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40 steps to better metric editing

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This checklist is intended to help authors and editors review all types of articles, including manuscripts, using SI, the modern metric system; it contains the basic principles for writing about measurable quantities and their units.

This checklist incorporates various rules and best practices for the correct use of quantity names and symbols and the metric units and symbols used to describe them. We have tried to go from general non-specific advice to quite detailed advice.

This checklist is suitable for all written work, but it is especially appropriate for scientific and technical writing as it is based on the modern metric system, which is more correctly known as the Système International d'Unités in French, the International System of Units in English, and as SI (pronounced ess-eye) in all of the world's languages.

Use only correct SI units

Only use units that are recognised as part of the International System of Units (SI), to express the values of quantities. If you want to refer to older units, write the correct SI unit first, followed by the old unit in [square] brackets.

SI uses standard unit symbols rather than abbreviations. Abbreviations such as Mtrs (for m or metres), sec (for either s or seconds), klms (for km or kilometres), cc (for mL or millilitres), or mps (for either m/s or metre per second) should be avoided in favour of standard unit names, symbols, and prefixes.

Keep style consistent

It is the editor's job to catch the inconsistencies and inaccuracies in style and word usage of the writers. Using SI units only is a good start but a *style of writing* is very hard to define so you should develop other rules that you follow. A good editor must be able to fix each writer's articles without destroying the individual writer's style. For instance do you write 223 Smith Street, 223 Smith Str. or 223 Smith St. Make a decision on this and all other style questions and then stick to it. You will be surprised at how many decisions you have to make. The editor has to make decisions correctly, and often quickly, that are not always popular. An editor's chair is not the place for indecision.

Be precise

Avoid words or phrases that confuse rather than inform. Don't use about 23.562 metres; use either 'about 24 metres' or '23.562 metres' without the 'about'.

Avoid billions and trillions

Unless you carefully define what you mean by these words they are probably best avoided. Similarly the combinations of letters 'ppm,' 'ppb,' and 'ppt,' and the terms 'part per

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million', 'part per billion', and 'part per trillion' should not be used to express the values of quantities. Use units such as 2.0 μL/L, 4.3 nm/m, or 7 ps/s instead.

Check for the use of non-preferred prefixes

Avoid unit names that use the prefixes centi (c), deci (d), deca (da), or hecto (h). Instead use unit prefixes that are multiples and sub-multiples based on thousands. Examples of preferred prefixes are micro (μ), milli (m), kilo (k), and mega (M). Correct usage of symbols is very important. An incorrect symbol may change the entire meaning of a quantity. Unit symbols are the same whether singular or plural. Where possible, choose prefixes so that numerical values are whole numbers rather than decimal numbers — 1200 millimetres is usually preferable to 1.2 metres.

Delete the doubles

Any unit may take only one prefix. For example 'millimillimetre' is incorrect and should be written as 'micrometre'. Units written in abbreviated form are never pluralised. So 'm' could always be either 'metre' or 'metres'; 'ms' would represent 'millisecond'. Double prefixes are not used in SI. They occur commonly with kilograms. A million kg is often written as Mkg using a double prefix; kilotonne (kt) is a better choice.

Check for capitals

SI unit names don't use capitals when spelt out except for degree Celsius. A unit that is named after a person is written all in lower case (newton, volt, pascal, etc.) when named in full.

SI symbols use a capital letter if the unit is named after a person (N for newton, V for volt, Pa for pascal, etc.), and lower case if it is not. An exception to this rule is the litre which, if written as a lower case 'l' could be mistaken for a '1' (one) and so a capital 'L' is preferred. Other examples include C for coulomb, Hz for hertz, and W for watt, mW for milliwatt and MW for megawatt. Misuses of capitalisation are common in unit symbols: for example the standard symbol for the millilitre (a thousandth of a litre) is mL, not ML, which is the symbol for the megalitre (a million litres).

SI prefixes that make a unit bigger are written in capital letters (M G T etc.), but when they make a unit smaller then lower case (m n p etc.) is used. The one exception to this is kilo (k) to avoid any possible confusion with kelvin (K).

Numbers with more than four digits

Numbers on either side of the decimal marker are separated into groups of three using a thin, fixed space counting from both the left and right of the decimal marker. For example, 12 345.678 90 is highly preferred to 12345.67890. Commas should not be used to separate digits into groups of three. It's best to use a 'non-breaking' space for this purpose. The SI preferred way of showing a decimal fraction is to use a comma (123,456) to separate the whole number from its fractional part. The practice of using a dot or a point, as is common in English-speaking nations, is acceptable providing only that the point is placed on the line of the bottom edge of the numbers (123.456).

Watch out for new words

A mistake when typing can either make a nonsense word or a real word. Real words are harder to find because you are not looking for them; even spelling checkers have trouble with new uses for old words. A football player had suffered a bruised thigh, but the hastily withdrawn headline read: SMITH BRUISES THING.

