The Chemistry Style Manual

KIERAN F LIM (林百君)

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Chapter 1: The Art of Scientific Communication

General

The message is the most important part of communication. Anything that distracts the reader or the listener from the content, will lessen the efficacy of that communication. This manual is intended to help you prepare written and oral submissions in a manner that aids the communication of your message.

The “80:20” principle states that once past the initial encounter with a new medium, 80% of our attention is captured by the content and 20% by the presentation. Hence, the readers’ and listeners attention is devoted primarily to the content, **unless** distracted by annoying aspects of the presentation. In this manual, the authors advocate the “KISS” (keep it simple) principle.

Our advice will not, by itself, make you a better scientific writer or presenter. You should also learn from good communicators by observing what makes a journal article easy to read and to understand, or what makes a particular lecture easy to listen to and to understand: try to put those practices into your own writing and oral presentations. Practise (and more practise) will help you improve your skills, especially if you are able to get constructive criticisms and feedback from your teachers and colleagues.

Chapter 2: Report Writing

General

A scientific report is intended to convey information concisely and precisely.[1] When writing a report, you should write for two groups of readers:

- The first group of readers are your classmates and scientific colleagues (who will include referees of scientific journals). They will be interested in the details of what you have done and how/why you reached your conclusions. As your peers, they will share a common body of knowledge so there is no need to state the details of standard techniques. The reader will assume that you used the correct sizes of glassware, or the most efficient method of computer program. You will have to detail all non-standard procedures.

- The second group of readers will be the managers and directors of your future employers (or editors of scientific journals). For the most part, they will be too busy to read the details of your methodolgy or discussions, and will only read the introductory and concluding sections. Hence these sections must detail the scientific rationale for the study and a summary of *all* of the main findings and conclusions of the study.

The information and advice in this Chapter has been derived from several sources, including the Royal Society of Chemistry document, *Journal of Analytical Atomic Spectrometry: Instructions to Authors*[a]

The Standard Format of a Scientific Report

The purpose of a scientific report is to convey information. This is true of all sub-disciplines of chemistry, and more generally true of all scientific disciplines. For example, Findlay explains:[b]

> A laboratory report (lab report, for short) is a summary of: (a) why you undertook this particular research; (b) what you expected to find; (c) how you actually did it; (d)

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[a] See Reference [2]. Used here with permission from the Royal Society of Chemistry.

[b] Reference [3]: B. Findlay, *How to Write Psychology Laboratory Reports and Essays*, Prentice Hall, Sydney, 1996. Used here with permission from the author, Dr Bruce Findlay.

what you *did* find; (e) how you interpreted the results; and (f) the theoretical and practical implications of the conclusions you drew from those results.

… readers need to know where in a report to look for the information they need in order to decide whether they want to read the report in more detail. So a more or less standard format if … reporting is useful.

… by your third year you should be approaching a profesional understanding of prior research, and your understanding of the conventions of presentation should conform to journal article standard.

…It is important that the messages your reader receives are the ones you, the writer, want to send. Sometimes the fixed format is at odds with this. Nevertheless, it is important that as un undergraduate you become expert at producing the standard format, and once you are completely in control of it, then you can decide whether it is appropriate to 'bend the rules' in particular cases.

Parts of a Scientific Report

A scientific report consists of several sections. The recommended order of presentation is indicated in this section.

When you first read articles from different journals, it is very easy to see only the differences in layout, and to ignore the broad similarities that exist across all sub-disciplines of chemistry and across different scientific fields. For example, the discussion of *chemistry* laboratory reports (based on guidelines from the Royal Soceity of Chemistry)[a] has the same underlying principles as Findlay's discussion of *psychology* laboratory reports and the *psychology* "standard format".[b]

Table 1. Standard formats for laboratory reports in chemistry and psychology

Chemistry format[a]	Psychology format[b]
Title	Title page
(Abstract)[c]	Abstract
Introduction	Introduction
Experimental (or computational) method	Method
Results	Results
Discussion	Discussion
Summary or Conclusion	
(Acknowledgements)	
References	References
(Appendices)	Appendices

Findlay[3] explains the overall structure of the report:[b]

> The Abstract is an overview or precis of the report. The rest of the report may be considered as being like an hour-glass in shape (Kidder & Judd 1986). Your Introduction should begin broadly, indicating the area … under study and why it is being studied, then begin to narrow down as you describe the work of previous researchers whose results have led to your study. At the end of the Introduction you should state the aims of your study and the specific hypotheses, which are predictions of what results you expected in your study. The Method and Results sections are the most specific, since they state precisely what was done and what results were obtained. The Discussion starts with an interpretation of the results, and

[c] The abstract is often omitted in short laboratory and assignment reports submitted as part of university assessment tasks. The term "short" is a relative and imprecise description. Generally university reports shorter than 10-15 pages do not require an abstract. If in doubt, consult your lecturer or other teaching staff.

the implications of your own study, then becomes broader again, ending with a general conclusion.

Title

This should be as brief as is consistent with an adequate indication of the original features of the work.

- For a synthetic chemistry report, the title should usually include the synthesis being reported.
- For an analytical chemistry report, the title should usually include the analyte being determined or identified, the matrix and the analytical method used.
- For other reports, the title should usually include the problem being addressed.

Abstract

A summary of about 250 words *or less*, giving the salient features and drawing attention to the novel aspects, should be provided for most papers.[c] It should be essentially independent of the main text and include relevant information.

- For a synthetic chemistry report, the abstract should usually include the yield.
- For an analytical chemistry report, the abstract should usually include relevant quantitative information, such as detection limits, precision and accuracy data.
- For other reports, the abstract should usually include relevant qualitative or quantitative information.

Introduction

This section is sometimes called “Aim of investigation”. It is a concise introductory statement of the novel features of the work; the object of the investigation with any essential historical background; and a justification for publication followed, if necessary, by a brief account of preliminary experimental work with relevant references.

In a university laboratory or assignment report, do not state the teaching-and-learning aims: only include the scientific aims of the invetigation.

There is a tendency to put the expected results into this section, based on the scientific literature. In *your* background reading, you will have encountered reports of *other writers*’

results. However, *you* do not have *personal* knowledge if the synthesis or the calculation will give those results: the nature of experimental science is to test predictions and *claimed* results. In this sense, your results are a new part of your personal knowledge and hence reports of other writers' results should usually be discussed in your Discussion section.

Experimental (or computational) method

This section is a description of the experimental (or computational) procedures. Working details must be given concisely, with sufficient detail for an informed reader to reproduce the experiment or computation: well-known operations should not be described in detail. Suppliers of equipment and materials, and their locations, should be mentioned. This section should also include information on how a new method was validated.

Results

The Results would include information such as yield, spectral data, crystal data, etc, if these have not already been included in the Experimental section. Numerical results are often (not always!) best presented in tabular or diagrammatic form (but not both for the same results).

In analytical chemistry reports, the results should be followed by an appropriate statistical evaluation, which should be in accordance with accepted practice.

In some physical chemistry reports the Results and Discussion are combined so that the results can be discussed as they are presented.

Discussion

Any discussion should comment on the scope of the method and its validity, or the generality of the synthesis or computation.

Where appropriate, there should be a discussion of the similarities and differences between the results presented in the report and any similar results previously published in the scientific literature.

The discussion should include a statement of any conclusions drawn from the work.

Summary or Conclusion

This should not simply duplicate statements in the discussion, but present an overview of the whole study, with a summary of the main findings and conclusions of the study.

Acknowledgements

Contributions other than from co-authors, companies or sponsors may be acknowledged in a separate paragraph at the end of the paper.

References

References should be numbered serially in the text by means of superscript figures, and collected in numerical order under “References” at the end of the paper. Details on the use of references are given in **Chapter 4: Use of References in Chemistry**.

Appendices

Appendices contain *additional* information, that *might* be of use or interest to the reader. Apendices should *not* contain information that is *essential* to the report.

Other Aspects of Report Writing

Nomenclature

Current internationally recognized (IUPAC) chemical nomenclature should be used.[4] Common trivial names may be used, but should first be defined in terms of IUPAC nomenclature.

Symbols and units

The SI system of units,[d] as recommended by IUPAC, should be followed. Their basis is the “Systeme Internationale d’Unites” (SI). A detailed treatment is given in the “Green Book”.[5] A summary of SI units is given in **Appendix A: The SI System of Units**. When non-SI units are used they must be adequately explained unless their definition is obvious (e.g., °C and Å). The derivation of derived non-SI units should be indicated. With the exception of percentages (and similar quantities) listed in Table 3, units should be expressed with superscript powers (eg. kJ mol^{-1}) instead of the solidus (/): see **Appendix A: The SI System of Units**. Units, which are combinations of more basic units (eg. kJ mol^{-1}, m s^{-2}, kg m^{2}), are separated by spaces, not by full stops.

[d] “Systeme Internationale d’Unites” (SI).

There are a number of conventions relating to SI units,[e] which have some very minor differences between them. you should use the standard (IUPAC) symbols and abbreviations for units.[f] For example, some old books use “gms” for grams, but this could mean “grams metres seconds”. Similarly, make sure you use the correct case (capital or lower case). For example, the lower case “s” and “t” are second and “tonne”, respectively, but the capital “S” and “t” are siemen and tesla. See Table 34 and page 48 (and following pages) for more details.

Abbreviations

Abbreviational full stops are omitted after the common contractions of metric units (e.g. ml, g, mg, mm) and other units represented by symbols. Abbreviations other than those of recognized units should be avoided in the text except after definition. Upper case letters without points should be used for abbreviations for techniques and associated terms subsequent to definition e.g. HPLC, AAS, XRF, UV, NMR, SCE.

The abbreviations Me, Et, Pr, Bu, Bu^{i}, Bu^{t}, Bu^{s}, Cp, Ph, Ac, Alk, Ar and Hal are accepted usage in chemical structures,[g] and can be used in text, provided that care is taken so there is no confusion about your intended meaning: others should be defined. Substituents should be indicated by R (one) or by R’, R”, R”’ (more than one).

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[e] Some other documents describing the usage of SI units with minor differences from the IUPAC conventions are: *Weights and Measures (National Standards) Amendment Act* 1984 (No. 77) (Australia); *Metric Practice,* ANSI/IEEE 268-192, American National Standards Insititute, New York, 1992; *SI Units and Recommendations for the Use of Their Mulitples and Certain Other Units,* ISO 1000:1992, International Standards Organization, Geneva, 1992.

[f] This book follows the SI conventions adopted by the International Union of Pure and Applied Chemistry (IUPAC). A detailed treatment is given in Reference [5] (the “Green Book”): I. Mills, T. Cvitas, K. Homann, N. Kallay and K. Kuchitsu (ed.), *Quantities, Units and Symbols in Physical Chemistry,* Blackwells Scientific, on behalf of the International Union of Pure and Applied Chemistry, Oxford, 1989 <http://www.iupac.org/reports/1993/homann/>. See **Appendix A: The SI System of Units**.

[g] Most of these are IUPAC-recommended abbreviations of ligand names, see for example Reference [4]: G. J. Leigh, H. A. Favre and W. V. Metanomski, *Principles of Chemical Nomenclature: A Guide to IUPAC Recommendations*, Blackwells Scientific, on behalf of the International Union of Pure and Applied Chemistry, Oxford, 1998.

Table 2. Examples of abbreviations that are accepted usage in chemical structures, and can be used in text,[g] provided that care is taken so there is no confusion about your intended meaning.

Me	methyl	Bu^t	*tert*-butyl
Et	ethyl	Cp	cyclopentadienyl
Pr	propyl	Ph	phenyl
Bu	butyl	Ac	acetyl
Bu^i	*iso*-butyl	Alk	alkyl
Bu^s	*sec*-butyl	Ar	aryl

Percentage concentrations of solutions should be stated in internationally recognized terms. Thus the symbols ‘m’ (instead of ‘w’) for mass and ‘v’ for volume are to be used.

Table 3. Examples of how to express percentages together with an acceptable alternative given in parentheses.

% m/m (g per 100 g)
% m/v (g per 100 ml)
% v/v

Further implications of the use of the term ‘mass’ are that ‘relative atomic mass’ of an element (A_r) replaces atomic weight, and ‘relative molecular mass’ of a substance (M_r) replaces molecular weight.

Molarity is generally expressed as a decimal fraction (e.g. 0.375 mol dm^{-3}).

Tables and diagrams

All tables and diagrams (figures) must have an explanatory caption (title). Table 80 and Table 80 (in **Appendix F: Detailed Examples of Different Parts of Reports**) are examples of captions (titles) from recent journal articles.

Table column headings should be brief. Tables consisting of only two columns can often be arranged horizontally. Tables must be supplied with titles and be so set out as to be understandable without reference to the text. Either tables or graphs may be used but not both for the same set of results, unless important additional information is given by so doing. The information given by a straight-line calibration graph can usually be conveyed adequately as an equation or statement in the text.

Column headings and graph axis labels should be in accord with SI conventions. Thus, the expression of numerical values of a physical quantity should be dimensionless, i.e., the quotient of the symbol for the physical quantity and the symbol for the unit used or some mathematical function of a number. Some examples are listed in Table 4. For units which are already dimensionless, i.e. ratios such as % or ppm, the type of ratio is indicated in parentheses: see Table 4. The diagonal line (solidus) will not be used to represent “per”. In accordance with the SI system, units such as grams per millilitre are already expressed in the form g ml^{-1}. It should be noted that the “combined” unit, g ml^{-1}, must not have any “intrusive” numbers. To express concentration in grams per 100 millilitres, the word “per” will still be required: see Table 4.

Table 4. Examples of column headings and graph axis labels.

p / Pa	flow rate / ml min^{-1}
ln (p / Pa)	Concentration / g per 100 ml
wavenumber / cm^{-1}	ε (%)
distance / m	δ (ppm)
mass of substance / g	

It may be preferable for an author to express concentrations in grams per litre (g l^{-1}) rather than grams per 100 ml.

All lettering appearing on figures should be in a clear font (a sans-serif font, like Arial or Helvetica, is preferable) and should be a minimum of 6-8 point type. The use of shading, colour and tints should be avoided.

Photographs and use of colour

Photographs can be included if they convey essential information that cannot be shown in any other way.

Colour photographs and figures are only acceptable when deemed scientifically necessary. The use of colour to "pretty up" a graph or instead of the use of distinguishing symbols is not sufficient justification.

Checklists

The following lists are (incomplete) sets of guidelines that should be used when writing reports. If you answer "no" to any statement, then read the pages of this book that are indicated and revise your report.

