Some Useful RULES (significant figures, rounding, problem solving format)

Rules for Significant Figures

All nonzero digits are significant	**1,234.56**	(6 *SigFig*)	**12**0	(2 *SigFig*)
Zeros *to the left of a decimal point* are significant	**3**00	(1 *SigFig*)	**300.**	(3 *SigFig*)
Zeros *between nonzero digits* are significant	**1,01**0	(3 *SigFig*)	**2.02**	(3 *SigFig*)
Trailing zeros *in the decimal* are significant	**23.20**	(4 *SigFig*)	0.**3400**	(4 *SigFig*)
Leading zeros are not significant	0.000**34**	(2 *SigFig*)	0.0**203**	(3 *SigFig*)
An ambiguous zero is underlined if significant	**1,01<u>0</u>**	(4 *SigFig*)	**23<u>0</u>0**	(3 *SigFig*)

Rules for Rounding

Addition and Subtraction: Final answer rounds to the same precision as least precise measurement.

97.3 + 5.85 = 103.15 → 103.2 (least precise is to a *tenth*)

Multiplication and Division: Final answer rounds to the least significant measurement.

123 × 5.35 = 658.05 → 658 (least significant is 3 *SigFig*)

Absolute Error and Relative Error

Absolute error = experimental value - accepted value $AbsErr = Exp - Acc$

Relative (or percent) error = absolute error ÷ accepted value (× 100) $RelErr(\%) = \frac{AbsErr}{Acc}(\times 100)$

The Required Problem Solving Format

1. Read the problem (underline key information if possible.)
2. List the **Known** (or *given*) and **Unknown** information (in a table or diagram.) Give each bit of information a letter (a variable). Include unit abbreviations.
3. **Relationship:**
   a. Write an equation in the most familiar form [variables only - MCAS format].
   b. Rearrange the variables in the equation if necessary to solve for the unknown.
4. **Solution.** Substitute the known in place of the variables. Include unit abbreviations.
5. Calculate, round correctly, and circle the **Answer**. Include unit abbreviations.

Use units everywhere. Cross out units that cancel.

Example Problem

Suzy rode her bicycle at an average speed of 19 kilometers per hour for 2.2 hours. How far did she go?

v_{avg} Δt d

$19\ km/h = v_{avg}$

$2.2\ h = \Delta t$

Knowns [with units and a variable]

$d = ?$

Unknown [with a variable]

$v_{avg} = \frac{d}{\Delta t} \rightarrow d = v_{avg}\Delta t$

Relationship [variables only; MCAS format]

Relationship [variables rearranged to solve for the unknown]

$d = 19\ km/\cancel{h} \times 2.2\ \cancel{h} = 41.8\ km = 42\ km$

Solution [with units; cross out units that cancel]

Answer [rounded; with units]