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Watch for libel

Most commercial magazines and newspapers have lawyers either on their staff or on a retainer to advise them if articles are libellous or not. The libel laws are complex and are best avoided. The editor should constantly ask 'How would I feel if this article was about me?' If the answer is that it would make you feel very angry then don't print it. Angry people sue!

Respect privacy

Use the same test as the test for libel. Ask yourself how you would feel if this article was about you. People have a right to have secrets from the rest of the community, and editors should respect that right.

Don't mix unit symbols, unit names, and mathematical operations

Use units such as kg/m^3, kg.m^{-3}, or kilogram per cubic metre and not units such as kilogram/m^3, kg per m^3 kg/cubic metre, kilogram/cubic metre, or kilogram per metre^3.

Check for a space

There should be a space between the number and the unit; that is between the numerical value and unit symbol, even when the value is used as an adjective. For electronic manuscripts use a 'non-breaking' space.

Use	a 25 kg sphere	not	a 25-kg sphere

This rule also applies to degrees Celsius.

Use	a temperature of 18 °C	not	a temperature of 18°C

The only exception to this rule occurs in the case of superscripts for degrees, minutes, and seconds of plane angle.

Use	an angle of 2°3'4"	not	an angle of 2 °3 '4 "

Use Arabic numerals (0123456789) with acceptable units and unit symbols.

'Acceptable units' is used to mean the units of SI plus

- those units accepted for use with SI
- those units temporarily accepted for use with SI and
- appropriate multiples and submultiples of such accepted and temporarily accepted units.

Use	m = 5 kg	not	m = 5 kilograms or m = five kg
Use	the current was 15 A	not	the current was 15 amperes

Don't modify unit names or symbols

Unit names or symbols should not be altered by the addition of subscripts or other information. For example, use these forms instead.

Use	V_{max} = 1000 V	not	V = 1000 V_{max}
Use	a mass fraction of 10 %	not	10 % (m/m) or 10 % (by mass)

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Check the use of %

Since the symbol % represents simply the number 0.01, statements such as 'the length l_1 exceeds the length l_2 by 0.2 %' are to be avoided. Forms such as '$l_1 = l_2(1 + 0.2\ \%)$' or '$\Delta = 0.2\ \%$' are preferred, where Δ is defined by the relation $\Delta = (l_1 - l_2)/l_2$.

Don't mix information with unit names or symbols

For example, the form 'the water content is 20 mL/kg' is used and not '20 mL H_2O/kg' or '20 mL of water/kg.'

Check numbers and units

Make sure that it is clear which number belongs to which unit and which mathematical operation applies to the value of a quantity since forms such as the following occur.

Use	35 mm x 48 mm	not	35 x 48 mm
Use	1 MHz to 10 MHz	not	1 MHz – 10 MHz or 1 to 10 MHz
Use	20 °C to 30 °C or (20 to 30) °C	not	20 °C – 30 °C or 20 to 30 °C
Use	123 g ± 2 g or (123 ± 2) g	not	123 ± 2 g
Use	70 % ± 5 % or (70 ± 5) %	not	70 ± 5 %
Use	240 (1 ± 10 %) V	not	240 V ± 10%

Equations between quantities are preferred

Avoid equations between numerical values. When a numerical-value equation is used the corresponding quantity equation should also be given.

Beware the use of unit names as quantity names

'What's the grammage?' This is a common error in paper selection. The speaker is asking for an estimate of area density measured as mass divided by area (grams per square metre g/m²) – it's just as easy to ask 'For this paper what's the mass divided by area?' or 'what's the grams per square metre?'

Use standardised quantity symbols

Use those given in the International Organization for Standardization (ISO) 'Standards Handbook *Quantities and Units*' or the International Electrotechnical Commission (IEC) 'IEC 27-1 to IEC 27-4'. For example, use *R* for resistance, and *A* for relative atomic mass, and not words, acronyms, or ad hoc groups of letters. Use *italics* in printing the symbols of quantities, as distinct from the symbols of units, where upright (Roman) letters are preferred.

Avoid obsolete terms

For example, the obsolete term normality and the quantity symbol *N*, and the obsolete term molarity and the quantity symbol M, should not be used. Instead use the quantity amount-of-substance concentration of B (commonly called concentration of B), and its

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symbol C_B and SI unit mol/m^3, instead. Similarly, the obsolete term molal and the symbol m should not be used; use the quantity molality of solute B, and its symbol b_B or m_B and SI unit mol/kg instead. 'Quantities, Units and Symbols in Physical Chemistry' compiled by Ian Mills and others, published by the International Union of Pure and Applied Chemistry (IUPAC) should be consulted for correct usage.

Use standardised mathematical signs and symbols

For example, use 'tan x' and not 'tg x.'; specify the base of 'log' in equations by writing $\log_a x$ (meaning log to the base a of x). Again use the ISO or the IEC recommendations.

Zero in

If a number is less than one it needs a zero before the decimal marker.