Table 5. Your report should satisfy the following *general* guidelines.

Does your report satisfy with the statements in this column?	**Yes**	**No**
There must be sufficient data, details and discussion in the main body of the report, so that a classmate, who has done everything you have done except this exercise (or this unit), can understand the report (see page 3).	❑	❑
All pertinent data, details and discussion, which are essential to the report, must be placed in the main body of the report (see pages 3, ff).	❑	❑
All (extra) data, details and discussion, which are not essential to the report, but which aid the reader, must be placed in an appendix (see page 3, ff).	❑	❑
Trivial arithmetic and other trivial details can be omitted altogether (see page 3).	❑	❑

Table 6. Your report should satisfy the following guidelines for writing the *introduction*.

Does your report satisfy with the statements in this column?	**Yes**	**No**
The Introduction should begin broadly, indicating the area under study and why it is being studied (see pages 3 and 6).	❑	❑
The Introduction should describe the work of previous researchers (ie "background") whose results have led to your study (see pages 3 and 6).	❑	❑
The Introduction should state the aims, and the specific question(s), issues or problems being addressed in your study (see pages 3 and 6).	❑	❑
The Introduction should describe the work of previous researchers (ie background) whose results have led to the present study. At the end of the Introduction you should state the aims of your study and the specific hypotheses, which are predictions of what results you expected in your study (see pages 3 and 6).	❑	❑

Table 7. Your report should satisfy the following guidelines for writing the *method* section.

Does your report satisfy with the statements in this column?	**Yes**	**No**
The *method* section should tell the "story" of what you have done, in your own words. It should not be a set of instructions for what someone else should do (see pages 3 and 7).	❑	❑
The *method* section should include all relevant details eg (where appropriate), solvent, source of reagents, wavelength range, computer program, instrument brands and names, etc (see pages 3 and 7).	❑	❑
The *method* section should *mention* any calibrations to check that the observed values actually match the true values. Ie that there is no systematic error in the instrument.	❑	❑

Table 8. Your report should satisfy the following guidelines for writing the *results* section.

Does your report satisfy with the statements in this column?	**Yes**	**No**
All graphs and mathematical equations, which are used in the interpretation of data and/or spectra (to get the results), are part of the experimental method and results, and should be included in the main body of the report.	❑	❑
Your report should *normally* use x-y scatter plots, which are the most common type of graph in chemistry (see page 67).	❑	❑
Your report should *normally not* use a "line" graph in MS Excel (see pages 67 and 68).	❑	❑
Linear plots may (should) be omitted from the report, especially if the data is reported in another diagram or table elsewhere in the report.	❑	❑
Useful methods of presenting numerical results are to use tables or diagrams. Numerical results can include both experimental measurements and quantities derived from measurements by the use of mathematics. All numerical results should be included in the main body of the report.	❑	❑
The purpose of any table or diagram is to present data in a *useful* format. Where there are too many numbers, you should try to plot the data in a diagram (ie graph).	❑	❑
Use terminaology correctly. "**Calculated**" results are computed or calculated from a theory or mathematical model (without experimental input). Numerical experimental results are **determined** from experiment.	❑	❑

Table 9. Your report should satisfy the following guidelines for writing the *discussion* section.

Does your report satisfy with the statements in this column?	**Yes**	**No**
The *discussion* section should evaluate your results. Are they reliable? Do they agree with literature values? (If not, why not?)	❑	❑
The discussion section should be devoted to a discussion of the scientific meaning or significance of your results. How or why is it so? (see pages 3 and 7).	❑	❑
The discussion should be concise (compact and "to the point").	❑	❑
Where appropriate, chemical structures, reactions or mechanisms should be used to illustrate the textual discussion.	❑	❑
The *discussion* section should be a single coherent "story", not a collection of separate and disjointed points.	❑	❑
The purpose of any table or diagram is to present data in a *useful* format. Where there are too many numbers, you should try to plot the data in a diagram (ie graph).	❑	❑
Use terminaology correctly. "**Calculated**" results are computed or calculated from a theory or mathematical model (without experimental input). Numerical experimental results are **determined** from experiment.	❑	❑

Table 10. Your report should satisfy the following guidelines for writing the *references* section.

Does your report satisfy with the statements in this column?	**Yes**	**No**
The *references* or bibliography should be in a consistent style with **all details recorded**. See any research journal for examples. (See **Chapter 4: Use of References in Chemistry**).	❑	❑
The *references* or bibliography should be at the end of the report ("end notes"), not as footnotes (See pages 54, ff).	❑	❑
Facts, which are not "common knowledge", must be supported either by your experimental or computational data (or mathematical modelling) or by a reference to the scientific literature (See pages 54, ff).	❑	❑
References should be cited by numbers in the body of the report, with the references numbered in the order of first citation in the report. Multiple citations to the same reference are given the same number (See page 56).	❑	❑
The original source of information (eg journal or book) should be cited, not the secondary reference (eg lecture notes).	❑	❑
The original source of all diagrams should be cited.	❑	❑
Computer programs, files (eg spreadsheets), internet documents, etc., should be referenced in the same manner as books ie, with details of author(s), title, publisher, city-of-publication, edition or revision, year (see pages 61, ff).	❑	❑

Table 11. Your report should satisfy the following guidelines for the use of Figures, Tables, etc.

Does your report satisfy with the statements in this column?	**Yes**	**No**
Figures can include graphs, structures and other types of diagrams. Each figure should have a caption (or title). All figures should be numbered (Figure 1, Figure 2, etc) in consecutive order, starting from one. (See pages 11 and 71).	❑	❑
Each table should have a caption (or title). All tables should be numbered (Table I, Table II, etc) in consecutive order, starting from one.	❑	❑
Important equations should be numbered (Equation 1, Equation 2, etc), in consecutive order, starting from one. Less important equations do not need to be numbered.	❑	❑
Figures, tables, equations and references should each have their own separate numbering, so that you can refer to (for example) “Equation 3”, “Table I”, or “Figure 6” in the report.	❑	❑
All figures, etc which are prepared using a computer should be “cut-and-pasted” into the report using computer editting, not physically cut and glue-pasted using scissors and glue (see page 74).	❑	❑
The figures and equations should use the correct “arrows”. Resonance (↔) involves only the rearrangement of electrons in a Lewis structure: no atoms or connectivities are altered. If atoms or connectivities (σ-bonds) are rearranged, then isomerisation (→) or equilibrium (⇌) is involved (see pages 43, ff and **Appendix B: Non-Roman Alphabets**).	❑	❑
The original source of all diagrams should be cited.	❑	❑

Table 12. Your report should satisfy the following guidelines for miscellaneous matters.

Does your report satisfy with the statements in this column?	**Yes**	**No**
The report should be written or typed in blue (or black) pen (or ink or printer). You should not use red or green. You must not use pencil.	❑	❑
Non-standard abbreviations and colloquialisms (eg "mass spec") should be either spelt in full, or replaced by the correct, standard abbreviations (see pages 8, ff).	❑	❑
The IUPAC convention of using superscripts for units (eg kJ mol^{-1}) should be followed, instead of using a solidus (eg kJ/mol) (see page 8 and **Appendix A: The SI System of Units**).	❑	❑
The correct mathematical and scientific symbols and fonts should be used: eg, arrows (→) not (- - >) multiplication (×) not "ex" (x), Greek letters (eg ν or ω in symbol font) not an English/Roman look-alike (v or w), etc.and equations should use the correct "arrows" (see pages 43, ff and **Appendix B: Non-Roman Alphabets**).	❑	❑
Superscripts and subscripts should be used where appropriate (see pages 48, ff).	❑	❑
All pages in the report should be numbered. Reports should be securely stapled.	❑	❑
The report should be carefully proofread to correct any spelling mistakes. you should not rely on the "spell checker"! A small number of spelling mistakes may be corrected by crossing out the ~~miss steaks~~ mistakes and neatly ~~righting~~ writing the corrections. If there are too many spelling mistakes, you should redo the relevant page(s) (see pages 27, ff).	❑	❑

Some technical matters

The final section of this chapter, deals with technical matters such as margins, line spacing, fonts and font sizes. The requirements in this Section are based primarily on the requirements for PhD theses at most universities and on the guidelines prescribed by major chemistry journals (eg those published by the Royal Society of Chemistry).

Paper size and layout

Standard A4 size (297 mm × 210 mm) paper should be used. Text should be printed in portrait layout ie, in the same layout as this book, with the text running parallel to the short side of the paper.

There should only be text and diagrams on one side of the paper (single-sided).

Margins

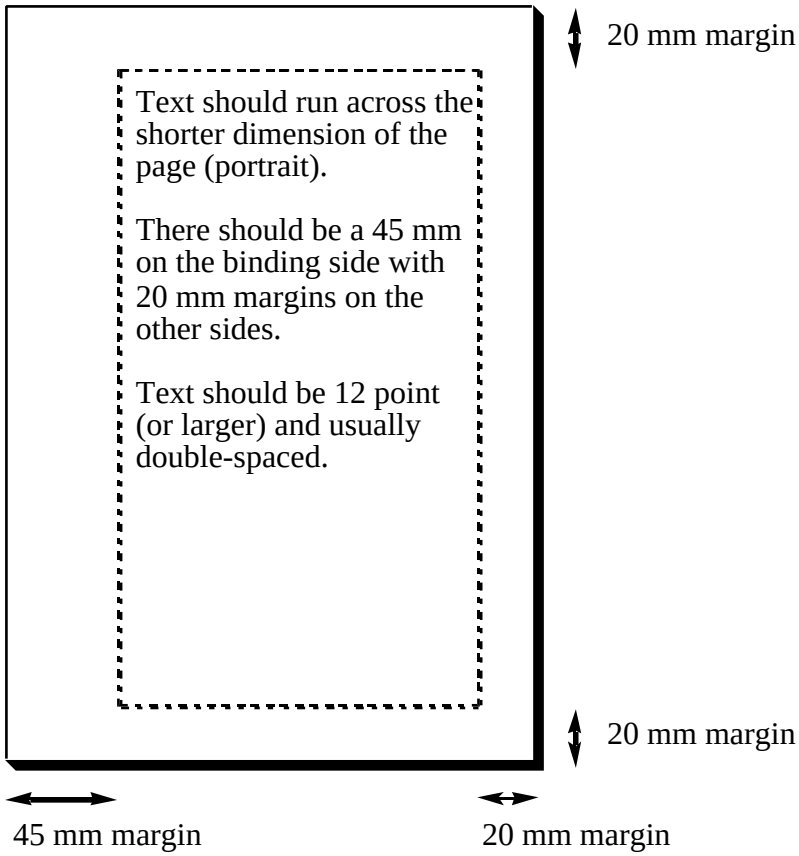
Margins should not be cramped: a minimum of 20 mm is recommended. In special cases, larger margins may be required. For example:

- Theses require a minimum of 45 mm on the left margin to allow for binding;
- Some journals require larger margins — *Physical Chemistry Chemical Physics* requires margins at top, bottom and left-hand side of at least 4 cm.

Check requirements!

Check with your journal editor or grader to determine what referencing styles, page sizes and margins, line spacing, font sizes, and other stylistic options are required.

Figure 1. Schematic diagram, showing layout, etc.



Fonts

Standard fonts should be used. This will ensure ease of reading and minimize problems should you transfer your document from one computer to another. **Table 13** lists the fonts recommended by the (joint) Information Technology Strategies Implementation Group (ITSIG) of the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO), and the International Telecommunication Union (ITU).[6]

Table 13. Recommended Fonts.[6]

Postscript fonts more common in Macintosh environment	TrueType fonts more common in PC environment
Times	Times New Roman
Helvetica	Arial
Courier	Courier New
Symbol	Symbol

Times and Times New Roman are *serif* fonts. They have smaller lines, at the tops and bottoms of the letters, which are used to finish the strokes in the letters. These serifs are designed to guide the eye in its scanning motion across the page. Serif fonts should be used for blocks of text.

Helvetica and Arial are *sanserif* fonts, without ("sans") the serifs or smaller lines at the tops and bottoms of the letters. These fonts should be used for small blocks of text such as headings, and dot points in overhead transparencies. They should not be used for large blocks of text: when first introduced in the nineteenth century, sanserif fontswere known as "grotesque".[7]

The Times, Times New Roman, Helvetica and Arial fonts are *proportional-spaced* fonts, in which the letters "n", "i", "l", "u", etc are narrower in total width than the letters "m", and "w". These fonts are pleasing to the eye, because each arch or opening in the letters "o", "e", "n", "u", "v", "m", and "w" is the same width: the total width of the letters is adjusted to compensate for the different numbers of openings, arches, etc. Text on different lines, written in *proportional-spaced* fonts, will not be aligned because the letters have different widths. This width irregularity adds to the beauty of these fonts.[h]

[h] The irregularity of almost-regular (ie pseudoperiodic) behaviour captures attraction. This can be observed in the hypnotic attraction of ocean waves breaking on the shore, or the flickering of flames. This *chaotic* behaviour is the subject of the book: J. Gleick, *Chaos*, Viking, New York, 1987.

Courier and Courier New are *mono-spaced* fonts. Each letter is designed to occupy the same width on a line. This is essential in tables and in printouts of computer programs where it is important for characters (letters) on different lines to be aligned (see **Table 14**).

Table 14. Differences in Alignment of Proportional-Spaced and Mono-Spaced Fonts.

Proportional-spaced font	**`Mono-spaced font`**
Letters and numbers have different widths.	`Letters and numbers have the same width.`
Letters and numbers on different lines are not perfectly aligned.	`Letters and numbers on different lines are perfectly aligned.`

for example:
telephone: + 65 (8) 5227 2346
fascimile: + 61 (2) 9141 1040
	`for example:`
	`telephone: + 61 (3) 5227 2146`
	`fascimile: + 61 (3) 9141 1040`

The Symbol font is used for Greek letters and other symbols commonly used in scientific and mathematical writing (see **Appendix B: Non-Roman Alphabets**).

Font sizes and line spacing

The choice of appropriate font sizes and line spacing is determined by two competing considerations:

- larger font sizes and line spacing will maximize readability and legibility; but
- smaller font sizes and line spacing will maximize efficient use of paper and information content.

The standard font sizes are 10-point and 12-point sizes. Originally, *points* were defined so that 72 points equaled one inch (2.54 cm). However, implementation of slightly varying standards on different printers has resulted in the 10-point size on PC-type computers and their printers being roughly equivalent to the 12-point size on Macintosh-type computers and

printers: this is the old typewriter font size for six-lines-per-inch.[i] The use of larger font sizes, gives the impression that the writer lacks content and is trying to stretch the material to fill the required number of pages. Conversely, using smaller font sizes, gives the impression that the writer is not concise, and is trying to cram both relevant and less-relevant material into a set page limit.

