accurately. In this article, we will explore the calculation involving the number 55".0100, analyze how to determine the result with the appropriate significant figures, and discuss the importance of significant figures in scientific computations.

Understanding Significant Figures

Before diving into the specific calculation, it's crucial to understand what significant figures are and why they matter.

What Are Significant Figures?

Significant figures (often abbreviated as sig figs) are the digits in a number that carry meaningful contributions to its precision. They include:

- All non-zero digits
- Zero digits between non-zero digits
- Zero digits following a decimal point and a non-zero digit
- Certain zeros in large numbers depending on context

Why Are Significant Figures Important?

Proper use of significant figures ensures that the calculated results do not imply more precision than the original measurements warrant. Overstating precision can lead to misleading conclusions, while understating it can waste valuable information.

Analyzing the Number 55".0100

The number in question, 55".0100, appears to be a measurement with units implied by the quotation mark. For clarity, let's assume it represents a measurement in inches, or a similar unit, but the main focus remains on the significant figures.

Significant Figures in 55".0100

- The digits 5, 5 before the decimal are non-zero: 2 significant figures
- The digits 0, 1, 0, 0 after the decimal point are significant because:
 - Zeroes between non-zero digits are significant
 - Trailing zeroes after a decimal point are significant

Total significant figures: 6

Performing Calculations with 55".0100

Suppose we are asked to multiply or divide this number by another measurement, or perhaps perform addition or subtraction. The key principle is that the result must be rounded to reflect the measurement with the least amount of precision.

Example Calculation: Multiplying 55".0100 by 2.5

Let's consider this operation to illustrate significant figures rules.

- First, identify the number of significant figures in each number:

- 55".0100 has 6 sig figs

- 2.5 has 2 sig figs

- Rule for multiplication/division:

The result should be rounded to the number of significant figures of the factor with the fewest sig figs. Here, that's 2.

- Performing the multiplication:

```
\[
55.0100 \times 2.5 = 137.525
\]
```

- Rounding to 2 significant figures:

```
\[
\boxed{1.4 \times 10^2}
\]
```

or

```
\[
140
\]
```

depending on the context.

Example Calculation: Adding 55".0100 and 12.3

For addition, the rule is different:

- The result should be rounded to the least precise decimal place among the addends.

- 55".0100 (which has four decimal places)

- 12.3 (which has one decimal place)

- The sum:

```
\[
55.0100 + 12.3 = 67.3100
\]
```

- Rounded to the least decimal places (1 decimal place):

```
\[
\boxed{67.3}
\]
```

How to Determine the Correct Result of a Numerical Calculation

Step-by-Step Process

1. Identify the operation (addition, subtraction, multiplication, division).
2. Determine the number of significant figures in each number involved.
3. Apply the relevant rule:
 - For multiplication/division: round to the fewest sig figs.
 - For addition/subtraction: round to the least precise decimal place.
4. Perform the calculation.
5. Round the result accordingly.

Example: Calculating $55.0100 \div 3.2$

- 55.0100 has 6 sig figs.
- 3.2 has 2 sig figs.
- Division result:

```
\[
\frac{55.0100}{3.2} \approx 17.1890625
\]
```

- Rounded to 2 sig figs (least in the divisor):

```
\[
\boxed{17}
\]
```

Significance of Correct Significant Figures in Scientific Communication

Accurate reporting of significant figures:

- Ensures clarity and precision.
- Prevents overstatement of measurement accuracy.
- Maintains scientific integrity in data analysis.
- Facilitates proper error analysis and uncertainty estimation.

Common Mistakes to Avoid

- Rounding too early in calculations.
- Using incorrect rules for addition/subtraction vs. multiplication/division.
- Ignoring trailing zeros in decimal numbers.

Practical Applications of Significant Figures

Significant figures are vital across various fields:

- Physics and Engineering: precise measurements during experiments.
- Chemistry: quantifying reactants and products.
- Medicine: dosage calculations requiring exactness.
- Data Analysis: maintaining data integrity.

Tips for Managing Significant Figures

- Always note the number of significant figures in your initial measurements.
- Use scientific notation to clearly indicate the precision.
- Double-check your rounding at each step.

Summary and Conclusion

The calculation involving the number 55".0100 requires careful attention to the significant figures to ensure the result accurately reflects the measurement's precision. With 6 significant figures in the original number, the final answer's significant figures depend on the operation performed:

- For multiplication/division, the answer should be rounded to 2 sig figs if multiplied by a number with 2 sig figs.
- For addition/subtraction, it should be rounded to the least precise decimal place.

Understanding and applying the rules of significant figures are fundamental for producing scientifically valid results. Properly handling significant figures not only preserves the integrity of measurements but also communicates their precision effectively.

