

## SCIENTIFIC ENGLISH

### 1. Scientific Writing

Good scientific writing must be scientifically accurate, concise, useful, clear, illustrated with visuals, targeted to a specific audience, well organized, interesting, consistent, complete, correct in spelling, punctuation and grammar.

- **Scientific precision** – Inaccurate statements destroy the author credibility. On the other hand, the readers make decisions, operate equipment, and draw scientific conclusions based on the information presented.

- **Concision** – It is important to avoid wordiness caused by:

- Modifiers: *final outcome, completely finished;*

- Coordinated synonyms: *each and every, basic and fundamental;*

- Excess qualification: *perfectly clear, completely accurate;*

- Expletives, relative pronouns, and relative adjectives: *there are ... who ... which;*

- Circumlocution: *a long, indirect way to express the idea.*

The author must also avoid repetition, pompous language, jargon, and consider that reducing a document is hard work. Blaise Pascal once wrote, “I have made this a long letter because I haven’t the time to make it shorter.”

- The document must be **useful** – People read a paper, technical report, or thesis because they intend to use the information in some way. Therefore, each sentence must contain useful information.

- **Clearness** – Keep the writing short and simple by breaking the text into short sections, and avoid jargon, because unknown terms is a cause of poor communication and also make the text obscure to the readers. Present the story

in a logical, orderly fashion, one step at a time. The use of visuals is recommended, and may include: photographs, drawings, diagrams, graphs, tables, and flowcharts.

- Illustrate the manuscript with **visuals** – Visuals make the document more interesting to the reader. You can use photographs, drawings, diagrams, graphs, tables, and flowcharts.

- Photographs (show actual physical images of subjects).

- Drawings (depict real or imaginary objects, and internal parts).

- Diagrams (show how the components interact and are interrelated).

- Graphs (show trends and how one variable changes in relation to another).

- Tables (organize information systematically).

- Flowcharts (show the parts or steps in a process or system interact).

- You should **target an audience** – Write to the level of technical proficiency and understanding of the audience.

- **Organize the document** – Plan, before writing, creating a rough outline that spells out the contents and organization of your document.

- **Interest** – Your paper competes with many other communications and, therefore, must be lively and lucid, to attract the reader, not dull and boring.

- **Consistency** – Inconsistencies confuse readers and convince them that your scientific work is as sloppy as your prose. Avoid random and unnecessary capitalization, mixed sets of units of measurement and indiscriminate use of abbreviations.

- **Completeness** – A complete document tells the readers all they need to know about the topic, but not a word more. Make sure the specification is complete and that no key data is omitted.

- **Correction** in spelling, punctuation and grammar – This is a key characteristic of every good paper or book.

## **2. Writing process**

A successful writing involves several phases, which include preparation, research, organization, writing and revision. It is important to follow the steps and to adhere to the scope of the work.

### **a. Preparation**

- Establish the purpose of your document – What should the readers know after they have finished reading the document?

- Assess the audience – Who exactly is the reader or readers? Who needs to see the document? What they do know about the subject?

- Consider the context – Context is the environment or circumstances in which writers produce documents and within which readers interpret their meanings.

- Determine the scope of the coverage – The decisions on what to include and what not to include in the writing define the scope.

- Select the appropriate medium – Decide in what journal or conference to publish your findings.

### **b. Research**

Research involves the question: What do you know about the subject? Then, you must conduct the research (primary or secondary), create and use questionnaires, if appropriate, interview for information. In the next phase you summarize the information, take notes, document the sources and, of course, avoid plagiarism.

### **c. Organization**

Organization involves the choice of the best methods of development. Then you should outline your notes and ideas, develop and integrate visuals. It is important to carefully consider the layout and design.

### **d. Writing**

During the writing phase, select an appropriate point of view, and adopt a style and tone. Use effective sentence construction. Construct effective paragraphs from the outline. Use quotations and paraphrasing, if appropriate for your document. After that, write an introduction for the document, then write an abstract, write a conclusion and choose a title.

#### **Principles of technical communication**

If possible, always use the active voice in your document and a plain rather than a complex language.

Delete words, sentences and phrases that do not add to your meaning and use specific and concrete terms rather than vague generalities. Use terms your reader can picture. Use the past tense to describe your experimental work and results, but, in most other writing, use the present tense. Break your writing into short sections to facilitate the perusal of the document.

### **e. Revision**

During the revision process, check for unity and coherence, verify sentence variety, emphasis, and subordination, check for ambiguity, awkwardness, and verify logic errors:

- Lack of reason is when a statement is contrary to the reader's common sense.
- Sweeping generalizations are statements too broad to be supportable.
- *Non sequitur* is a statement that does not logically follow a previous one.
- False cause refers to the logic fallacy that because one event followed another one, the first event caused the second.

- Biased or suppressed evidence is both illogical and unethical.
- Facts, which are verifiable, versus opinion.
- A loaded argument occurs when a conclusion is based on an opinion.

Aim at positive writing, consider ethics, copyright, avoid biased language and plagiarism. Verify appropriate word choice, affectation and jargon, do not use vague words (*real, nice, important, good, bad*), and clichés (*last but not least*). Minimize the problems with grammar. Review punctuation, abbreviations, capitalization, contractions, dates, italics, number and measurement units, proofreading, and spelling.

