

Technical Writing Rules for Physics Students

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Hyphenation

To hyphenate or not to hyphenate, that is the question. As compound nouns evolve over time in English, they generally move from being written “open” (**data base**), to being hyphenated (**data-base**), to being written “closed” (**database**). Just where your particular word might be in its evolution is often unclear and subject to the inscrutable and highly idiosyncratic logic of copy editors. Consult a recent edition of a standard dictionary.

If two closely associated nouns, or an adjective and a noun, are used together as an adjective to modify another noun, they are usually hyphenated, e.g., **high-energy physics**. However, there are many exceptions to this rule, e.g., **condensed matter physics**. For such cases, use the form of the phrase as it appears in the most influential journal in your particular subdiscipline, in a recent scientific dictionary (*McGraw Hill* or *Oxford*), or in the *American Institute of Physics*, 4th ed. or *CBE Manual*, 6th ed. style guidelines. An excellent discussion of the hyphenation of compound words is included in *The New York Public Library Writer’s Guide to Style and Usage* (New York, HarperCollins, 1994).

Adverbs (many of which end in *ly*) and the words they modify are *never* hyphenated when they are used as compound adjectives, e.g., **highly charged particles**, **weakly dependent nonlinear effects**, **very large fluctuations**.

If a measured value is used as an adjective, the numeral and the unit of measure are *always* hyphenated, e.g., **10- μ m surface defects**. However, actual numerical measurements are *never* hyphenated, e.g., “The associated surface defects were **$\approx 10 \mu\text{m}$ in diameter**.” (Note that the symbol for “approximately equal to” is \approx . The \sim symbol means “of order of” or “asymptotically equal to.”)

Hyphens and Dashes

Hyphens are used only to break a word at the end of a line of text or to join compound modifiers. Dashes are used as punctuation. Hyphens should not be used in place of dashes, nor should they be used as minus signs.

The *em dash* (—) is the most common dash and is used to set off information in sentences, instead of a comma, a colon, or parentheses.

Several phenomena—inadequate annealing, surface quenching, or bulk impurities—could account for this effect.

Words enclosed by a pair of dashes often provide an explanation or give parenthetical information. Using a pair of dashes instead of parentheses tends to emphasize (rather than de-emphasize) those words.

How can particulate and soluble agents—so different in size and in the host cell receptors to which they bind—adopt the same caveolae-dependent endocytic machinery to gain entry to the cell?¹

The *en dash* (–) is used to join compound modifiers formed from two-word nouns or proper nouns, or already hyphenated words, e.g., the **condensed matter–biology interface** or the **Hartree–Fock method**. An en dash may also be used to indicate a range between numbers, e.g., **3 T–6 T**, **500°C–600°C**, **15 Å–20 Å**; however, to avoid ambiguity, I recommend using the words “to” or “through” between the numbers instead of the dash. Note that no spaces appear before or after an en or em dash. For more than you ever wanted to know about hyphenation, see [Hyphens, Dashes, and Minus Signs](#).

¹ J.-S. Shin and S.N. Abraham, *Science* **293**, 1447–1448 (2001).

Capitalization

The notation **k** (kilo), as in **kV**, **kW**, **kA**, **kg**, **keV**, is *always* written in lower case. If you write **KeV** for kilo-electronvolt, nobody else may notice, but I will come back and haunt your dreams. The abbreviations for deka (10^1) and hecto (10^2) are also written lower case; all other factors of 10^6 or greater are capitalized when abbreviated, e.g., MB, GeV, PW.

Elements are not capitalized when they are written out as words (**oxygen**, **lead**, **vanadium**), even when they are named after a person or place that would normally be capitalized (**californium**, **americium**, **curium**). However, the abbreviations for chemical elements are always capitalized (**O**, **Pb**, **V**, **Cf**, **Am**, **Cm**). The same rules apply for units of measure, e.g., **curie (Ci)**, **watt (W)**, **volt (V)**, **joule (J)**, **tesla (T)**. Useful mnemonic: *Abbreviations are Always Capitalized*.

If a proper noun is used as an adjective, it is capitalized, e.g., **Poisson's equation**, **Fourier transformation**, **Monte Carlo method**. However, if the proper noun is used to name an entirely new class of things, the resulting new things are treated as common nouns and are not capitalized. Thus, we have **Fermi energy level** and **Fermi–Dirac statistics**, but **fermions** and **fermium**.²

If a numeral is associated with a common noun and comes after it, the noun is treated as a title and is capitalized; e.g., “in **Chapter 2**” and “in **the second chapter**” are capitalized correctly.

