

Significant Figures

The **Significant Figures** of a number refer to those digits that have *meaning in reference to a measured or specified value*. Correctly accounting for Significant Figures is important while performing arithmetic so that the resulting answers accurately represent numbers that have computational significance or value.

There are three rules that are used to determine how many significant figures are in a number. There are also rules for determining how many digits should be included in numbers computed using addition/subtraction, multiplication/ division, or a combination of these operations.

A. Rules for determining how many Sig Figs are in a number:

Rule #1: *Non-Zero digits (# 1 – 9) and Zeros that are in between two non-zero digits are always significant.*

Rule #2: *Leading zeroes are never significant.*

Rule #3: *Trailing zeroes are only significant if a decimal point is present in the number.*

Examples:

a. 809,231

Zero in between
DOES count

Ans: 6 SF's

b. 0.00456

Leading zeroes do
NOT count

Ans: 3 SF's

c. 2300

Trailing zeroes do
NOT count

Ans: 2 SF's

d. 130.00

Trailing zeros
DO count bc of the decimal

Ans: 5 SF's

B. Rules for performing Addition / Subtraction: The final answer is written so that it has the *same number of decimal places as the measurement that has the fewest decimal places (i.e. the number that is the least precise)*.

Examples:

a. $420.03 + 299.270 + 99.068 = 818.368 = \overset{\text{ANSWER}}{818.37}$

This number is the least precise (2 decimal places). So the answer MUST BE rounded to 2 decimal places.

b.
$$\begin{array}{r} 504.09 \\ 246.8 \\ - 119.32 \\ \hline 137.97 \end{array}$$

Least Precise

ANS: 138.0
(1 Decimal place)



C. **Rules for performing Multiplication / Division:** The final answer is written so that it has the *same number of Sig Figs as the measurement with the fewest SF's.*

Examples:

a. $(2400)(3.45)(16.21) = 134,218.8 = 130,000$

(2 SF's) (3 SF's) (4 SF's)

ANSWER

This number only has 2 Sig Figs, so the answer must be rounded to 2 SF's.

Only has 3 SF's, so answer needs rounded to 3 SF's.

b.
$$\begin{array}{r} 0.9935 \\ 10.48 \\ \times 13.4 \\ \hline 139.519192 \end{array}$$
 (Need to round)

ANS: 140.
OR 1.40×10^2

Decimal point causes the "0" to count as a SF.

D. **Rules for Performing a Combination of Operations:** The previous rules listed for A/S and M/D still apply along with incorporating the rules for order of operations (*i.e. PEMDAS*). Be cautious, however, that you **do not round the answer too early!**

Example: $1.4 \times 2.639 + 117.25$ (Order of Operations \rightarrow Multiply then Add)

This is **CORRECT!**

Step 1: Multiply -

$1.4 \times 2.639 + 117.25$
 $= 3.6946$

Because this is multiplication, the answer to this part can only have 2 SF's. This means that the first and second digits are significant. For this particular problem, this means the ones place and the first decimal place. Make note of this, but do **NOT** round yet.

This is **NOT** Correct!

$= 1.4 \times 2.639 + 117.25$
 $= 3.7 + 117.25 = 120.95 \neq 121.0$

Error - Rounded too early. Should have been left as 3.6946.

Step 2: Addition -

$= 3.6946 + 117.25 = 120.9446 = 120.9$ (Correct Answer)

1 decimal place 2 decimal places

Answer needs to be rounded to 1 decimal place because that is the least precise number in the addition calculation.

Note - Conversion Factors are considered to be "perfect" quantities and are not used to determine the number of sig figs / decimal places in the calculated answer.