### **3. Writing an Article**

#### **Parts of the document**

- Title, authors and affiliations – Capitalize the initial letters of the words of the title, except articles (a, an, the), coordinating conjunctions (and, but), or prepositions (to, at, into) unless they begin or end the title.
- Abstract – Highlight and summarize, in 50 to 200 words, the major points of an article. This is the base for researchers to decide whether to read your article. It must be readable apart from the original document.
- Keywords – Three to five words related to the main theme of the article.
- Introduction – Point out the purpose of the paper, define the problem examined, and present the scope of the article.
- Methodology – Discuss previous work in the field, the rationale of the approach to the problem and the reason to reject alternative approaches.
- Results – This section contains the main results of the research.
- Discussion – An optional section with a discussion of the main results, commonly used in Medicine and Biomedical articles.
- Conclusions – This section interprets the results in relation to the purpose of the study and the methods used to conduct it. The conclusion must depend entirely on the evidence found in the research.

- References – It is necessary to cite the references and list them at the end of the document.

- Appendix – Appendices are optional.

*There is a difference between References (A list of works cited.) and Bibliography (An alphabetical list of all sources that were consulted in researching the report, but not necessary mentioned in the work).*

#### **4. Rules for Word Division**

- A word should be divided only between syllables (com•pu•ter). Dictionaries indicate how to divide words at syllable breaks
- If a vowel stands alone as a single syllable, it must remain on the same line as the first part of the word (experi•ment)
- A word is generally divided between double consonants (neces•sary), unless it means breaking up the root of the word (process•ing)
- If a word contains a natural hyphen, divide only at that point (sixty-five)
- If a word contains a prefix or suffix, it is best to divide at that point (auto•correlation)
- Do not divide one-syllable words (length), no matter how long the word may be
- Do not divide a word in the first or last line on a page
- Do not divide a word in the first line of a paragraph
- Do not divide words on two consecutive lines
- Do not divide a proper name or number (Kolmogorov, 1931)
- Do not separate two letters from the rest of the word
- Do not separate contractions or abbreviations (wouldn't, ATSC)
- Do not use a hyphen to break a URL or an e-mail address
- Do not use excessive word division

- Do not separate the unit of measurement from the number (550 kHz)

## 5. Rules for Number Writing

- Write out all numbers below ten:
  - zero deviations from the expected value
  - nine devices to count for
- The exception to this rule are numbers used with:
  - units of measurement (3 meters)
  - age (15 years old)
  - dates (October 11, 1957)
  - time (2 seconds)
  - page numbers (page 4)
  - percentages (5 percent)
  - money (\$8)
  - proportions (30:1 or 30 to 1)
- Write the numbers as numerals if two or more are in the same section:
  - the transmitter has 5 audio amplifiers, 2 pass-band filters and a net gain of 60 dB
- Large numbers must be written in the form most familiar to the audience:
  - 15,300,000
  - $15,3 \times 10^6$
  - fifteen million and three hundred thousand
- Place a hyphen between a number and a unit of measurement when they modify a noun:
  - 3-month-old experiment
- Use the singular for fractions and decimals that are used as adjectives:
  - 0.5 kilogram
  - 0.1 centimeter
- Write decimals and fractions as numerals:

– zero point two five – 0.25

• Do not begin a sentence with numerals

• Keep all units consistent

– Chose one standard and stick with it

• Use the correct units

– There are two different versions of the metric system, cgs (centimeter, gram, second) and SI (meter, kilogram, second, ampere, kelvin, mole, candela)

• When writing the units of measurement in word form they should never be capitalized:

– hertz (Hz), ampere (A), tesla (T), ohm , henry (H)

• Indicate multiplication by a raised dot (·) and division by a slash (/):

– 10 W/Hz

– 150 V·s

## 6. Latin terms and abbreviations

✓ ca. – *circa* (about, approximately)

✓ cf. – *confer* (compare)

✓ e.g. – *exempli gratia* (for example)

✓ et al. – *et alii, et aliae, et alia* (and others)

✓ etc. – *et cetera* (and other things, and so on)

✓ et seq. – *et sequentes* (and the following)

✓ f.v. – *folio verso* (on the back of the page)

✓ ibid. – *ibidem* (in the same place)

✓ id. – *idem* (the same)

✓ i.e. – *id est* (that is)

✓ inf. – *infra* (below)

✓ loc. cit. – *loco citato* (in the place cited)



- ✓ n.b. – *nota bene* (note well)
- ✓ op. cit. – *opere citato* (in the work cited)
- ✓ Q.E.D. – *quod erat demonstrandum* (which was to be proved)
- ✓ q.v. – *quod vide* (which see, a reference to another part of a published work)
- ✓ [sic] – *sic* (so, thus, inserted in brackets)
- ✓ sup. – *supra* (above)
- ✓ s.v. – *sub verbo, sub voce* (under the word)
- ✓ ut sup. – *ut supra* (as above)
- ✓ v. or vs. – *versus*
- ✓ viz. – *videlicet* (namely)
- ✓ vs. – *versus* (inverted, against)

## References

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