Smaller fonts (sizes 6 to 8 point) are generally used for superscripts, subscripts, and subsidiary matter. Occasionally, large tables will use smaller fonts to prevent the table "spilling" over the page. Larger fonts (bigger than size 14 point) are generally used for headings, titles, overhead transparencies, etc.

Single-space (line spacing) is unsuitable for superscripts and subscripts, which are common in scientific writing. A *minimum* of one-and-a-half (line) spacing (ie the tops of lines of 12-point letters is spaced at 18-point intervals) is required for scientific manuscripts. In many cases, *double-space* is required so that editors and graders (markers) have space to write comments. Check with your journal editor or grader to determine which line spacing is required.

[i] The 72 points per inch standard is the Anglo-American point system. We suspect, but have not been able to confirm, that the slightly larger "point" on PC-type computers and their printers is based on the European Didot point system.

Chapter 3. Scientific English

Language exists as a medium of communication.[a] In the general community, there is no "correct" or "incorrect" grammar. "Grammar" is merely a description of the manner in which we use the English language.

The use of Australian English (or any other regional form of English) can lead to confusion (or even insult) when used inappropriately:

- In Australian English, an "entree" is the dish served *before* the main course at dinner. However, in North America, an "entree" *is* the main course at dinner.

- Similarly, the use of abbreviations and contractions can lead to disaster: Australians use the abbreviation "C" for cold water, but English-speaking tourists in Italy are scalded by hot water when using the "C" tap (*cauldo* = hot)!

The community of chemists consists of scientists from many countries: it is an international grouping. Hence, we should use "Scientific English" in writing reports to make our meaning clear when communicating with other chemists, many of whom would not have the same cultural background as ourselves.

Much of the advice in this Chapter is based on information from Deakin University's Faculty of Arts,[b] which has been adapted to describe the use of Scientific English.

Writing

If your expression is not good it would be advisable to purchase one of the many books on usage which are available almost anywhere. This guide only touches on a few areas of concern and provides a few examples. You can consult the following reference books, which provide a comprehensive explanation of good usage:

- M. Hewings, *Advanced Grammar in Use: A self-study reference and practice book for advanced learners of English*, Cambridge University Press, Cambridge, 1999;[9]

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[a] P. L. Berger and B. Berger, *Sociology: A Biographical Approach*, Basic Books, New York, 1972.

[b] Reference [8]: Deakin University Faculty of Arts' *1999-2000 Assignment Preparation and Style Guide*, Section 5. The *Assignment Preparation And Style Guide* describes the appropriate use of Australian English for academic purposes. It has been used in this book with permission from Deakin University's Faculty of Arts. Where appropriate, changes have been made to describe the use of Scientific English.

- M. A. Ramsay, *The Complete Guide to English Usage for Australian Students*, 3rd Edn., Nelson Thomson Learning, Southbank (Vic), 1998;[10]
- *Style Manual for Authors, Editors and Printers*, 5th Edn., AusInfo (formerly the Australian Government Publishing Service), Canberra, 1994;[7]
- R. Murphy, *English Grammar in Use: A reference and practice book for intermediate students*, 2nd Edn., Cambridge University Press, Cambridge, 1994;[11]
- R. J. Gula, *Precision: A reference handbook for writers*, Winthrop Publishers, Cambridge (MA), 1980;[12]
- W. Strunk and E. B. White, *The Elements of Style*, Macmillan, New York, 1984;[13]
- B. Bailey, V. Shaffer and H. Shaw, *Handbook of English*, Australian Edn., McGraw-Hill, Sydney, 1968;[14]

Other good references and textbooks are listed in Reference [8].

Use of colloquialisms and related matters

Some words and phrases have lost their effectiveness through overuse. Many expressions like ‘a calculated risk’ or ‘a near miss’ or figures of speech such as ‘blind as a bat’ are common in conversation but are inappropriate in a formal written piece. Avoid words which are overused eg, “incredible”, “unreal”, “basically” and “amazing”.

You should avoid the use of contractions or informal terminology, in favour of more precise and formal terms: Table 15.

Table 15. Examples of contractions or informal terminology, which should be replaced by more precise and formal terms.

can’t	cannot
won’t	will not
loo	toilet or lavatory
Kinder	Kindergarten
mass spec	mass spectrum or mass spectrometry

Colloquialisms often generalise meanings as well as being too informal to use in academic work. Whenever something you have written strikes you as being overly general, or when you are not quite sure of the point you are making, do not leave it. Work out what you **are** saying and use the **exact** words needed to pinpoint your meaning.

Note that although "Kinder" is a common colloquialism in many Australian states, it is virtually unknown in South Africa. Do not use colloquialisms in academic writing!

Go through your first draft and cut out all superfluous or ineffective words. Avoid pretentious verbosity: see "**Clichés**" (page 32) and Table 16. Table 52 lists more examples of superfluous phrases and clichés (to be avoided).

Table 16. Examples of pretentious verbosity, which can be replaced by simpler words or phrases.

more economically viable	cheaper
more commercially viable	cheaper
at this point in time	now

Spelling and meaning

Accurate spelling is one mark of good scholarship and poor spelling signals ill-considered, careless work. For example, the misspelling of "butane" as the similar "butene", "butyne", "butanal", or "butanol" will completely alter the meaning of your text.

When in doubt of the correct spelling of a word, you should consult a dictionary. In Australia, you should use the (Australian) *Macquarie Dictionary*, or one of its smaller versions.[c] However, since many of the reputable journals are based overseas, American or British spellings are generally acceptable, as long as you are consistent: using only Australian or American or British spellings, not a hybrid. Most Commonwealth countries

[c] Different countries will have a perferred or national dictionary. In general, the *Oxford English Dictionary* is seen as the definitive dictionary for British spelling, while the *Webster Dictionary* is seen as the definitive dictionary for American spelling

(eg, Australia) tend to follow the British spellings for words such as recognise (rather than recognize) and labour (rather than labor) except when you are using a direct quotation, which uses the American spelling. **Never change direct quotes**.

Make sure you know the difference between the words listed in Table 17. If in doubt, consult a dictionary!

Table 17. Examples of Commonly-Confused Words and Terms.

absorb / adsorb	appraise / apprise
accept / except	ascent / assent
access / assess / excess	assurance / insurance
assay / essay	ensure / insure / unsure
ascent / assent	aural / oral
assurance / insurane	base / bases / basis
assure / ensure / insure / unsure	biannual /biennial
adapt / adopt	censor / sensor
advice / advise	choose / chose / chosen
affect / effect	cite / sight / site
aggravate / irritate	collaborate / corroborate
all ready / already	colleague / college
all together / altogether	continual / continuing / continuous
allusion / illusion	cord / chord
alternate / alternative	coarse /course
an ion / anion	complement / compliment / supplement

Table 17 continued. Examples of Commonly-Confused Words and Terms.

dependant / dependent	lain / lane
deviant / deviate / devious	lead / led
device / devise	licence / license
devolve / evolve / involve / revolve	loath / loathe
discreet / discrete	mass / weight
die / dye	maybe / may be
elder / older	meter / metre
elicit / illicit	of / off
emit / omit	pain / pane
evade / invade	past / passed
extant / extent	plain / plane
farther / father / further	Poisson / poison
flammable / inflammable / nonflammable	practice / practise
impatient / in-patient	principal / principle
informed / unformed / uniformed	right / rite / write
in-line / on-line	simple / simplistic
in vitro / in vivo	stationary / stationery
ion / iron	their / there / they’re
itch / scratch	then / than
its / it’s	to / too / two
laid / lay / laying / lie / lye / lying	translucent / transparent

Table 17 continued. Examples of Commonly-Confused Words and Terms.

unit / unite / unity	weather / whether /wether
vial / vile	whose / who's
war / wore	wont / won't
wave / waive	wood / would
weak / week	your / you're

Commonly-mistaken "opposites"

In English, "im-", "in-" or "un-" are commonly used as prefixes to mean "not", ie to indicate the oppposite of a word: see Table 18. However, in some cases, these prefixes do *not* mean "the oppposite of": see Table 19. Make sure you know the difference between the use of the prefixes "im-", "in-" or "un-", when they mean "not" and when they have some other meaning: Table 18 and Table 19. If in doubt, consult a dictionary!

Table 18. Some examples where the prefixes "im-", "in-" or "un-" *do* mean "the oppposite of" or "not". These words are antonyms (opposites).

bound(ed) / unbound(ed)	partial / impartial
common / uncommon	sure / unsure
form(ed) / unform(ed)	visible / invisible
mature / immature	

Table 19. Some examples where "im-", "in-" or "un-" are *not* prefixes meaning "the opposite of". These words are not antonyms (opposites).

come / income	pact / impact
deed / indeed	pale / impale
denture / indenture	part / impart
dispose / indispose	plant / implant
duct / induct	ply / imply
flame / inflame	port / import
form(ed) / inform(ed)	pose / impose
fringe / infringe	post / impost
hale / inhale	prove / improve
ion / union	put / input
lay / inlay	scribe / inscribe
let / inlet	sure / insure
migrate / immigrate	to / into

Note that other prefixes which may, or may not, mean the opposite are "il-" (illegal), "ir-" (irreducible), etc.

Commonly-mistaken plurals

Table 20 lists words for which the singular and plural forms are often misused. For example, we should write "this datum shows" (singular) or "these data show" (plural). The singular form has been listed first, for each entry in Table 20.

Table 20. Examples of commonly-mistaken plurals. In each entry, the singular form has been listed first.

analysis / analyses	hypothesis / hypotheses
apparatus / apparati	medium / media
axis / axes	moment of inertia / moments of inertia
basis / bases	phenomenon / phenomena
centre of mass / centres of mass	quantum / quanta
criterion / criteria	spectrum / spectra
datum / data	statistic / statistics
die / dice	thesis / theses
embryo / embryos	

Clichés

Table 21. Examples of clichés which should be avoided.

the moment of truth	in this day and age
stand up and be counted	at this moment in time
last but not least	slowly but surely

Sentences

Check that you have written full sentences. A sentence must contain a verb (an action word) and usually contains a subject, verb and object. For example:

‘The samples were full of impurities’. (sentence)

‘Full of them’. (non-sentence)

Avoid sentences which are too long. Try to make your meaning clearer by dividing such sentences into a series of shorter ones. Keep a dictionary handy to assist with your spelling and a thesaurus to assist with variety of expression.

In general English, the active voice is preferred over the passive voice, eg. “The professor attended the reception” is preferable to “The reception was attended by the professor”.[8] However, Scientific English uses both the active and passive voices: see “**Active and passive voice**“ on page 34.

Paragraphs

Avoid paragraphs which are either too long or too short. One sentence paragraphs and paragraphs that extend over most of the page are seldom justified and will not present your argument to advantage. Remember that each paragraph should contain only one idea, but it should explain the idea fully, so that the paragraphs show the logical steps in the development of your argument.

Agreement of tenses

Your tenses should be consistent throughout the essay. For example:

> Women in the nineteenth century wore voluminous clothing. They find this difficult to keep clean when they are working around the house, **is incorrect.**

It should read:

> Women in the nineteenth century wore voluminous clothing. They found this difficult to keep clean when they were working around the house.

First or third person

In the past, the use of the first person (“I”, “we”) was discouraged to foster impartiality and objectivity. Writers were encouraged to refer to their own contributions in the third person, or to remain anonymous. It is now acceptable to use the first person if it results in a clearer and more straightforward presentation.

Table 22. Examples of the use of the first person.

- In previous papers, we have shown that …
- We were unable to repeat the synthesis of …

Active and passive voice

Table 23. Examples of active and passive voice.

A verb is in the *active* voice when its subject performs the action:[d]	A verb is in the *passive* voice when its subject recieves the action:[d]
• I *heated* the test-tube over the burner.	• The test-tube *was heated* over the burner.
• I *synthesised* acetyl-d_1 chloride by the addition of deuterium chloide to ketene.	• Acetyl-d_1 chloride *was synthesised* by the addition of deuterium chloide to ketene.
• The computer program *uses* a Runge-Kutta algorithm.	• A Runge-Kutta algorithm *is used* by the computer program.
• Arhenius *concluded* that energy is required for a reaction to occur.	• It *was concluded* by Arhenius that energy is required for a reaction to occur.
• We *conclude* that the pulse-flow instrument is a versatile and useful device.	• It *is concluded* that the pulse-flow instrument is a versatile and useful device.

[d] These definitions are taken from Reference [14]: B. Bailey, V. Shaffer and H. Shaw, *Handbook of English*, Australian Edn., McGraw-Hill, Sydney, 1968.

The passive voice should be used when the acting agent is not important.[e] For example, any competent chemist should be able to perform a synthetic reaction by following a prescribed procedure. Hence, the passive voice is preferred in the first and second examples of Table 23.

Conversely, you should use the active voice when the acting agent has some significance. In the third example in Table 23, the algorithm is relevant only because it is used *by the computer program*: the active voice is preferred.

The fourth example in Table 23 illustrates the general principle in general English that the active voice is usually more direct. However, many older books advise the use the passive voice to avoid the use of the first person ("I", "we") in the last example of Table 23: see the sub-section "**First or third person**" on page 33). It is now acceptable to use the first person (as the subject of an active verb) if it results in a clearer and more straightforward presentation.[15]

The use of "that" versus "which"

Consider the sentences in Table 24.[f]

Table 24. Examples of defining and non-defining clauses introduced by "that" or "which".

You must pick up the cat *that* is black.	*That* introduces a defining (or restrictive) clause.
You must pick up the cat *which* is black.	*Which* introduces a defining (or restrictive) clause.
You must pick up the cat, *which* is black.	*Which* introduces a non-defining (or non-restrictive) clause.

The use of *that* or *which* is determined by whether the clause introduced by *that* or *which* is a defining or non-defining clause:[7]

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[e] See Reference [15]: B. E. Cain, *The Basics of Technical Communication*, American Chemical Society, Washington (DC), 1988.

[f] The comments on the that/which ambiguity incorporate contributions from Associate Professor Bryce Williamson (University of Canterbury).

