⊛ Significant Figures and Calculations.

↳ remember from earlier (p.1-6), the number of sig.figs. equals the number of certain digits in a measurement, plus one best guess digit (the uncertain digit).

* Rules for Counting Significant Figures:

① Nonzero #'s are always counted as significant.

② Leading Zeros are never significant.

ex: 0.0025 ⟶ 2 sig. figs.
(this is nothing → 0; 0.00 ↳ leading zeros)

ex: .0043 ⟶ 2 sig. figs.
(.00 ↳ leading zeros)

③ Captive Zeros (Inclusive Zeros) are located between nonzero numbers and are always counted as significant.

ex: 1.008 ⟶ 4 sig. figs.
↳ captive zeros

ex: 50347 ⟶ 5 sig. figs.

④ Trailing Zeros = zeros at the right end of a number.
↳ they are significant only if the # contains a decimal point.

ex: 100 ⟶ 1 sig. fig
ex: 4.200 ⟶ 4 sig. figs.
ex: 100. ⟶ 3 sig. figs.

ex: 4200 ⟶ 2 sig. figs.
ex: 1.00×10^{-4} ⟶ 3 sig. figs.
↳ ignore this part.
ex: 0.003400 ⟶ 4 sig. figs.

⑤ Exact Numbers. ⇒ Different from Rules 1-4 above.
↳ = these are #'s that are not obtained by measurement. Instead they are obtained by counting. Thus, there's no uncertainty.

ex: 12 eggs ⟶ infinite # of sig. figs. (∞)
ex: 172 atom ⟶ ∞ sig. figs.
ex: 10 experiments ⟶ ∞ # of sig. figs.

ex: Conversion factors (coming up soon) are said to have an infinite # of significant figures.

1 inch is defined as exactly 2.54 cm.
↳ ∞ sig. figs.
↳ ∞ sig. figs.

ex: How many significant figures in the following?

a) 600 ⟶ 1 sig. fig.
b) 6.0×10^2 ⟶ 2 sig. figs.
c) 6.00×10^6 ⟶ 3 sig. figs.
d) 0.0048 ⟶ 2 sig. figs.
e) 17 apples ⟶ ∞ sig. figs.
f) 0.00480 ⟶ 3 sig. figs.
g) 4.80×10^{-3} ⟶ 3 sig. figs.
h) 4.800×10^{-3} ⟶ 4 sig. figs.

ex: Use exponential notation to express 780 to:

a) 1 sig. fig. ⟶ 8×10^2
b) 2 sig. figs. ⟶ 7.8×10^2
c) 3 sig. figs. ⟶ 7.80×10^2
d) 4 sig. figs. ⟶ 7.800×10^2

✱ Rules for Significant Figures in Mathematical Operations

① For Multiplication and Division: the # of sig. figs. in the answer is the same as the number with the least # of sig. figs.

ex: $4.56 \times 1.4 = 6.38 = \boxed{6.4}$
(3 sig. figs.) (2 sig. figs.) (on calculator) (2 sig. figs.)

② For Addition and Subtraction: the answer will have the same number of decimal places as the number with the fewest places to the right of the decimal point.

ex: $12.11 + 18.0 + 1.013 = 31.123 = \boxed{31.1}$

↳ limiting term because it has the fewest digits to the right of the decimal place.

$$\begin{array}{r} 12.11 \\ 18.0 \\ 1.013 \\ \hline 31.123 \end{array} = \boxed{31.1}$$

ex: Do the math and express your answer in the proper number of significant figures.

a) $\frac{0.102 \times 0.0821 \times 273}{1.01} = \boxed{2.26}$ → 3 sig. figs. (Rule #1)

b) $\frac{2.00 \times 10^{6}}{3.00 \times 10^{-7}} = \boxed{6.67 \times 10^{12}}$ → 3 sig. figs. (Rule #1)

c) $171.5 + 72.915 - 8.23 = \boxed{236.2}$ → tenths place (Rule #2)

d) $21.901 - 13.21 - 4.0215 = \boxed{4.67}$ → hundredths place (Rule #2)

e) $\frac{9.2 \times 100.65}{8.321 + 4.026} = \frac{\text{"925.98"}}{12.347} = \boxed{75}$ → 2 sig. figs. (Rule #1)

→ carry all digits...

→ thousandths place (Rule #2)