Remember: The correct result of a numerical calculation is not just about the mathematical answer but about presenting that answer with the appropriate level of precision, ensuring clarity and accuracy in scientific work.

FAQs

Q1: Why do zeros after the decimal point count as significant?

A1: Because they indicate the measured precision of the number. For example, 55.0100 shows the measurement was precise to the hundredth place.

Q2: How do I decide which significant figures to keep in a calculation?

A2: Follow the rules based on the operation: for multiplication/division, keep the number of sig figs equal to the smallest in the inputs; for addition/subtraction, keep the least decimal places.

Q3: Can significant figures be used to estimate measurement uncertainty?

A3: Yes, they are closely related; the number of significant figures reflects the precision and potential measurement error.

In conclusion, mastering the concept of significant figures ensures that scientific calculations accurately represent the precision of measurements,

promotes clear communication, and supports reliable scientific conclusions.

Frequently Asked Questions

What is the result of multiplying 55.0100 by 1 with the correct number of significant figures?

55.0100 (since multiplying by 1 does not change the value, and the original number has 6 significant figures, the result retains 6 significant figures)

How many significant figures should the product of 55.0100 and 2.0 have?

2.0 has 2 significant figures, so the product should be rounded to 2 significant figures, resulting in 110.

What is the result of dividing 55.0100 by 3.00 considering significant figures?

Using 3.00 with 3 significant figures, the quotient is approximately 18.338, rounded to 3 significant figures: 18.3.

If you add 55.0100 and 10.0, what is the correct result based on significant figures?

Adding 55.0100 and 10.0 gives 65.0100, but since 10.0 has 3 significant figures, the result should be rounded to 3 significant figures: 65.0.

What is the result of subtracting 5.00 from 55.0100 with proper significant figures?

The difference is 50.0100, but rounded to 3 significant figures (from 5.00), the answer is 50.0.

When performing a calculation with 55.0100 and 0.0030, what is the correct result considering significant figures?

Multiplying gives $55.0100 \times 0.0030 = 0.16503$, which should be rounded to 2 significant figures (from 0.0030), resulting in 0.17.

What is the significance of the trailing zeros in 55.0100 when performing calculations?

Trailing zeros in 55.0100 indicate that the number has 6 significant figures, which affects the precision of calculations and rounding accordingly.

How do you determine the correct number of significant figures in a result involving 55.0100?

Identify the factor with the fewest significant figures in the calculation; the final result should be rounded to that number of significant figures to reflect the precision.

What is the final answer when multiplying 55.0100 by 0.1, considering significant figures?

$55.0100 \times 0.1 = 5.50100$, which should be rounded to 2 significant figures (from 0.1), resulting in 5.5.

Additional Resources

What Is The Result Of This Numerical Calculation Using The Correct Number Of Significant Figures? (55".0100)

Understanding the significance of significant figures in numerical calculations is fundamental to scientific accuracy and integrity. When presented with a measurement such as 55".0100, the question arises: what is the correct result of any calculation involving this number, considering the appropriate number of significant figures? This article delves into the principles underpinning significant figures, examines the specific case of 55".0100, and explores how to determine the correct result in various calculations.

Introduction to Significant Figures

Defining Significant Figures

Significant figures (often abbreviated as sig figs) are the digits in a number that carry meaningful contributions to its precision. They include all non-zero digits, zeros between significant digits, and zeros that are to the right of a decimal point in a number. The significance of each digit reflects the measurement's precision.

For example:

- The number 55".0100 has:
- Two non-zero digits before the decimal: 5 and 5.
- Four digits after the decimal: 0, 1, 0, 0.

This totals to 6 significant figures because all non-zero digits and zeros that are part of the measurement's precision are counted.

Rules for Identifying Significant Figures

- Non-zero digits are always significant.

- Zeros between non-zero digits are significant.
- Leading zeros (zeros before the first non-zero digit) are not significant.
- Trailing zeros (zeros after a decimal point) are significant if they follow a non-zero digit.
- Trailing zeros in a whole number without a decimal point may or may not be significant depending on context, but in measured quantities, they are often considered significant.

Applying these rules, 55".0100:

- Has six significant figures, as all zeros after the decimal are significant, given the measurement's precision.

Analyzing the Number: 55".0100

Understanding the Format and Context

The number 55".0100 appears to be a measurement, likely in inches with decimal precision, denoted by the quotation mark ("), which is a common symbol for inches. The decimal part .0100 indicates a precise measurement with four decimal places.

Key observations:

- The number has a total of six significant figures.
- The zeros in .0100 are significant because they specify the measurement's precision.
- The measurement is precise to within one ten-thousandth of an inch.

This high level of precision has implications for the calculation process, especially when considering the rules for significant figures during arithmetic operations.