- A defining (or restrictive) clause contains information essential to the meaning of the sentence. The clause answers the question “which (one)?”, “who?” or “what kind?”[14]
  The first two examples in Table 24 refer to a number of cats — which one must you pick up? You must pick up the black cat.
  Both *that* and *which* can be used to introduce defining clauses. Normally, the clause is not separated from the rest of the sentence by a comma. Sometimes the word *that* or *which* can be omitted without loss of clarity:[7]
  “The illustrated book I sold yesterday cost me very little.”
  “The techniques you use are out of date.”

- A non-defining (or non-restrictive) clause contains information not essential to the meaning of the sentence. In the last example of Table 24, there is only one cat, which you must pick up. The colour just happens to be black. The meaning of the sentence is the same with and without the clause.[14]
  That is *not* used to introduce non-defining clauses. The clause is separated from the rest of the sentence by a comma.[7,14]

The “than what” construction in Australian English

The “than what” construction is very common in Australian English. Some examples are given below in Table 25. Usually “than what” can be replaced by just “than”.

Table 25. Examples of the “than what” construction in Australian English.

“Than what” construction in Australian English	**What you should write in Scientific English**
She is taller than what she looks.	She is taller than she looks. She is taller than what she looks like.

Although the “than what” construction is not confusing as such, it does interfer with the delivery of your message and should not be used in Scientific English.

The use of “as” to mean “because” or “since”

Australians and New Zealanders often use “as” to mean “because” or “since”. The clause

Shoot the cat as it urinates on the carpet

means to shoot the cat *in the act* of urinating (ie, to shoot at the same time as the offending act). However, if your intended meaning is to shoot the cat *because* it commits an offending act (ie, the relationship between the shooting and offending act is cause-and-effect), then “because” or “since” would be less ambiguous. (See footnote [g]).

The use of “different to …”

The construction “different to …” is common in Australian English (especially in the spoken language):[h]

Cats are different to dogs.

This usage of the preposition “to” is correct in English, but often annoys readers and listeners because it is far less common[i] than the construction “different from …”:

Cats are different from dogs.

It is recommended that you use the latter, more common, construction (“different from …”).

Other Australian English oddities

There are many phrases which are unique to Australian English. Many of these have been formed by the omission of one of more words, and are often associated with rhyming slang. You should avoid the use of these Australian English oddities as non-Australians may have difficulty understanding you.

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g The comments on the use of “as” incorporate contributions from Associate Professor Bryce Williamson (University of Canterbury).

h See References [16] and [17]: H. W. Fowler and E. Gowers, *A Dictionary of Modern English Usage*, 2nd corrected Edn., Oxford University Press, Oxford, 1982; *Oxford English Dictionary*, Oxford University Press, Oxford.

i See Reference [18]: *The Oxford Dictionary of Quotations*, 3rd Edn., Oxford University Press, Oxford, 1980.

Table 26. Examples of phrases which are unique to Australian English.	
You should not use:	**You should use the original phrase:**
A big ask	A big thing to ask (of you)
… should of …	… should have …

Punctuation

Colons and semi-colons

Do not use commas instead of full stops between independent sentences. Semi-colons are used to separate closely related independent clauses where a full-stop could be used, but the clauses are considered to be so closely related that a full stop would make too sharp a separation. For example:

> Your car is new; mine is five years old.

The colon, which is quite different from a semicolon, indicates that something is to follow.

> Here are the facts: the money was there five minutes before he entered the room; it was missing immediately after he left; the next day he bought a new suit, although he had previously spent all of this month's allowance.
>
> The matters raised included:
>
> Table 2. ……**;**
>
> (b) ……**;**
>
> I …….

You can use a colon to introduce a quote, but do not use one if your example is introduced by 'for example', 'including', 'such as', 'that is', 'namely' and so on.

The apostrophe for possessive nouns

An apostrophe followed by s is added to both singular and plural nouns which do not end in s to denote ownership (the possessive case):

> the clock's hands; the turbine's blades; the knife's handle;
> the children's playground; the oxen's yokes.

There is some disagreement whether to include or omit the final s to indicate ownership by singular nouns ending in s:

> James's or James'; Hess's law or Hess' law.

The Australian Government Publishing Service recommends the following rules.[7]

An apostrophe without a final s is added to *plural* nouns ending in s:

> babies' clothing; the harpies' wings; the characters' words (several characters).

You should retain the final s for *singular* nouns ending in s:

> James's; Hess's law; Dickens's novels.

However, the final s may be omitted for ancient or biblical *singular* nouns ending in s:

> Jesus' parables; Ulysses' travels.

Note that it's means "it is". It *never* has an apostrophe to denote possession:

> It's (it is) a dog; Its coat is brown; It's (it is) good tempered.

Dates and apostrophes

Apostrophe means either that something has been omitted, or indicates the possessive (belonging to). So you could write 1990 or '90 when referring to the single year 1990. Or you could write 1990s or '90s when referring to the whole decade. Note that 1990's is almost always not what you should write: it means belonging to 1990.

Hyphens in compound adjectives

Compound words are formed by two words, so that the resultant compound word has a different meaning from each of the individual words.[7] Compound adjectives, which has one adjective or a noun *modified* by another adjective (eg, light-brown fox) require a hyphen to join the two words.

Table 27. Examples of compound adjectives.

Compound adjectives	Two separate adjectives
Light-brown fox. "light" *modifies* the adjective "brown" to mean the colour is light brown.	Light brown fox. "Light" is a *separate adjective* meaning "not heavy" and has no relationship to the colour.
Very low-pressure pyrolysis. The pressure is very low.	Big fat man. The man is both big and fat.
We need more-experienced staff.[7] The staff should have more experience.	We need more experienced staff.[7] Greater numbers (more) staff, who have experience, are needed.

Note that adverbs do not need hyphens when they are part of a compound adjective since there is no ambiguity (eg, lightly tanned fox). (See footnote [j]).

Abbreviations

The most common difficulty in using abbreviations is to decide whether to put a full-stop at the end. The following guidelines will help you use or omit full-stops in abbreviations.

There is an increasing tendency to omit full-stops from abbreviations.

Abbreviations, which end with the same letter as the full word or phrase, should not be followed by a full-stop, unless they occur at the end of a sentence:

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[j] The comments on the use of hyphens in compound adjectives incorporate contributions from Associate Professor Bryce Williamson (University of Canterbury).

Mr Jones, Coles-Myer Ltd, Dr Lewis.

Abbreviations, which do not end with the same letter as the full word or phrase, should be followed by a full-stop:

Assoc. Prof. Smith, Mon., Tues., Jan., Feb.

Plurals formed by adding “s” to the end of an abbreviation, should not be follwed by a full-stop (same rules as above), unless they occur at the end of a sentence:

Figs (figures), vols (volumes), eqns (equations).

Omit apostrophes in abbreviations:

Qld (not Q’ld for Queensland)
expt (not exp’t)
Cwlth (not C’wlth for Commonwealth).

Note that contractions such as can’t, he’d (he had), do have apostrophes, but you should avoid the use of these contractions in Scientific English because many people from non-English-speaking backgrounds have difficulty understanding the contracted words.

Plurals formed by repeating a letter follow the same practice as the singular abbreviation:

p. 9, pp. 9-15 (page and pages).

Many compound abbreviations are formed by abbreviating a number of words:

N.S.W. (New South Wales), U.S.A. (United States of America),
p.m. (post meridan), B.Sc., Ph.D.

The spaces between the abbreviations (initials) for the individual words have been omitted. The increasing tendency to omit full-stops from abbreviations means that the form without full-stops is being more accepted:

NSW, USA, pm, BSc, PhD.

This trend also applies to scientific abbreviations:

b.p. (older abbreviation for boiling point), bp (current abbreviation),
N.M.R. (older), NMR (current abbreviation),

but full-stops have been retained where confusion would result from their omission:

i.d. (internal diameter), id (a term in psychology).

Some abbreviations are ambigous. If in doubt, you should always define your abbreviations:

SA can mean “South Australia” or “South Africa”.

Please check recent journals or textbooks to determine the current practice in your particular area, or consult your lecturer or marker.

Abbreviations of scientific units do not have full-stops, unless they occur at the end of a sentence. See “**Common abbreviations in chemistry**“ on page 45 and “**Appendix A: The SI System of Units**“ on page 105 for more details:

10.4 mm, 30 Hz.

Contractions

Contractions are shortened forms of words where an apostrophe is used to indicate missing letters, for example: you’ll (you will), don’t.

You should avoid the use of contractions in Scientific English because many people from non-English-speaking backgrounds have difficulty understanding the contracted words. Furthermore, contractions are considered too informal to be used in most academic written work: see Table 28.

Table 28. Examples of contractions, where the expanded form should be used.

don’t / do not	won’t / will not
I’ll / I will or I shall	you’ll / you will
it’s / it is	you’re / you are
shan’t / shall not	

You can use contracted words, which have become so common that the apostrophe is now omitted:

Table 29. Examples of contractions, where the contracted form can be used.	
bus / ‘bus (omnibus)	plane / ‘plane (aeroplane)
phone / ‘phone (telephone)	

Other issues

Billion

The use of the word “billion” is ambiguous and should be avoided. The official Australian definition is the British billion, 10^{12} (ie one *million* million),[7] but most people usually refer to the American billion, 10^{9} (ie one *thousand* million). The unit “ppb” (parts per billion) meaning 10^{-9} has been defined by international convention and can be used without ambiguity.

Litre

The IUPAC preferred symbol for the non-SI unit “litre” is “l”.[5] However, official Australian usage prefers “L”,[7] as do many American textbooks and journals. In your reports, you may use either symbol, provided you do so consistently. When writing for publication in British and European journals, “l” is preferred. The most important thing is that you are consistent in your use of “L” or “l”.

Special symbols

You should use the correct symbols for mathematical and scientific notation. In particular, you should use the multiplication sign (×) instead of “ex” (x). You can use the “**insert symbol** “ menu option in Microsoft Word, or equivalent menu options in other word-processing packages. Similiarly, you should use the correct arrows (→, etc) instead of combinations of hyphens and brackets (- - >, etc). See **Appendix B: Non-Roman Alphabets** for more details.

Chemical names

IUPAC nomenclature is preferred. In some cases, the “common” name (eg acetic acid) is preferred over the “systematic” name (eg ethanoic acid).

Avoid “common” non-scientific names such as “bicarb of soda”: use the chemical name “sodium hydrogen carbonate”.

Some textbooks use older naming conventions. Where there is a difference between current conventions and older nomenclature, put the old name in parentheses at the first mention but use the current name thereafter: eg chloromethane (methyl chloride).

Where trade names are used, put the scientific names in parentheses at the first mention: eg “tris” (tri(hydroxymethyl)methyl amine).

Table 30. Examples of IUPAC-Preferred and Non-IUPAC-Preferred Nomenclature.

IUPAC-Preferred Name	Other Name(s)	Reason
acetic acid	ethanoic acid	“common” name is preferred
acetone	propanone	“common” name is preferred
calcium hydroxide	slaked lime	“common” name is outdated
calcium oxide	lime; calx; quick lime	“common” names are outdated
chloromethane	methyl chloride	systematic name is preferred
copper (I) or copper (II)	cupric or cuprous	systematic name is preferred
ethanol	ethyl alcohol	systematic name is preferred
graphite	lead (as in “pencil lead”)	“common” name is ambiguous
iron (II) or iron (III)	ferric or ferrous	systematic name is preferred
2-methylpropane	iso-butane	systematic name is preferred
2,2-dimethylpropane	neo-pentane	systematic name is preferred

Table 30 continued. Examples of IUPAC-Preferred and Non-IUPAC-Preferred Nomenclature.

IUPAC-Preferred Name	Other Name(s)	Reason
potassium hydroxide	potash	"common" name is outdated
potassium dihydrogen phosphate	potassium phosphate, monobasic	systematic name is preferred
sodium chloride	salt	"common" name is ambiguous
sodium hydrogen carbonate	sodium bicarbonate; bicarb of soda; baking soda	"common" names are outdated
sodium hydroxide	soda lye; caustic soda; sodium hydrate	"common" names are outdated
sucrose	sugar	"common" name is ambiguous
sulfur	sulphur	modern spelling ("f") is preferred
toluene	methylbenzene	"common" name is preferred
xylene	dimethylbenzene	"common" name is preferred

Chemical formulae are written in roman (non-italic) type without spacing. For example, although the name "sodium hydrogen carbonate" has three separate words (with spaces), its formula "$NaHCO_3$" has no spaces.

Common abbreviations in chemistry

Some abbreviations are so common in chemistry that they may be used without explanation. Some of these are listed in Table 31. More complete lists can be found in the chemical literature: see eg, Reference [19]. If in doubt, put the full name or concept in parentheses at the first mention.

Table 31. Examples of Common Abbreviations that can be used Without Explanation.

Abbreviation	Definition
bp	boiling point
DMF	*N*,*N*-dimethylformamide
DMSO	dimethyl sulfoxide
DNA	deoxyribose nucleic acid
EPR	electron paramagnetic resonance
ESR	electron spin resonance
FM	frequency modulation
i.d.	internal diameter
IR	infrared
MO	molecular orbital
mp	melting point
NMR	nuclear magnetic resonance
rf	radio-frequency
rms	root-mean-square
RNA	ribonucleic acid
RRKM	Rice-Ramsperger-Kassell-Marcus (theory)
RT	room temperature

Table 31 continued. Examples of Common Abbreviations that can be used Without Explanation.	
STP	standard temperature and pressure (0° C and 1 atmosphere)[k]
uhf	ultrahigh-frequency
UV	ultraviolet

Common, but ambiguous abbreviations in chemistry

Some ambiguous abbreviations are in common use in chemistry: they can be used without definition if their meaning is clear from the context. However, you should define the abbreviation by putting the full name or concept in parentheses at the first mention if the intended meaning is unclear, or avoid the use of the ambiguous abbreviation by spelling the term in full. Some of these are listed in Table 32.

Table 32. Examples of Abbreviations that can be Ambiguous.	
Abbreviation	**Definition**
CD	circular dichroism; compact disk
m	mass; molality
PC	personal computer; paper chromatography

Use of italics and bold mathematical notation

Be careful in the use of italics and bold text for symbols (eg, in mathematical equations) as they have specific meaning: see Table 33.[l]

[k] The American “standard temperature and pressure” (0° C and 1 atmosphere, ie 273 K and 101.3 kPa) should not be mistaken for the IUPAC “standard conditions” (27° C and 1 bar, ie 300 K and 100 kPa).

Table 33. Examples of when to use (and not use) italics and bold mathematical notation.

