

000 Working with Significant Figures - Rules 2

1. Leading zeros are never significant.
Imbedded zeros are always significant.
Trailing zeros are significant only if the decimal point is specified.
Hint: Change the number to scientific notation. It is easier to see.
2. **Addition or Subtraction:**
The last digit retained is set by the first doubtful digit.
3. **Multiplication or Division:**
The answer contains no more significant figures than the **least** accurately known number.

EXAMPLES:

Example	Number of Significant Figures	Scientific Notation	
0.00682	3	6.82×10^{-3}	Leading zeros are not significant.
1.072	4	1.072×10^0	Imbedded zeros are always significant.
300	1	3×10^2	Trailing zeros are significant only if the decimal point is specified.
300.	3	3.00×10^2	
300.0	4	3.000×10^2	

EXAMPLES

Addition

$$\begin{array}{r}
 4.7832 \\
 1.234 \\
 + 2.02 \\
 \hline
 8.0372 \\
 \Downarrow \text{rounding} \\
 8.04
 \end{array}$$

Even though your calculator gives you the answer 8.0372, you must round off to 8.04. Your answer must only contain 1 doubtful number. Note that the doubtful digits are underlined.

Subtraction

$$\begin{array}{r}
 1.0236 \\
 - 0.97268 \\
 \hline
 0.05092 \\
 \Downarrow \text{rounding} \\
 0.0509
 \end{array}$$

Subtraction is interesting when concerned with significant figures. Even though both numbers involved in the subtraction have 5 significant figures, the answer only has 3 significant figures when rounded correctly. Remember, the answer must only have 1 doubtful digit.

Multiplication	$\begin{array}{r} 2.8723 \\ \times 1.6 \\ \hline 4.59568 \\ \Downarrow \text{rounding} \\ 4.6 \end{array}$	The answer must be rounded off to 2 significant figures, since 1.6 only has 2 significant figures.
Division	$\begin{array}{r} 45.2 \\ \div 6.3578 \\ \hline 7.1093775 \\ \Downarrow \text{rounding} \\ 7.11 \end{array}$	The answer must be rounded off to 3 significant figures, since 45.2 has only 3 significant figures.

Notes on Rounding

- When rounding off numbers to a certain number of significant figures, do so to the nearest value.
 - example: Round to 3 significant figures: 2.3467×10^4 (Answer: 2.35×10^4)
 - example: Round to 2 significant figures: 1.612×10^3 (Answer: 1.6×10^3)
- What happens if there is a 5? There is an arbitrary rule:
 - If the number before the 5 is odd, round up.
 - If the number before the 5 is even, let it be.

The justification for this is that in the course of a series of many calculations, any rounding errors will be averaged out.

 - example: Round to 2 significant figures: 2.35×10^2 (Answer: 2.4×10^2)
 - example: Round to 2 significant figures: 2.45×10^2 (Answer: 2.4×10^2)
 - Of course, if we round to 2 significant figures: 2.451×10^2 , the answer is definitely 2.5×10^2 since 2.451×10^2 is closer to 2.5×10^2 than 2.4×10^2 .

Question 1 Give the correct number of significant figures for 4500, 4500., 0.0032, 0.04050
Answer = _____

Question 2 Give the answer to the correct number of significant figures:
 $4503 + 34.90 + 550 = ?$
Answer = _____

Question 3 Give the answer to the correct number of significant figures:
 $1.367 - 1.34 = ?$
Answer = _____

Question 4 Give the answer to the correct number of significant figures:
 $(1.3 \times 10^3)(5.724 \times 10^4) = ?$
Answer = _____

Question 5 Give the answer to the correct number of significant figures:
 $(6305)/(0.010) = ?$