Use 0.35 metre or 0.35 m not .35 metre or .35 m

In some primary and secondary schools a number such as .35 is said to have a naked decimal point — this is often pronounced as 'nekkid'.

Consider the word 'weight'

If you don't know, find out the difference between mass and weight. Your technical editing can look really silly if you don't know the difference between them. Make sure the intended meaning is clear since, in science and technology, weight is a force for which the SI unit is the newton (N); in commerce and everyday use, weight is a synonym for mass, for which the SI unit is the kilogram (kg).

Distinguish clearly between energy and power

Make sure you know the difference between energy and power.

> *Energy is the ability to do work. Energy is measured in joules.*
>
> *Power is the time rate of doing work or of using energy. Power is measured in watts.*

One problem is that many members of the public (and their politicians) have only a slippery grasp on the physical concepts of energy and power as scientists and engineers define and use them. It is therefore not a great idea to use these words interchangeably and with seemingly random definitions. But in any rational discussion of climate change we have to understand the words used by all others especially when they are used in a technical scientific sense. Otherwise communication simply ceases — or doesn't even begin.

I know of one 'energy' reporter at a leading Australian newspaper who doesn't know this difference – his writing on energy, power, and climate change often looks quite foolish.

Distinguish between objects and quantities

Note the difference between 'surface' and 'area'; 'body' and 'mass'; 'resistor' and 'resistance'; 'coil' and 'inductance'.

Look for unclear expressions

An example is 'mass per unit volume' where no unit is specified for the volume. If you intend to use mass density, it is better written as 'mass divided by volume'.

Remember your audience

Be careful that you don't write only for your interests and the interests of your writers. Ultimately it's the readers who pay both of you.

Check tone and style

The editor also has to design attractive page layouts with their readers in mind. The tone and style of the journal, paper, or magazine are the sole responsibility of the editor. There may be an editorial panel to advise but the final decisions are all the editor's responsibility.

Write headlines

Every article must have a headline that will attract the readers' interest to that article. Writing the headline is the editor's responsibility. Avoid double meanings.

'POLICE CAN'T STOP GAMBLING'

This is a great headline, but what does it mean?

Meet deadlines

Every publication has a deadline, the point when a copy has to be at the printers and no further corrections can be done. If you have a mistake at this stage you'll soon have thousands of them when the copies return from the printers.

Move each article

Make sure that each article is at the correct stage. If an article has to be entered at a keyboard, make sure it gets to the right people at the right time. If articles need illustration, make sure that artists are supplied with the correct materials.

Use a big-word filter

Often the users of big words are being pompous. If you can get rid of big words do so. Remember your first ~~responsibility~~ duty is to your readers, not your writers (for one thing there are more of them).

Strangle long sentences

For quick reading the best sentences average 17 to 20 words, but the best sentences depend on the rhythm of the words, not on their number. If necessary, break the long sentences into two or three parts. A final test is to read the sentence aloud. If you totally run out of breath the sentence needs cutting.

Question the facts

All the facts mentioned in every article need to be checked and double checked. Check the spelling of every person's name, if necessary get in touch with the person concerned and ask them for the correct spelling. If you have to write the surname SMITH, how do you spell it? SMYTH - SMYTHE - P'SMITH or just plain SMITH. Remember if you get it wrong the whole family will be upset, and so will their workmates and neighbours.

Answer unanswered questions

As you read an article, questions will occur to you. The article should answer each question that is raised in your mind. If you are confused, the writing will also confuse your readers. Send the offending article back to the writer and ask them to answer your questions.

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Correct mistakes

As editor you are the last person to read the manuscript before it goes to the printer and, it's safe to assume, the last person to read everything word for word. Editors must be able to spot errors invisible to lesser mortals and fix them accurately. Also, as editor you might also be regarded as the first reader, or as the reader's representative in dealing with writers.

Select articles

An editor has to decide what goes in and what goes out. The editor also has to tell the writers which pieces are rejected and why. The main aim of the editor is to select articles that will exactly suit their readers' interests.

Read each article at least three times

Firstly read the whole document for sense. Secondly edit the article fixing the mistakes. Thirdly edit the editing; make sure you did not build in a few mistakes of your own.

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Metric system consultant, writer, and speaker, Pat Naughtin, has helped thousands of people and hundreds of companies upgrade to the modern metric system smoothly, quickly, and so economically that they now save thousands each year when buying, processing, or selling for their businesses. Pat provides services and resources for many different trades, crafts, and professions for commercial, industrial and government metrication leaders in Asia, Europe, and in the USA. Pat's clients include the Australian Government, Google, NASA, NIST, and the metric associations of Canada, the UK, and the USA.

Pat specialises in the modern metric system based on the International System of Units (SI), but he is mostly concerned with the processes that people use for themselves, their groups, their businesses, their industries, and their nations as they go about their inevitable metrication process. See http://www.metricationmatters.com/ for more metrication information, contact Pat at pat.naughtin@metricationmatters.com or subscribe to the free 'Metrication matters' newsletter at http://www.metricationmatters.com/newsletter/