Font usage	Examples
Variables and fundamental constants are italicised	*m* for mass, *c* for the speed of light
Functions are italicised	*f* for a function: $y = f(x)$
Contractions for named functions are not italicised	log for logarithm, sin for sine, cos for cosine, lim for limit, erf for error function
Variables and functions, which are vector quantities, are in bold	$\boldsymbol{B}$ for magnetic field vector, $\boldsymbol{p}$ for momentum, $\boldsymbol{v}$ for velocity
Scalar values (ie, the absolute value) of variables and functions, which are normally vector quantities, are not in bold	*B* for magnetic field strength, *p* for magnitude of momentum (without direction), *v* for speed
Superscript or subscript *labels* for variables are normally not italicised …	v_{max} for maximum speed, x_{ave} for average *x* value
However when superscript or subscript *labels* are a *variable*, then the label is italicised	v_x for the speed in the *x*-direction, $\boldsymbol{v}_z$ for velocity in the *z*-direction

Capitalisation, italics, subscripts, superscripts, and spaces

Capital letters, lower-case letters, italics, subscripts, superscripts and spaces are used to convey special meaning in chemistry and must be used correctly. Incorrect use of capital

[1] Also see Reference [20]: Interdivisional Committee on Nomenclature and Symbols, *On the use of italic and roman fonts for symbols in scientific text*, International Union of Pure and Applied Chemistry <http://www.iupac.org/standing/idcns/fonts_for_symbols.html>, 2000 (updated 31 January 2000; accessed 22 May 2002).

letters, lower-case letters, italics, subscripts, superscripts and spaces will lead to confusion as shown in Table 34 and Table 35. In general, italic type is used for physical quantities, roman (non-italic) type is used for units, element symbols and abbreviations, while bold type is used for vectors and matrices.

Table 34. Examples Where Use and Non-use of Capital Letters, Lower-case Letters, Subscripts and Superscripts Convey Different Meanings.

One possible usage		Another possible usage	
Usage	**Meaning**	**Usage**	**Meaning**
cd	candela, SI unit for luminous intensity	CD	circular dichroism; compact disk
cD	centiDebye, 0.01 Debye, a unit for dipole moment	Cd	symbol for element cadmium
Co	symbol for element cobalt	CO	symbol for molecular carbon monoxide
i.d.	internal diameter	id	term in psychology related to the “psyche
ID	abbreviation for identification	I’d	contraction of “I had” or “I would”
K	equilibrium coefficient	*k*	Boltzman constant; rate coefficient
K	kelvin	***k***	wave vector
m	magnetic dipole moment	***M***	magnetisation
m	metre	*m*	mass; molality

Table 34 continued. Examples Where Use and Non-use of Capital Letters, Lower-case Letters, Subscripts and Superscripts Convey Different Meanings.

mm	millimetre, 10^{-3} m	mM	millimolar, 10^{-6} mol m^{-3}
Mm	megametre, 10^{6} m	MM	megamolar, 10^{3} mol m^{-3}
O^{2-}	superoxide anion	O_2^-	singly-changed molecular oxygen anion
rf	radio-frequency	R_f	retention factor (in chromatography)
Rf	symbol for element rutherfordium		

Table 35. Examples Where Spaces and No Space Convey Different Meanings.

One possible usage		Another possible usage	
Usage	**Meaning**	**Usage**	**Meaning**
RT	room temperature	*R T*	(gas constant) × (temperature)
m s^{-1}	metres per second, the SI unit for velocity	ms^{-1}	inverse milliseconds, a derived unit for frequency, equivalent to kilohertz (kHz)

The same letter or symbol may carry different meanings, depending on the context. Careful use of Scientific English will usually indicate the meaning without ambiguity. If there is any doubt, you should clarify the meaning by giving the meaning or definition in parentheses or footnotes.

Phase information

The IUPAC recommendation for designations of the phase of matter "(aq)", "(s)" and especially "(l)", is that they should be non-italic Roman letters in a serif font, on the line (not subscript) and same point size as the text.[5] "l" for liquid should not be "curly" or script. (See footnote [m]).

Grades of purity

In science, there is a specific meaning attached to the concept of "purity". For example, distilled alcohol (ethanol) can have a maximum "purity" of 95% ethanol and the remainder 5% is water: this ethanol can be used for medical purposes ("biological purity"). However, substances like pyridine can be used to remove the water to obtain "purer" (99.99%) ethanol, but in this case, although the total impurities are less, this ethanol sample is more toxic. Hence it is important that the grade of purity be specified correctly, shown in Table 36.

Table 36. Definitions of grades of purity.

Abbreviation	Definition and Applications
Spectroscopic grade	Solvents for spectroscopy (*absorbance of impurities* is neglible)
AR	Analytical grade reagents: standard materials for analytical chemistry
tech.	Technical grade: raw materials for laboratory and pilot plants
BP	Biological purity: suitable for medical purposes or food products
	Food grade: suitable for food products (level of impurities are non-toxic)

Note that definitions of "purity" are given in terms of the intended purpose. If in doubt, cite the numerical purity and method of analysis, eg. >99.5% (HPLC).

[m] The comments on the designations of the phase of matter incorporate contributions from Associate Professor Bryce Williamson (University of Canterbury).

Chapter 4: Use of References in Chemistry

General

In science, as in many disciplines, the way to acknowledge the contribution of other people to our work is to use references or citations to their work. The following sub-sections describe *what* contributions need references or citations, and *why* we should use references or citations. The main sections of the Chapter describe *how* to use references or citations to the work (studies) of other people and to earlier work done by ourselves.

What types of facts and conclusions need references or citations?

Every report will present various facts and conclusions based on those facts. For example, suppose my report states a typical person has a fourth finger (ring finger) with average length 7.4 cm. This fact or conclusion needs to be supported by evidence:

- Firstly, the report might be describing how I measured the length of peoples' fingers. In this situation, the fact is evidenced by the report itself;
- Secondly, someone else might have done a study of the length of peoples' fingers. In this situation, I only know this fact because someone else has report it. If the original report was incorrect, then my report may be incorrect also. Since I cannot claim credit or take the responsibility for the truth of that reported fact, I need to state the evidence for that fact by referring to the original study by someone else;
- Thirdly, I might have previously done a study of the length of peoples' fingers. In this situation, I still need to state the evidence for that fact by referring to the earlier study by myself because the population may have changed over time, or sampling methods may have changed, etc.;
- Lastly, some facts are so commonly known (the sky is blue) that they need no farther evidence.

The above statements about a "fact" also applies to any conclusion presented in a report.

Why should I acknowledge other people's facts and conclusions?

In scholarly writing, it is important to distinguish between those ideas, which are our own, and those, which we have obtained from other sources. In the latter case, the original source

of the idea or concept must be acknowledged. There are several inter-related reasons why we should acknowledge the work of others:

- Firstly, it enhances our professional standing if our written report has compared and contrasted the similar and opposing views of other experts in our field. Isaac Newton once commented

  "If I have seen further it is by standing on the shoulders of giants."[a]

  By acknowledging that our own work comes from a lineage of authority, it both establishes the authority of our work, and is a subtle claim that we have expert knowledge of the area;

- Secondly, it is good professional practice to do what we want others to do for us. Imagine if the situation were reversed. Would we want others to steal our ideas? No. So we should not steal their ideas, but to acknowledge the original work of others, if we make use of their ideas.

How do I use references in chemistry?

A consistent reference style mshould be used. The style used is up to the individual choice of the student, but *chemistry* reports and theses should follow the style used by the American Chemical Society or by the Royal Society of Chemistry. Most major chemistry journals have very similar referencing styles, but with minor differences (cf. Table 37 and Table 38):

· in the order of journal title, year, volume, etc.;

· in the use of italics and/or bold typesetting;

· in the placement of authors' and editors' initials before or after the last name;

· in the use of commas, colons, and semi-colons; and

· some other minor differences.

Inspection of an appropriate journal is a convenient way to determine the style required.

[a] Sir Isaac Newton, in a letter to Robert Hooke, 5 February 1675/6, cited in *The Oxford Dictionary of Quotations*, 3rd Edn., Oxford University Press, Oxford, 1980.

Although *some* journals still use the Harvard (author, date) style, most major journals do not do so. The Harvard and similar author-date styles should *not* be used *for chemistry assignments and theses*.

Table 37. Examples of Royal Society of Chemistry referencing style.

Homonuclear metal cluster complexes have been extensively studied, with the chemistry of the triosmium clusters and organic substrates being the most well-established.[1,2] The synthesis and chemistry of homonuclear metal cluster complexes have been reported: for example, see references[2,3].

1 D. F. Shriver, H. D. Kaesz and R. D. Adams, *The Chemistry of Metal Cluster Complexes*, VCH Publishers, New York, 1990.

2 K. Burgess, *Polyhedron,* 1984, **3**, 1175.

3 U. Klabunde, *Inorg. Synth.,* 1974, **15**, 82.

Table 38. Examples of American Chemical Society referencing style.

Homonuclear metal cluster complexes have been extensively studied, with the chemistry of the triosmium clusters and organic substrates being the most well-established.[1,2] The synthesis and chemistry of homonuclear metal cluster complexes have been reported: for example, see references[2,3].

1 Shriver, D. F.; Kaesz H. D.; Adams, R. D. *The Chemistry of Metal Cluster Complexes*; VCH Publishers: New York, 1990.

2 Burgess, K. *Polyhedron,* **1984**, *3*, 1175.

3 Klabunde, U. *Inorg. Synth.,* **1974**, *15*, 82.

This chapter describes a referencing style based on Royal Society of Chemistry (RSC) journals. (Please remember that you may use an alternate referencing style based on American Chemistry Society journals, or some other hybrid style. The main requirement is that you use a consistent style.) Consult any member of the academic staff if you require more information.

References in Biology

The use of the Harvard-style "author-date" referencing is preferred in many Biology and humanities journals (eg, the journal *Cell*).

References in Biomedical Journals

The use of the "Vancouver style" of referencing is required in over 500 Biomedical and Biochemical journals. In 1979, the Vancouver Group first published its requirements for manuscripts submitted to biomedical journals. The fifth edition of those requirements,[21] printed in 1997 and updated in 1999 and 2000,[22] is an attempt to reword and reorganize the previous edition to increase clarity and address concerns about rights, privacy, descriptions of methods, and other matters. A major revision was scheduled for 2001.

Details of the "Vancouver style" of referencing is given in **Appendix E: The "Vancouver style" of referencing for biomedical journals** (pages 139, ff).

EndNote™ and similar programs

Many universities advocate the use of EndNote™, or a similar program. For example, Deakin University has a site licence for all students and staff to use this bibliographic referencing package. The user needs to build up a "library" of reference entries in a database. These entries are then copied-and-pasted into the assignment/thesis document at the appropriate places in the text (without worrying which referencing style is required). In a separate operation, EndNote will number all the entries and collate a bibliography at the end of the document, by collecting information from the database and automatically preparing your list of references. You can choose an appropriate referencing style (eg. *Journal of the American Chemical Society*) from pre-defined lists of styles. However, it may be necessary in some instances to amend the pre-defined style to allow for unusual entries.

Tips on the use of EndNote™ and similar programs are described in **Appendix C: Some Hints on the Use** of the Microsoft Word Program.

In-text citation

Literature references are given by consecutive superscript numbers through the text. If a particular reference is cited more than once, the same number is used throughout and is determined by the first appearance of that citation in the text.[2,19] There is no space between the superscripted citation and the word, phrase or sentence, which preceeds the citation.

Bibliography or reference list

The bibliography or reference list is collated at the end of the assignment or thesis. It is not inserted as footnotes.

Authors' and editors' names are listed by initials and last name, eg. K. F. Lim, R. A. Russell and G. M. Elsey. A list of names is separated by commas with "and" between the names of the last two authors.

The list of references is formatted with "hanging indents", preceded by the reference number, but with no full-stop after the reference number.

Journal articles

The following information is included: author(s), journal, year, volume number, page. Journal titles should be abbreviated and italicised.[b]

Table 39. Example of the journal article referencing style.

1 U. Klabunde, *Inorg. Synth.*, 1974, **15**, 82.

2 S. J. Davies, J. A. K. Howard, M. U. Pilotti and F. G. A. Stone, *J. Chem. Soc. Dalton Trans.*, 1989, 1855.

3 K. F. Lim, *Parabola*, 1981, **17** (1) 17.

Some journals use the year to number the volumes without a (separate) volume number: omit the "year" entry for these journals (see example 2 in Table 39). The issue number is normally omitted. However, some journals repaginate anew from page one in each issue: see example 3 in Table 39 cites a quarterly journal that has four page 9s in any given year. For these journals the issue number must be included.

Only the first page of each article is cited.

[b] See "Appendix H: Abbreviations of Journal Names".

Books

The following information is included: author(s), book title, publisher, city, year, volume. The book titles should be italicised and all major words in the title should be capitalised. If the city of publication is not well-known, then the state or country should also be included (see example 2 in Table 40). The edition is listed before the year only if it is the 2nd (or later) edition.

Table 40. Examples of the book referencing style.

1 R. B. King, *Transition-Metal Compounds*, Academic Press, New York, 1965, vol. 1.

2 G. H. Aylward and T. J. V. Findlay, *S.I. Chemical Data*, Wiley, Milton (Qld), 2nd Ed., 1974.

3 W. Kemp, *NMR in Chemistry: A Multinuclear Introduction*, Macmillan, London, 1986.

Book sections

The following information is included: author(s), book title, editor(s), publisher, city, year, volume, page or chapter. This is very similar to the referencing style for books. The title of the book section or chapter is not identified but the word “in” clearly indicates that the cited work is merely part of the edited book. The chapter (or first page of the article) has to be identified.

Table 41. Examples of the book section and edited book referencing style.

1 W. Chesnavich and M. T. Bowers, in *Gas Phase Ion Chemistry*, ed. M. T. Bowers, Academic Press, New York, 1979, vol. 1, p. 119.

2 P. C. Jurs, in *Reviews in Computational Chemistry*, ed. K. B. Lipkowitz and D. B. Boyd, VCH Publishers, New York, 1990, vol. 1, p. 169.

3 W. H. Miller (ed.), *Dynamics of Molecular Collisions*, Plenum Press, New York, 1976.

Sometimes it may be more appropriate to cite an edited book instead of the individual sections within the book. In this case, the information about individual authors and page numbers are omitted, and the editor(s) are listed first, as in a normal book citation.

Articles from general encyclopaedias

The use of encyclopaedia articles from *Microsoft Encarta*, the *Encyclopaedia Britannica*, and similar works is not recommended. Such articles usually give a general overview but do not give much *chemical* information. Hence, assignments which are researched from encyclopaedia sources, are usually good *general* essays, but are *not chemistry* essays and are marked *down* accordingly.

