CHEMWHIZ QUICK REFERENCE

TOPIC 01

Significant Figures & Measurement

Counting sig figs, rounding, scientific notation, SI units and prefixes, and dimensional analysis.

01 Exact vs measured — CORE RULE

Exact numbers (counts, definitions) have infinite sig figs and never limit precision. Measured values are inexact and do limit sig figs.

02 Counting significant figures — CORE RULE

Rules for counting significant digits: (1) All nonzero digits are significant. (2) Zeros between nonzero digits are always significant. (3) Leading zeros (before the first nonzero digit) are never significant. (4) Trailing zeros after a decimal point are significant. (5) Trailing zeros without a decimal point are NOT significant.

03 Scientific notation — CORE RULE

Write as $a.bcd \times 10^{n}$ with exactly one nonzero digit before the decimal (1.23×10^{4}, not 12.3×10^{3}). Every digit shown in the coefficient is significant.

04 Rounding — CORE RULE

If the first dropped digit is ≥ 5, round the last kept digit up; cascade the carry (999.6 to 3 sf → 1.00×10^{3}).

05 Arithmetic with sig figs — METHOD

Add/subtract: round to the fewest decimal places among inputs. Multiply/divide: round to the fewest sig figs. Exact numbers never limit sig figs.

Multi-step: carry all digits through every step and round only the final result. Early rounding propagates error.

06 Dimensional analysis — METHOD

Multiply by conversion factors equal to 1 with the old unit in the denominator so units cancel. Track every unit through every step.

Squared/cubic units: raise the factor to that power ($1\ m = 10^{2}\ cm \rightarrow 1\ m^{2} = 10^{4}\ cm^{2}$). Compound units ($g/cm^{3} \rightarrow kg/m^{3}$): convert top and bottom separately.

07 Common SI base units — REFERENCE

length → m · mass → kg · time → s · temperature → K · amount → mol. Liter, m/s, and kg/m^{3} are derived units.

08 Temperature — CORE RULE

$K = °C + 273.15$ (273.15 is exact). $°C = (°F - 32) \times 5/9$. $°F = °C \times 9/5 + 32$.

09 Common SI prefixes — REFERENCE

Prefix	Symbol	Value
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}

10 Common conversions — REFERENCE

Exact (defined): 1 in = 2.54 cm · 1 lb = 0.45359237 kg · 1 mi = 1609.344 m · 1 gal = 3.785411784 L · 1 mL = 1 cm^{3} · 1 Å = 10^{-10} m · 1 atm = 101,325 Pa = 760 torr · 1 cal = 4.184 J (thermochemical). Approximate: 1 atm ≈ 760 mmHg.

11 Density as a conversion — CORE RULE

Density links mass and volume; write it in the orientation that cancels the known unit and leaves the unknown.

12 Watch out — WATCH OUT

You cannot add sig figs a measurement does not have. To show a whole-number result's trailing zeros are significant, use a trailing decimal (300.) or scientific notation.