

V. SIGNIFICANT FIGURES IN CALCULATIONS:

Follow along and complete these notes as you view video “#5: Significant Figures in Calculations” at <https://edpuzzle.com>.

- Scientific calculations involve measurements that have _____

- Calculated result can not be more precise than the _____
- Must determine number of significant figures for result, then _____.

A. Rounding

- Largest non-zero digit is _____. Starting there, count to right the _____

- Look at the digit _____
 - If the digit is less than 5, _____
 - If the digit is greater than 5, _____

 - Size of number MUST _____
 - If the number is < 1 , _____
 - If the number is > 1 and you have removed any digits above the ones place, _____

 - If unable to have the correct # of 0's, you _____

Examples: Round the following number to 3 significant figures:

Original #	Rounded	Original #	Rounded
77.0653 g		6,300,178.2 cm ³	
0.00023350 mL		102,030 ft	
2.895×10^{21} km		759.9 ns	

B. Using Significant Digits with multiplication and/or division...

- The result has the same number of significant digits as the _____ used in the problem that has the _____ of significant figures. **ROUND** your answer to this number of sig figs.
- The result can be no more precise than the _____
 - Perform the following calculations. Remember _____
 - $4.32 \text{ mm} \times 1.7 \text{ mm} =$
 - $38.742 \text{ g} \div 0.421 \text{ g} =$
 - $5.40 \text{ m} \times 3.21 \text{ m} \times 1.871 \text{ m} =$

- Do the calculation first, then round!
- You are NOT throwing away important information—you are indicating _____

- Perform the following mathematical operations, indicate the correct number of significant figures needed in the answer, and round your answer correctly. Be sure to include the correct units in your final answer.

OPERATION	RAW ANSWER	SF	ROUNDED ANSWER
$89.5540 \text{ cm} \times 43.10 \text{ cm}$			
$3380 \text{ m}^2 \div 457.0 \text{ m}$			
$0.006750 \text{ g} \div 32 \text{ specks}$			
$278.4 \text{ mm}^2 \times 25.2 \text{ mm}$			

C. Determining Significant Figures using addition/subtraction...

- All numbers _____
 - e.g. $85.1 \text{ g} + 91.8 \text{ km} = ???$
- The result is rounded to the _____
 - e.g. when adding $11.234 \text{ g} + 2.8 \text{ g} + 9.57 \text{ g}$, the result would be rounded to the _____ since 2.8 has the least precise decimal place
 - It is helpful to see this in columnar form:

$\begin{array}{r} 11.234 \text{ g} \\ 2.8 \text{ g} \\ + 9.57 \text{ g} \\ \hline 23.604 \text{ g} \end{array}$	Another example: $\begin{array}{r} 7532 \text{ m} \\ + 400 \text{ m} \\ \hline 7932 \text{ m} \end{array}$
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Perform the following additions and subtractions, indicate the correct number of significant figures needed in the answer, and round your answer correctly. Be sure to include the correct units in your final answer

OPERATION	LAST SIG DIGIT	COLUMNAR	ROUND ANSWER
$2.77 \text{ cm} + 83.018 \text{ cm} + 5.3 \text{ cm}$			
$25.89 \text{ mL} - 22.49 \text{ mL}$			
$250. \text{ m} + 0.67 \text{ m}$			

D. Combined Calculations

- If you have a calculation involving a combination of addition/subtraction and multiplication/division, _____

➤ e.g. when computing % error:

$$\% \text{ Error} = \frac{\left| (8.42 \text{ g/cm}^3 - 8.92 \text{ g/cm}^3) \right|}{8.92 \text{ g/cm}^3} \times 100\%$$

➤ The subtraction is first calculated, with precision to the _____:

$$\left| (8.42 \text{ g/cm}^3 - 8.92 \text{ g/cm}^3) \right| = 0.50 \text{ g/cm}^3$$

➤ This now has _____:

$$\% \text{ Error} = \frac{0.50 \text{ g/cm}^3}{8.92 \text{ g/cm}^3} \times 100\% = \boxed{5.6\%}$$

Example

- A student finds puts a sample of palladium (Pd) with a mass of 39.07 g into 5.35 mL of water in a 10.00-mL graduated cylinder and records the final volume as 8.6 mL. Calculate the density of Pd to the proper number of significant figures allowed by these measurements.

➤ First determine the volume by water displacement:

- _____
- This is subtraction, so the result is precise to the tenths place

➤ Next use the volume of the metal in the density equation:

$$D_{\text{Pd}} = \underline{\hspace{2cm}}$$

- This is division, so the result is precise to 2 sig figs.
- Recording the final volume to one more dec. place would allow one more sig fig!