Table 42. Examples of the general-encyclopaedia article referencing style.

1 W. H. Kruskal, "Richard Price", in *The International Encyclopedia of Statistics*, ed. W. H. Kruskal and J. M. Tanur, The Free Press, New York, 1978, vol. 2, pp. 733-734.

2 "Metaphysics", in *The New Encyclopaedia Britannica*, Encyclopaedia Britannica Inc., Chicago, 1995, 15th edn, Micropaedia vol. 8, pp. 62-63.

3 "Metaphysics", in *The New Encyclopaedia Britannica*, Encyclopaedia Britannica Inc., Chicago, 1995, 15th edn, Macropaedia vol. 24, pp. 1-26.

If you feel that you must use an encyclopaedia article, these should be referenced in the same manner as a book section. Remember that the author(s) of the article and the page number must be identified.

Often the author name (or authors' names) or initials are indicated at the end of an article (see example 1 in Table 42). In other cases, no author is identified (see example 2 in Table 42) or different parts of the article were written by different authors who are not easily identified (see example 3 in Table 42). If no author can be readily[c] identified, then use the name of the article.

Note that referencing must distinguish between short articles in the "Micropaedia" and longer articles in the "Macropaedia" sections of the *Encyclopaedia Britannica* (see examples 2 and 3 in Table 42).

Articles from specialist encyclopaedias

Table 43. Examples of the specialist-encyclopaedia article referencing style.

1 S. Budavari, M. J. O'Neil, A. Smith, P. E. Heckelman and J. F. Kinneary (ed.), *The Merck Index - An encyclopedia of chemicals, drugs, and biologicals*, Merck &Co., Inc., New Jersey, 12th Edn., 1996.

2 N. W. Barnett and R. N. Evans, in *The Encyclopedia of Analytical Science*, ed. A. Townshend, Academic Press, London, 1995, p. 2733.

3 W. H. Kruskal, in *The International Encyclopedia of Statistics*, ed. W. H. Kruskal and J. M. Tanur, The Free Press, New York, 1978, vol. 2, pp. 733-734.

4 E. C. Wragg, in *International Encyclopedia of Teaching and Teacher Education*, ed. W. L. Anderson, Pergammon, New York, 1975, 2nd Edn, pp. 207–211.

[c] The *Encyclopaedia Britannica* lists the names of the contributors to the "Macropaedia" articles in the "Propaedia" By cross-referencing the "Macropaedia" and the "Propaedia" it is possible to discover that different parts of the article cited in example 4 in Table 42 was written by W. H. Walsh and B. W. Wilshire, while the bibliography was complied by A.C. Grayling and B. W. Wilshire. In this case, it is not necessary to cite the authors' names.

Some specialist monographs (books) have the word “encyclopaedia” in the title, or are specialist encyclopaedias. These should be referenced as edited books (see example 1 in Table 43). The articles in these specialist encyclopaedias should be referenced as chapters of an edited book (see examples 2, 3 and 4 in Table 43). Often the author name (or authors’ names) or initials are indicated at the end of an article (see the article “Richard Price”, listed as example 3 in Table 43).

University theses

The following information is included: author, thesis type, university, year. The thesis type is the name of the degree for which the thesis has been submitted. Theses should only be cited when the information has not been published elsewhere.

Table 44. Examples of the university thesis referencing style.

1 J. A. Christiansen, PhD thesis, University of Copenhagen, 1921.

2 T. C. Brown, MSc thesis, Australian National University, 1982.

3 C. R. Reid, BSc (Hons) thesis, University of Sydney, 1984.

Computer programs and software

Computer programs which are released through a program library, eg. the Quantum Chemistry Program Exchange or the Computer Physics Communications Library, are referenced as journal articles based on the announcement of the program’s release (see example 1 in Table 45).

Computer programs which are released through an institution or a commercial publisher should be referenced like a book or thesis (see examples 2, 3 and 4 in Table 45), but the title of the computer program is not italicised.

Table 45. Examples of the computer program and software referencing style.

1 W. L. Hase, R. J. Duchovic, X. Hu, A. Komornicki, K. F. Lim, D.-H. Lu, G. H. Peslherbe, K. N. Swamy, S. R. Vande Linde, A. Varandas, H. Wang and R. J. Wolf, *Quantum Chem. Program Exchange Bull.*, 1996, **16** (4), 43.

2 R. G. Gilbert, M. J. T. Jordan and S. C. Smith, Program package UNIMOL: Calculation of rate coefficients for unimolecular and recombination reactions, University of Sydney, 1990.

3 G. M. Sheldrick, SHELX System of Crystallographic Computer Programs, University of Cambridge, 1976.

4 M. J. Frisch, G. W. Trucks, H. B. Schlegel, G. E. Scuseria, M. A. Robb, J. R. Cheeseman, V. G. Zakrzewski, J. A. Montgomery, R. E. Stratmann, J. C. Burant, S. Dapprich, J. M. Millam, A. D. Daniels, K. N. Kudin, M. C. Strain, O. Farkas, J. Tomasi, V. Barone, M. Cossi, R. Cammi, B. Mennucci, C. Pomelli, C. Adamo, S. Clifford, J. Ochterski, G. A. Petersson, P. Y. Ayala, Q. Cui, K. Morokuma, D. K. Malick, A. D. Rabuck, K. Raghavachari, J. B. Foresman, J. Cioslowski, J. V. Ortiz, A. G. Baboul, B. B. Stefanov, G. Liu, A. Liashenko, P. Piskorz, I. Komaromi, R. Gomperts, R. L. Martin, D. J. Fox, T. Keith, M. A. Al-Laham, C. Y. Peng, A. Nanayakkara, C. Gonzalez, M. Challacombe, P. M. W. Gill, B. G. Johnson, W. Chen, M. W. Wong, J. L. Andres, C. Gonzalez, M. Head-Gordon, E. S. Replogle and J. A. Pople, Gaussian 98 (Revision A.7), Pittsburgh PA, 1998 <http://www.gaussian.com>.

Internet “articles”

There is often a problem with using Web documents because they are unrefereed (ie, often of dubious quality). Furthermore, they are constantly changing. Hence, there must be sufficient information in your citation for a reader to access the document and to compare the version that (s)he is reading with the version that you are citing. The following advice on citing World-Wide-Web articles is based on Quinion’s article[23] (example 1 in Table 46).

Table 46. Examples of the Internet "article" referencing style.

1 M. B. Quinion, *Citing online sources* <http://www.clever.net/quinion/words/articles/citation.htm>, 11 February 1998 (Accessed 16 October 1998).

2 T. Berners-Lee, L. Masinter and M. McCahill, *RFC 1738: Uniform Resource Locators (URL)* <ftp://ftp.demon.co.uk/pub/doc/rfc/rfc1738.txt>, 1994 (Accessed 16 October 1998).

3 J. R. Walker, University of South Florida, *MLA-Style Citations of Electronic Sources* <http://www.cas.usf.edu/english/walker/mla.html>, January 1995 (Version 1.2 Revised November 1997; Accessed 16 October 1998).

4 Royal Society of Chemistry, *Journal Abbreviations* <http://www.rsc.org/is/journals/authrefs/jabbr.htm>, (accessed 3 November 2001).

A Web citation includes: author(s), title of document, the URL, the date of document, and the access date. The title of the document should be italicised.

Although the authors' affiliations are not required, inclusion of the affliction can make the source a better authority — for example, we do not know who Janice Walker is, but knowing that she is affiliated with the University of South Florida does add creditability to her article (see example 2 in Table 46). Alternatively, if there is no author, then list the institution that produced the document (see example 4 in Table 46).

Anonymous articles should never be used because their accuracy cannot be checked.

Use the URL (Uniform Resource Locator) to identify the source of the material, as specified in the standards document RFC1738 (example 3 in Table 46). This begins with a code for the type of access involved ("http://", "ftp://", "gopher://", etc.). Give filenames as you first encountered them, including suffixes indicating compressed format, such as "gz" or "zip". You may break URLs across lines, but if possible arrange for breaks to occur only at punctuation separators (but not on hyphens, and don't ever add hyphens).

If the accessed document is dated internally, use that date for the citation. If there is no date given, use the date at which it was first accessed (prefixed by "Accessed" in parentheses). Optionally, give both (for example, if you have any reason to think the document may have been amended since its nominal date of creation).

Special rules for submission of theses

The guidelines given in this Chapter are *based on* the practise of the Royal Society of Chemistry journals.

Many universities have special rules for submission of theses. Most require that the full title of journal articles and book chapters, etc be included in the list of references. Names of all journals are to be given in full. The other information can still follow the general RSC or ACS referencing style.

Please check the rules that apply in your home institution.

Table 47. Example of the journal article referencing style *used in theses*. (Qv. Table 39).

1 U. Klabunde, "Dicarbonylchloro(*p*-toluidine)iridium(I)", *Inorganic Synthesis*, 1974, **15**, 82.

2 S. J. Davies, J. A. K. Howard, M. U. Pilotti and F. G. A. Stone, "Chemistry of polynuclear metal complexes with bridging carbene or carbyne ligands. Part 89. Tetra- and penta-nuclear tungsten-rhodium complexes: Crystal structures of $[W_3Rh_2(\mu\text{-}CO)_2(\mu\text{-}CMe)\{\mu\text{-}C(Me)C(O)\}(\mu\text{-}PPh_2)_2\text{-}(\mu_3\text{-}CMe)(CO)_2(\eta\text{-}C_5H_5)_3]$ and $[W_3Rh_2(\mu\text{-}CO)_3(\mu\text{-}CMe)\{\mu\text{-}C(Me)PPh_2\}(\mu_3\text{-}CMe)(CO)_2(\eta\text{-}C_5H_5)_3]$", *Journal of the Chemical Society, Dalton Transactions*, 1989, 1855.

3 K. F. Lim, "The Knight's tour", *Parabola*, 1981, **17** (1) 17.

Table 48. Examples of the book section referencing style *used in theses*. (Qv. Table 41).

1 W. Chesnavich and M. T. Bowers, "Statistical methods in reaction dynamics", in *Gas Phase Ion Chemistry*, ed. M. T. Bowers, Academic Press, New York, 1979, vol. 1, p. 119.

2 P. C. Jurs, "Chemometrics and multivariate analysis in analytical chemistry", in *Reviews in Computational Chemistry*, ed. K. B. Lipkowitz and D. B. Boyd, VCH Publishers, New York, 1990, vol. 1, p. 169.

Table 49. Example of the specialist-encyclopaedia article referencing style *used in theses*. (Qv. Table 43).

2 N. W. Barnett and R. N. Evans, "Luminescence", in *The Encyclopedia of Analytical Science*, ed. A. Townshend, Academic Press, London, 1995, p. 2733.

Table 50. Examples of the university thesis referencing style *used in theses*. (Qv. Table 44).

1 J. A. Christiansen, "Reaktionskinetiske studier", PhD thesis, University of Copenhagen, 1921.

2 T. C. Brown, "Studies in rate processes under conditions of very low-pressure", MSc thesis, Australian National University, 1982.

3 C. R. Reid, "The thermal decomposition kinetics of acetic and propanoic acids", BSc (Hons) thesis, University of Sydney, 1984.

Chapter 5: Graphs

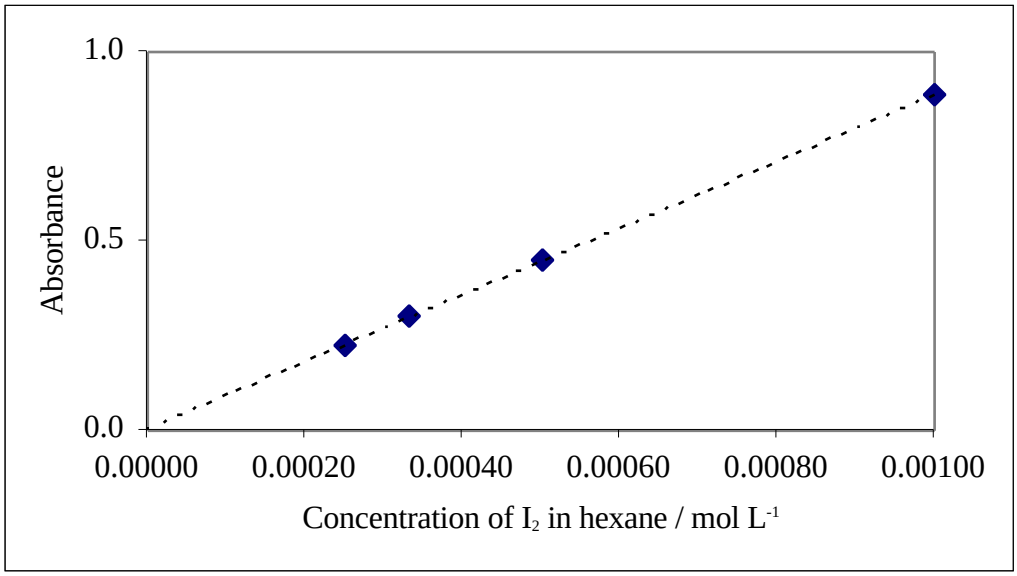
Introduction

In many cases in the physical and biological sciences, and in other areas, the interpretation of experimental data is simplified if the data are represented graphically. The purpose of this Chapter is to provide guidelines by which clear and useful graphs may be produced.[a]

Scatter Plots

Most graphs in the sciences are scatter plots, which are also known as x-y plots. The data consist of pairs of numbers: the observation (or dependent variable) is plotted on the vertical (or "y"-) axis, while the other number (the independent variable) is plotted on the horizontal (or "x"-) axis.