Significant Figures in Calculations: Rules and Principles

Calculations involving measurements must respect the rules of significant figures to maintain the integrity and accuracy of the data.

Basic Rules for Arithmetic Operations

- Addition and Subtraction: The result should be rounded to the least precise decimal place among the numbers involved.
- Multiplication and Division: The result should be rounded to the number with the fewest significant figures among the operands.

Implication for Complex Calculations

When performing multi-step calculations, it's essential to:

1. Carry all significant figures through intermediate steps.
2. Round off only at the final step according to the rules above.

Applying Significant Figures to the Number 55".0100

Precision and Its Impact

Given that 55".0100 has six significant figures, any calculation involving this number should preserve this level of precision, provided the other numbers involved have equal or greater precision.

Suppose you are asked to multiply 55".0100 by another measurement. In that case, the product must be rounded to six significant figures, matching the measurement with the fewest sig figs involved.

Potential Calculations and Their Results

To illustrate the importance of significant figures, consider common calculations involving 55".0100.

Example 1: Multiplication

Suppose we multiply 55".0100 by 2.5:

- 55".0100 (6 significant figures)
- 2.5 (2 significant figures)

Calculation:

$$55.0100 \times 2.5 = 137.525$$

Determining the result:

- The factor with the fewest significant figures is 2.5 (2 sig figs).
- The product must be rounded to 2 significant figures.

Final answer:

- 137.525 rounded to 2 sig figs $\rightarrow 1.4 \times 10^2$ inches (or 140 inches if expressed in standard notation).

Note: The measurement is now expressed with two significant figures,

respecting the rules.

Example 2: Addition

Suppose we add 55".0100 to 10.0 inches:

- 55".0100 (6 sig figs, precise to four decimal places)
- 10.0 (3 sig figs, precise to the tenths place)

Calculation:

$$55.0100 + 10.0 = 65.0100$$

Determining the result:

- In addition, the result should be rounded to the least precise decimal place among the operands.
- 10.0 is precise to the tenths place, while 55".0100 is precise to four decimal places.
- Therefore, the final result should be rounded to the tenths place: 65.0 inches.

Special Considerations in Measurement and Calculation

Understanding Measurement Uncertainty

When performing calculations involving measurements, it's crucial to recognize the inherent uncertainty. Significant figures encode the measurement's precision, and the final result must reflect this.

For example:

- If a measurement is recorded as 55".0100, the last digit (the hundredths place) is known with certainty.
- Any calculation involving this measurement cannot be more precise than the least precise measurement involved.

Impact of Rounding

Rounding is a vital step to maintain the correctness of significant figures in the final answer. Incorrect rounding can either overstate or understate the precision of the result.

- Always perform rounding at the final step.
- Use proper rules for rounding to avoid introducing bias.

Significance in Scientific and Engineering Contexts

In scientific research and engineering, the correct application of significant figures ensures data integrity, reproducibility, and correct interpretation of results. Overly precise figures may imply unwarranted accuracy, while insufficient precision can undermine the validity of the findings.

Conclusion: Determining the Correct Result

The core of this discussion hinges on understanding that 55".0100 is a measurement with six significant figures, reflecting high precision. When performing calculations involving this number, the rules for significant figures dictate how to round and present the final result.

Key takeaways:

- The number 55".0100 has six significant figures.
- Any calculation involving this number must consider the sig figs of all operands.
- The final answer should be rounded to match the least precise measurement, ensuring the integrity of the data.
- For multiplication or division involving 55".0100, the result should be expressed with six significant figures.
- For addition or subtraction involving 55".0100, the result should be rounded to the least precise decimal place among all numbers involved.

In practical terms, if you perform a calculation such as:

"55".0100 $\times$ 2.5" $\rightarrow$ 1.4 $\times$ 10² inches (rounded to 2 sig figs)

or

"55".0100 + 10.0" $\rightarrow$ 65.0 inches (rounded to the tenths place)

these examples demonstrate how the principles of significant figures govern the correctness and precision of final results.

Final Remarks

Mastering the application of significant figures is essential for anyone engaged in scientific, technical, or engineering work. The example of 55".0100 underscores how meticulous attention to the number of significant figures ensures that calculations accurately reflect the measurement's precision.

In conclusion, the correct result of calculations involving 55".0100 depends on the context of the operations performed, but always adheres to the fundamental rules of significant figures. Whether multiplying, dividing, adding, or subtracting, preserving the appropriate number of significant figures guarantees the credibility and reliability of the results, which is

central to scientific methodology and rigorous data analysis.

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- Lyman, F. (2018). Significant Figures in Measurement and Calculation. Journal of Chemical Education, 95(8), 1357-1362.

Author's note: Always verify the context and the exact rules applicable to your specific field or the guidelines provided for your work, as some conventions may vary slightly.

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