Acronyms and Abbreviations

Common nouns that are fodder for acronyms and abbreviations are *not* capitalized when they are written as words; only the acronyms are capitalized, e.g., **fractional quantum Hall effect (FQHE)** [note *Hall* is capitalized, because it is the surname of the physicist, Edwin Hall, who discovered the voltage difference across an electrical conductor transverse to the current and perpendicular to an applied magnetic field]. Other examples are **smoothed-particle hydrodynamics (SPH)**, **cosmic microwave background (CMB)**, and **Bose–Einstein condensate (BEC)**. Proper nouns *are* capitalized, e.g., **South Pole telescope (SPT)**. Some common acronyms, generally acronyms derived from a single word or only two words, are not capitalized, e.g., **alternating current (ac)**, **infrared (ir)**, **electromotive force (emf)**, **radio frequency (rf)**. Consult the most influential journal in your particular subdiscipline, a recent scientific dictionary (*McGraw Hill* or *Oxford*), or the *American Institute of Physics* style manual.

Acronyms and abbreviations must be defined at their first usage, as shown above.

An apostrophe is *not* used to make an acronym or abbreviation consisting of more than one character plural—just add a lower-case *s*, e.g., **atomic force microscopes (AFMs)**, **Equations 1–3 (Eqs. 1–3)**. Single numbers (**1's and 0's**) and letters (**p's and q's**) *do* use an apostrophe in plurals.

Do not begin a sentence with an acronym, abbreviation, numeral, or symbol. Double penalties apply for beginning a paragraph with one. An acronym or abbreviation that has previously been defined must be written out again if it is used to begin a sentence. Sentences may be recast to avoid beginning with a numeral or symbol.

- Wrong: “**Fig. 1** shows ...” “**TEM** was used ...” “**α-particle** transport occurs ...”
“**50** samples were prepared ...”
- Right: “**Figure 1** shows ...” “**Tunneling electron microscopy** was used ...”
“**Alpha-particle** transport occurs ...” “**Fifty** samples were prepared ...”

² The only two exceptions to this “rule” that I can think of are *Hamiltonian* and *Lagrangian*. (Pesky mathematicians!)

Nuclides and Their States

The Symbols, Units, and Nomenclature Commission of the International Union of Pure and Applied Physics recommends that the following symbols be used to denote nuclides and their states:

Mass number (anterior superscript): ^{235}U

State of ionization (posterior superscript): Ca^{2+}

Excited state (posterior superscript): $^{110}\text{Ag}^m$, $^{14}\text{N}^*$

Number of atoms in a molecule (posterior subscript): $^{14}\text{N}_2$

Numbers and Numerals

Whether to express a mathematical quantity in numerals or in words is a nontrivial issue. There are two fundamental rules:

- Use a number style that conveys information unambiguously.
- Maintain the style with witless consistency throughout the text.

Here are three general guidelines:

- Write out cardinal numbers **zero** through **nine** and ordinal numbers **first** through **ninth** in words.
- Use numerals for cardinal numbers **10** and greater and ordinal numbers **10th** and greater.
- Always write quantities as numerals that have been **measured** or **calculated** (rather than counted), and abbreviate the units.

10 l

1.75 in

6 kg

2.4 ms

Fractional numbers written as decimals must have a zero preceding the decimal point, e.g., **0.5 μg** .

Numbers that begin a sentence are always written as words; thus, a sentence that begins with a quantity that was measured or calculated must be recast.

For clarity, adjacent numbers should be written in a combination of numerals and words:

fifteen 10-mg doses

twelve 20-percent doped samples

sixty-four 900-sq ft apartments

15 one-dose oral vaccines

6 six-hour runs

64 two-body calculations

Qualifiers (“about,” “approximately,” “of order of”) should not be used with exact numbers—they sound ridiculous.

“Approximately 17 of the samples were contaminated with iron filings.” ???

Use language precisely. The phrase “three times more than” *means* “four times as much as.”³ Is this really what you mean? “Twice the size” is an ambiguous phrase and should be avoided—does “size” refer to “dimensions” or “mass” or “volume” or some other measure? The term 1:4 is a ratio and is read as “one to four.” For example, if the ratio of doped to undoped samples is 1:4, and you are referring to the doped samples, you are talking 20 percent of the samples, **not** 25 percent. Phrases such as “two times less than” or “12 times smaller than” create confusion, sound idiotic (at least to copy editors), and should be rephrased.

³ Think about it. If you extrapolate down to “*once* more than,” you obviously mean twice as much, i.e., the original amount plus an additional equivalent amount. So what is “three times smaller than”?