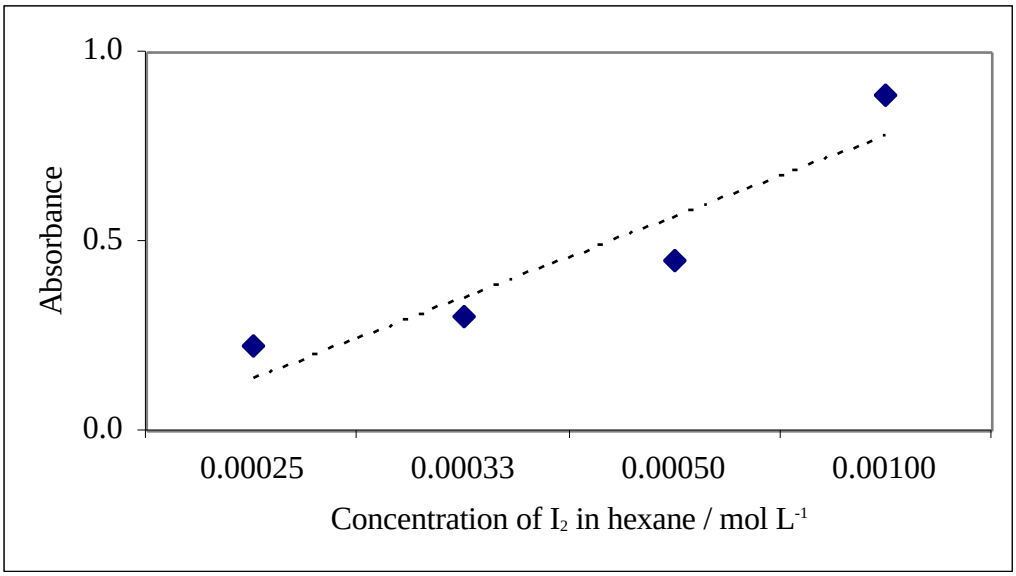
Figure 2. Scatter plot of absorbance of I_2 in hexane *versus* concentration.



[a] The guidelines in this Chapter apply equally to (rough) graphs drawn on graph paper for insertion in laboratory notebooks.

Note that the default graph in Microsoft Office (Excel, Word and PowerPoint) is a "line graph", which is a variant of a column graph or histogram: the data are plotted evenly along the horizontal axis, without regard to the numerical values of the independent variable ("x" values): see Figure 3. Since the data are plotted incorrectly, the "line of best fit" in Figure 3 is meaningless.

Figure 3. Incorrect "line plot" of absorbance of I_2 in hexane *versus* concentration (for the same data as Figure 2).



Data Points in Graphs

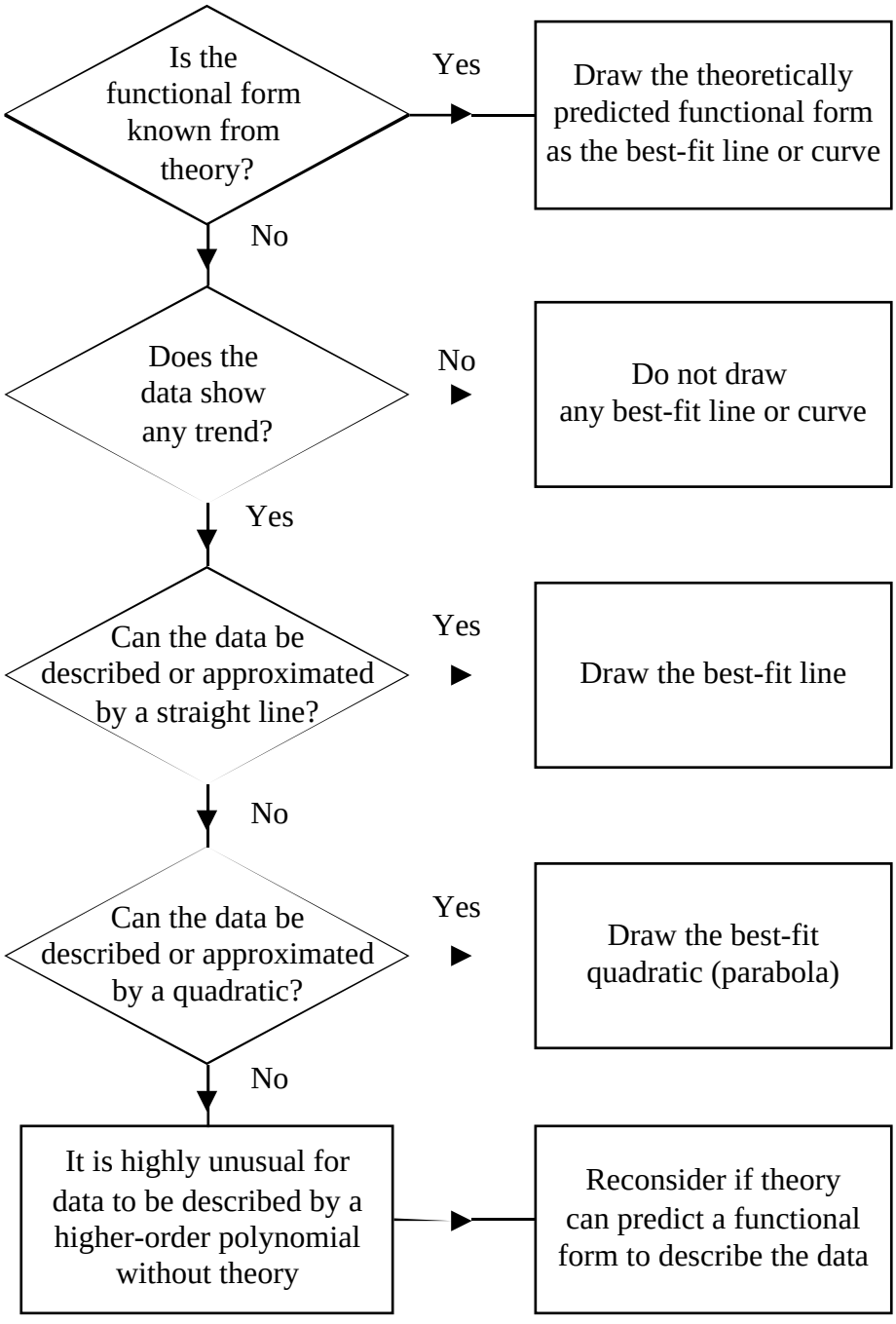
Points should be a reasonable size. Some judgement is required here: if the points are too small, then the reader may not be able to distinguish the data, but if they are drawn as large dots this introduces some uncertainty as to where, exactly, the actual points are within the dots drawn. To make the position of the points easy to see each point should be given a distinguishing symbol, eg

♦ Δ ◊, etc.

When two different sets of data are to be drawn on the same page using the same set of axes, the points for each graph should be distinguished by using a different symbol. Make sure that the symbols are defined in a legend or in the caption so that the reader knows which symbols correspond to a particular data set.

Drawing the Curve of Best Fit

Figure 4. Should I use a best-fit line or best-fit curve?

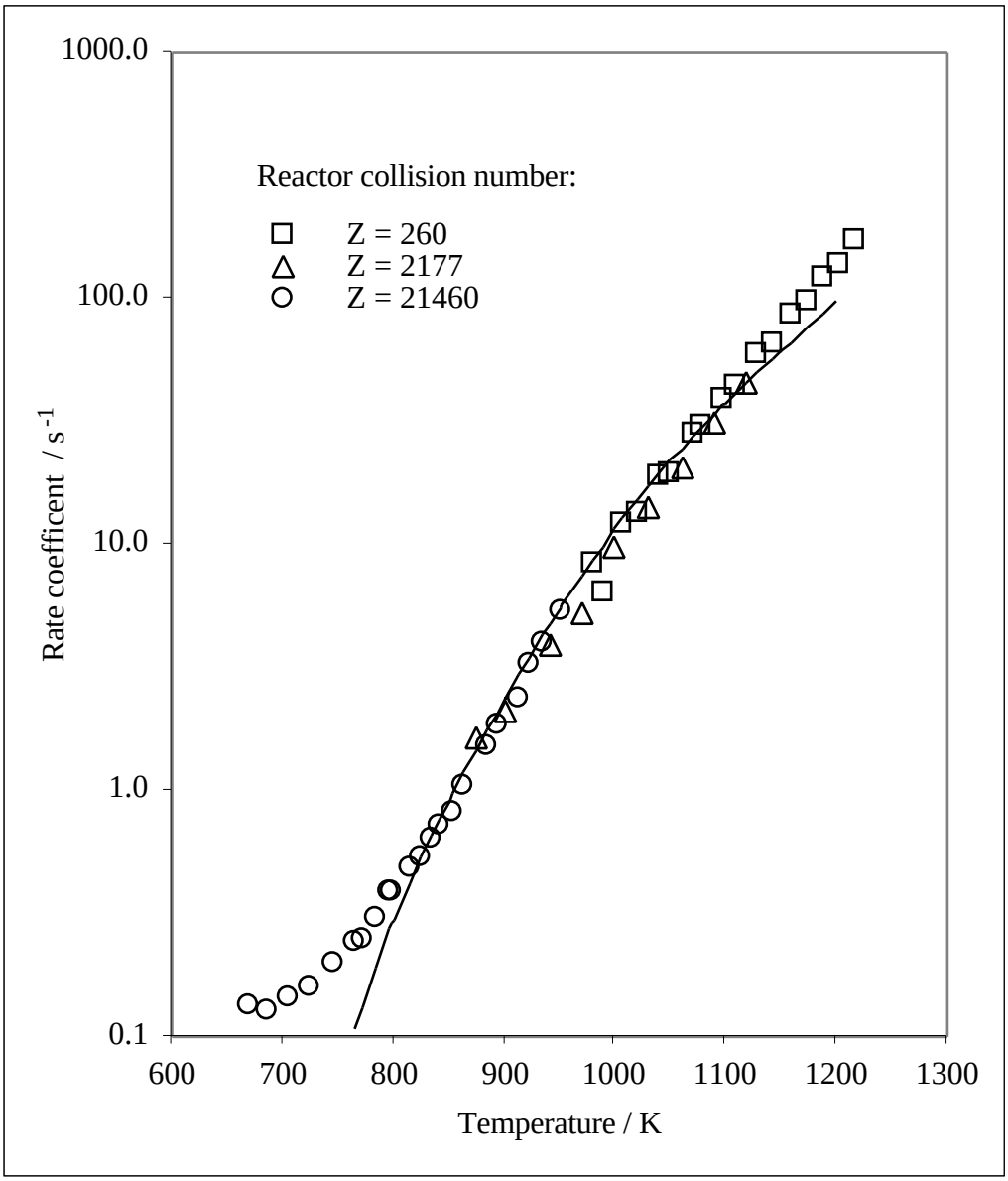


In many cases, a smooth curve of best fit should be drawn to show the trend in the data points. Usually the best-fit "curve" will be a straight line, sometimes a curve. The decision

tree in Figure 4 will help you to decide what kind of best-fit line or curve to use. While this flow chart will not cover every single circumstance, it does set the type of factors which should influence your final decision of whether to include a best-fit line or best-fit curve.

For example, the Beer-Lambert Law predicts that absorbance *versus* concentration data should be described by a straight line, which is the line of best fit in Figure 2.

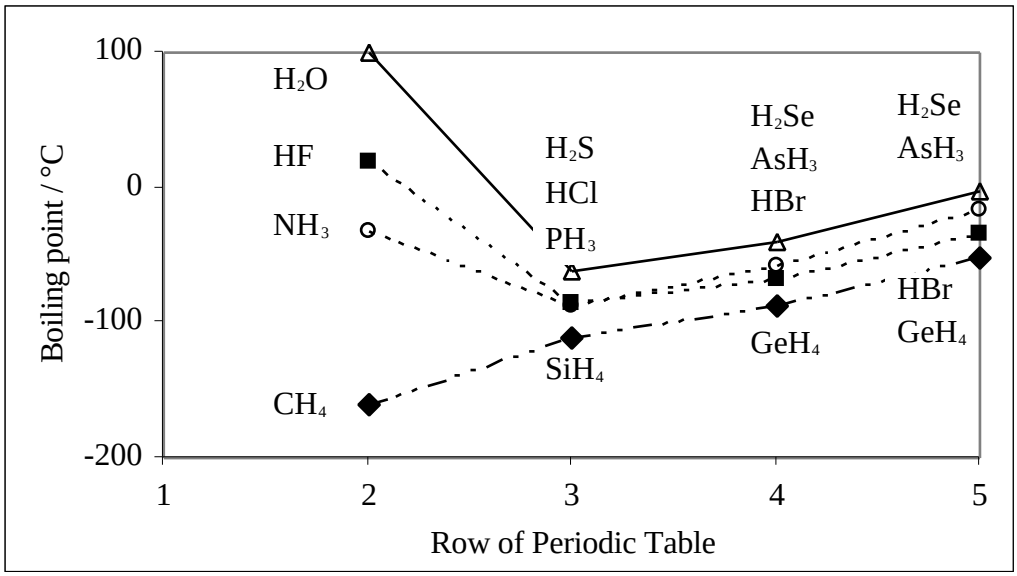
Figure 5. Decomposition of acetyl chloride-d_3 under very-low pressure pyrolysis conditions as a function of temperature.



The semi-log plot of Figure 5 is almost linear over the range 800-1200 K. However, the line (curve) of best-fit is not drawn: the theoretically-predicted curve is drawn in preference to any assumed trend. Any discrepancies between the theoretical curve and the plotted data are due to inadequacies in the theory, or the experimental precedure, and should be resolved in discussion of the data and the theoretical fit.

The decision tree in Figure 4 does not replace your own best judgement. For example, in Figure 6, there is some overlap of symbols. Lines are used to guide the eye and to indicate where overlapping symbols (HCl and PH_3) are located. These are not lines of best fit.

Figure 6. Boiling points of the hydrogen compounds of group 14, group 15, group 16 and group 17 elements. The anomolously high boiling points for H_2O, HF and NH_3 result from hydrogen bonding.



Caption

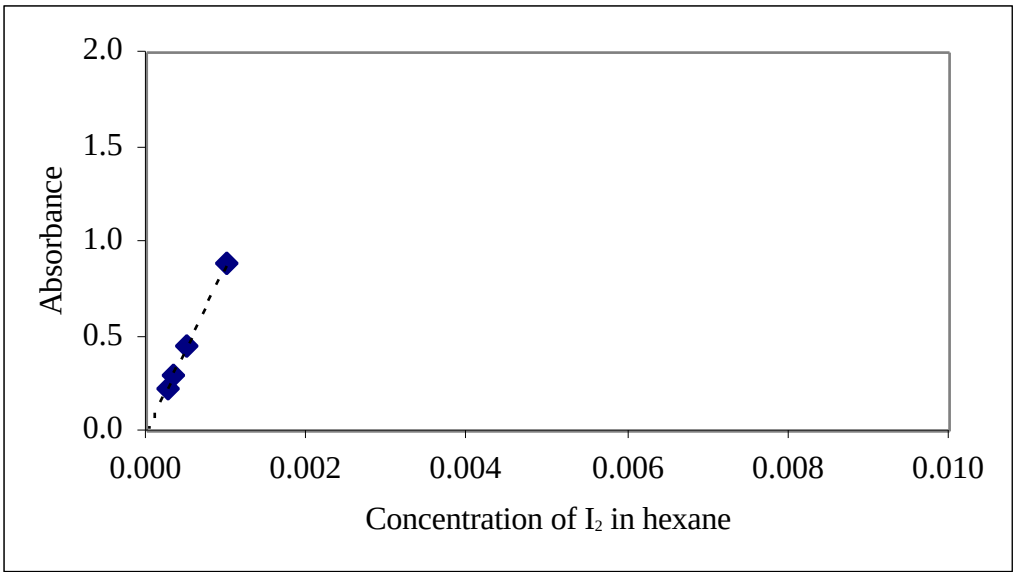
All graphs should be given a caption (also called a title), which indicates what is being plotted, eg., “Variation of current with applied voltage for standard resistor”. This is especially important when several similar graphs are included in the report. Table 80 in **Appendix F: Detailed Examples of Different Parts of Reports** gives examples of figure captions, which have been used in recent journal articles.

