

Significant Figures

Rules: (1) All non-zero digits ✓

ex: $\overset{\checkmark}{3}\overset{\checkmark}{8}\overset{\checkmark}{1}\overset{\checkmark}{2}$ kg (4 s.f.)

(2) Captive zeros ✓

ex: $\overset{\checkmark}{3}\overset{\checkmark}{0}\overset{\checkmark}{2}\overset{\checkmark}{1}$ s (4 s.f.)
↑ captive

(3) Leading zeros ✗

ex: $\overset{\times}{0}\overset{\times}{0}\overset{\checkmark}{3}\overset{\checkmark}{8}\overset{\checkmark}{1}$ m (3 s.f.)
 $\overset{\times}{0}\overset{\times}{0}\overset{\checkmark}{1}\overset{\checkmark}{0}\overset{\checkmark}{8}\overset{\checkmark}{8}\overset{\checkmark}{4}$ A (5 s.f.)
↑ captive

(4) Trailing zeros:

✓ if there's a decimal point

✗ if there is not a " — " .

ex: $\overset{\checkmark}{3}\overset{\checkmark}{0}\overset{\checkmark}{2}\overset{\times}{0}$ m (3 s.f.)

ex: $\overset{\times}{0}\overset{\times}{0}\overset{\checkmark}{1}\overset{\checkmark}{0}\overset{\checkmark}{8}\overset{\checkmark}{0}$ μ A (4 s.f.)

$\overset{\checkmark}{2}\overset{\checkmark}{0}$ kg (2 s.f.)

↑ ±1

last sig. fig is ±1

1.9 - 2.1 kg

10,000.0 (6 s.f.)

$\overset{\checkmark}{3}\overset{\checkmark}{2}\overset{\times}{0}$ mol (2 s.f.)

↑ ±1

310 - 330

vs.

$\overset{\checkmark}{3}\overset{\checkmark}{2}\overset{\checkmark}{0}$ mol (3 s.f.)

↑ ±1

319 - 321

Sci. Not

ex: $\boxed{6.022} \times 10^{23}$
4 s.f.

moves d.p.
- doesn't affect
s.f.

ex: $\boxed{6.626} \times 10^{-34}$
4 s.f.

sig. figs

Exact/Defined

counted: ∞ s.f.

1 ft = 12 in
↑ ∞ s.f. ↓

(1) Adding / Subtracting

- go by the fewest # digits after the decimal point (d.p.)

ex: 4.802 3dp
 7.19 2dp. * worst!
 $\oplus 8.3042$ 4dp.

$$\begin{array}{r} 4.802 \\ 7.19 \\ \oplus 8.3042 \\ \hline 20.2962 \end{array} \leftarrow \text{calculator}$$

last digit we can report!
 \Rightarrow Must **ROUND OFF** other digits.

20.29 ?

20.30

0-4 : remove

5-9 : round-up!

$$10.42 - 8.2 = 2.2\cancel{2} = 2.2$$

2dp. 1dp. 1dp.!

$$10.42 - 8.42 = 2.00$$

2dp. 2dp. 2dp.

Multiplying + Dividing

- fewest # sf.

ex: $3.84 \times 12.01 \times 0.0098$


(3s.f.) (4s.f.) (2s.f.)

$$= 0.45196032$$
$$= 0.45 \text{ (2s.f.)}$$

Accuracy + Precision

How close to
"true" value.

How close measurements
are to one-another.

ex:  exactly 3.82cm
long.

Measure: 2.12 cm
2.11 cm
2.14 cm

v. precise!
inaccurate!

Dimensional Analysis

- Factor-label method
- conversion-factor "

...

- Used for conversions!

NEED: 2 equivalent quantities.

ex: 1 in = 2.54 cm

ex: 1 gallon gas = \$3.699

Can write a CONVERSION FACTOR!

$$\frac{1 \text{ in}}{2.54 \text{ cm}} \left\} \frac{2.54 \text{ cm}}{1 \text{ in}} \right\} \frac{1 \text{ gallon}}{\$3.699} \left\} \frac{\$3.699}{1 \text{ gallon}}$$

To convert, we multiply the thing
to be converted by "correct" factor.

$$4.82 \text{ in} \rightarrow ?? \text{ cm}$$

$$\frac{1 \text{ in}}{2.54 \text{ cm}} \quad \frac{2.54 \text{ cm}}{1 \text{ in}}$$

$$(1) 4.82 \text{ in} \times \frac{1 \text{ in}}{2.54 \text{ cm}} \quad ??? \quad \frac{\text{in}^2}{\text{cm}}$$

$$(2) \overset{(3 \text{ s.f.})}{4.82 \text{ in}} \times \frac{\overset{\infty \text{ s.f.}}{2.54 \text{ cm}}}{\underset{\infty \text{ s.f.}}{1 \text{ in}}} = \overset{3 \text{ s.f.}}{12.2428 \text{ cm}}$$

$$= \boxed{12.2 \text{ cm}} \quad 3 \text{ s.f.}$$

(exact)

$$0.325 \text{ g} \rightarrow ? \text{ mg}$$

$$\text{mg} = 10^{-3} \text{ g} \quad \text{exact!}$$

$$\overset{(3 \text{ s.f.})}{0.325 \text{ g}} \times \frac{\text{mg}}{10^{-3} \text{ g}} = \overset{(3 \text{ s.f.})}{325 \text{ mg}}$$

||||| train-track!

$$\frac{0.325 \text{ g}}{10^{-3} \text{ g}} \left| \begin{array}{l} \text{mg} \\ \dots \\ \dots \end{array} \right| =$$

More complex...

$$32.0 \text{ in}^2 \rightarrow ? \text{ cm}^2$$

$$1 \text{ in} = 2.54 \text{ cm}$$

$$\frac{32.0 \text{ in}^2}{(3\text{s.f.})} \underbrace{\frac{2.54 \text{ cm}}{1 \text{ in}} \frac{2.54 \text{ cm}}{1 \text{ in}}}_{\infty} = 206 \text{ cm}^2 \quad (3\text{s.f.})$$