Axes

Each axis should be labelled with both the **quantity** being measured and its **unit**; one without the other is meaningless.

The choice of scales for use on the x (horizontal) and y (vertical) axes should be such that the graphical **data** fill as much of the available space as possible. If the data are squeezed onto one corner of the graph or spread along one edge, this results in a loss of accuracy and makes the graph difficult interpret and read.

Figure 7. Scatter plot of absorbance of I_2 in hexane *versus* concentration. Same data as Figure 2, but with inappropriate choice of axis scales.



If the data cover a range of values, not including zero, then the scale should include zero if the intention is to show the **absolute values** of the data (ie, how far removed they are from zero).

Conversely, the scale should not include zero if the intention is to show the **spread and distribution** of the data without regard to the absolute zero.

Figure 8. Rotational energy transfer per collision (<ΔE_R>) from excited propane to helium bath gas, using the hard-sphere collision model, for different trajectory subsets with atom-atom encounter number *n* and initial excitation energies *E'* = 41 000, 30 000 and 15 000 cm^{-1}.

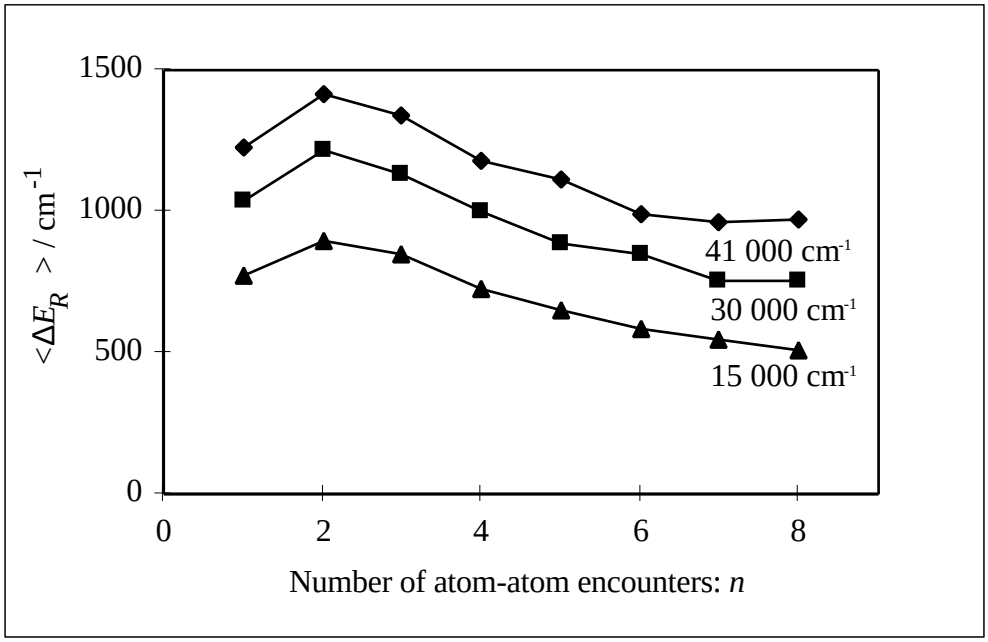
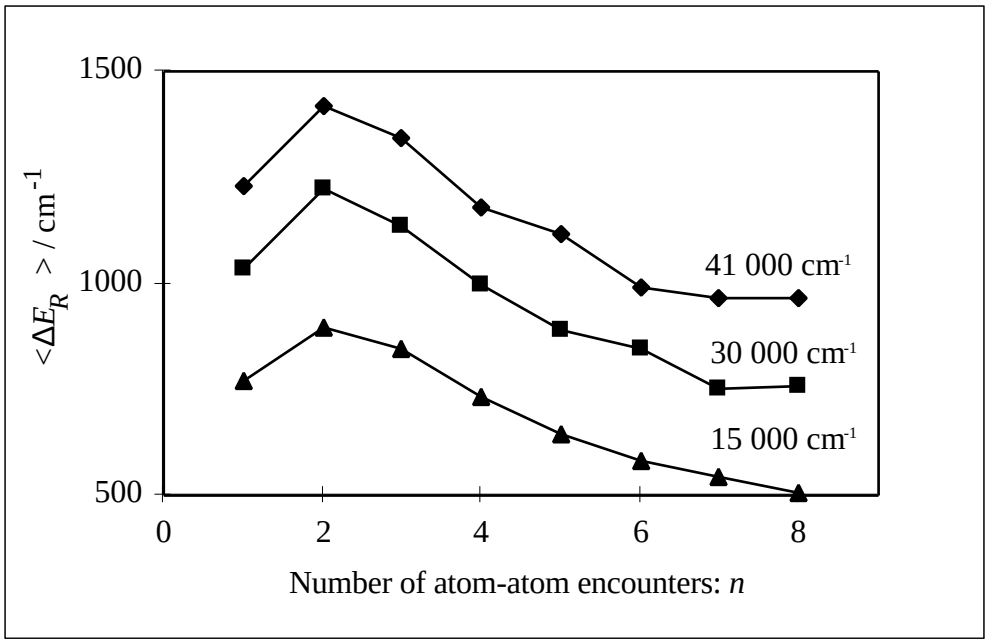


Figure 9. Same data as Figure 8, but with a different choice of axis scale.



Inserting graphs into reports

In keeping with the International Standards Organisation (ISO)[6] and journal guidelines, all graphs should be prepared and saved as separate documents using an appropriate spreadsheet or graphing program (eg, Origin, Excel). From the spreadsheet or graphing program, the graph should be **copied and pasted** into the word-processed report (thesis) using the **paste special → paste as a picture** option. This may also require reformatting the graph (using **format picture → layout**) as that it appears as an "in-line object", ie it sits in the text of the report and is moved and placed in the report as if it were a word or other text-based object.

The size of graphs should altered in the native spreadsheet or graphing program, not re-sized in the word-processed report (thesis).

Use of colour in graphs

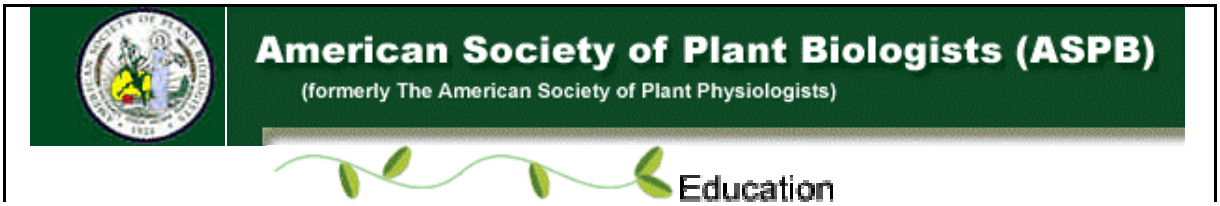
Colour can be used to enhance a graph and to help convey information. However, it is very easy to misuse colour. Also, remember that approximately 5% of males are colour-blind. Colours should be chosen for their contrast as well as their hue. A good test is to examine a black-and-white (ie, greyscale) photocopy of your graph. Is it still informative? Is there sufficient contrast and pattern for a reader to understand your graph?

Chapter 6: How to Make a Great Poster

Note

This Chapter is a reprint of the article “How to Make a Great Poster” by Dina F. Mandoli (University of Washington), which was published by the American Society of Plant Biologists as Reference [24]: <http://www.aspb.org/education/poster.cfm>. The article is reprinted here with the permission of Professor Mandoli and the American Society of Plant Biologists. A later version of the article with more details and photos can be found at Professor Mandoli’s website as Reference [25] <http://faculty.washington.edu/mandoli/poster/poster.htm>.

How to Make a Great Poster



HOW TO MAKE A GREAT POSTER

by Dina F. Mandoli, University of Washington, Department of Botany, Box 355325, Seattle, Washington 98195-5325, USA.

Making a great poster can be fun and is certainly a challenge! Here are some ideas about how to get the most attention for your efforts.

I. A GREAT POSTER IS...

readable,

Readability is a measure of how easily the ideas flow from one item to the next. Text that has lots of grammatical problems, complex or passive sentence structure, and misspellings is “hard to read”.

legible,

If a text is legible, it can be deciphered. For example, an old book may not be legible if the paper has corroded or the lettering has faded. A common error in poster presentations is use of fonts that are too small to be read from 6-10 feet away,[a] a typical distance for reading a poster.

well organized, and

Spatial organization makes the difference between reaching 95% rather than just 5% of your audience: time spent hunting for the next idea or piece of data is time taken away from thinking about the science.

succint.

Studies show that you have only 11 seconds to grab and retain your audience's attention so make the punchline prominant and brief. Most of your audience is going to absorb only the punchline. Those who are directly involved in related research will seek you out anyway and chat with you at length so you can afford to leave out all the details and tell those who are really interested the "nitty gritty" later.

II. TWO WAYS TO MAKE A POSTER ARE TO

have someone else do it, or

A professional illustrator will ask you about all the items in this presentation! Although they will execute the work, you are the final arbiter of the quality and content of the poster.

make your own.

Designing the poster elements. Most posters are most quickly made using some kind of computer software. A word processing program plus a few graphics packages (e.g. CricketGraph, MacDraw Pro, Aldus Freehand, Adobe Photoshop for IBM or MacIntosh) are important tools. If you have not tried computer graphics or are just starting out, find someone whose poster you like and ask them what they use and if they like it.

Printing the poster elements. There are many ways to make the elements or parts of your poster.

Computerized word or graphic images printed on paper.

Laser prints made directly from color slides are inexpensive, easy to mount poster elements. A printer used for printing manuscripts for submission is essential (dot matrix is just not legible).

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[a] 6–10 feet correspond to approximately 2-3 metres. Legibility at this distance requires a minimum font size of 24 points or larger.

Cannon color copiers print **color laser prints** either from a printed image or directly from a slide for less than $2.00 each (try Kinko's or other commercial copy center).[b]

There are also **prints with high resolution** and a waxy finish made via a process called "dye sublimation". This process gives great color but tends to blur edges of the images because of the way the dye is layered.

Hand drafting can be scanned into a computer and "prettied up" in a graphics program such as Aldus Freehand.

Photographs can be touched up with Adobe Photoshop. State exactly what modifications have been made to the images - it is very easy to alter your data and you must be able to defend any and all of your changes.

III. TO BEGIN:

decide what the main message is,

Keep it short and sweet and make this your title! Use the active voice (i.e., avoid "ing" on the ends of verbs) and avoid the verb "to be" whenever possible.

measure the space you have,

Lay out the space physically as well as on paper to double check yourself. If you can, make the poster flexible enough to change the size by adding or omitting elements. This flexibility is handy if you are going to more than one meeting, if the poster boards are not exactly the size advertised, if the meetings have different in size requirements for posters, or if you wish to update your data between meetings.

lay out your elements crudely,

Before you actually spend time making the final elements of the poster, take pieces of paper that are about the right size and see if you can actually make it all fit. This will save you a lot of time in the long run.

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[b] These are US dollar prices. We are uncertain of the equivalent Australian costs, but a crude estimate can be obtained from the August 2001 exchange rate: AUD$1.00 = USD$0.52.

ELIMINATE all extraneous material,

Given that the average poster gazer spends less than 10 minutes on your work and you have 11 seconds to trap your subject before they move on, only show data that adds to your central message. You do need a Title, Authors, Introduction, Results, and Conclusions. Some meetings require you to include the abstract also. Usually, omitting Materials & Methods is fine: most people will not read them anyway. If you wish, have a methods handout for those who ask for it. Although sometimes the method is essential to understand the data or the validity of the conclusions, most of the time, a short version here will do as well.

begin to make individual components of the poster!

IV. POSTER LAYOUT

How to arrange poster elements and text within each panel.

People approach new information in a known spatial sequence: we track vertically from center to top to bottom, and horizontally from left to right. This means that you should put the most important message in the center top position followed by the top left, top right, bottom left, and finish in the bottom right corner. That's why the poster title should be your punch line because, in that position, the title and your name will be seen in the first 11 seconds that a person looks at the poster.

The overall format of a good poster is dictated by the way we assimilate information. For example, you would never put your first panel on the right and ask your reader to proceed to the left because we are not trained to read that way. Newspaper format, two vertical columns that are arranged so that you read the left one first and then the right one, is highly "readable" since the reader does not spend time figuring out which panel to read next. A left to right horizontal rows arrangement works too but is not as common. You can easily walk around any meeting and find lots of variation.

Space is important in a poster: without it, your reader has no visual pauses to think. Books leave space on the margins and by having chapters. Posters that are crammed with information are tiring to read and are seldom read in their entirety. Omit all extraneous text or visual distractions, including borders between related data and text, so the reader can assimilate your ideas easily.

Size of poster elements or the fonts in each element can serve to emphasize the main points. For example, making your subheadings in all capitals and two font sizes larger than the rest of the text on the same panel will draw the reader's eye first, and so be emphasized. The use of multiple fonts in a poster can distract from the science.

You will lend the most power to your words if you spatially arrange the text in each panel of your poster following the same principles used for the poster layout as a whole. A common street sign reads “go children slow”.[c] Because the word “children” is in capitals larger than the other words and is in the center of the image, you read “Children, go slow” even though that is not the actual spatial arrangement of the words in the sign. This sign is powerful, succinct, and highly readable.

Practical matters.

It takes time to make a great poster. Allow 2 to 3 days to assemble all the bits and pieces, such as photos or laser copies, and then 1.5 to 2 days to cut all the boards and assemble the poster physically. That last bit of data you rush around to get at the last moment will go completely unnoticed if your poster is messy and disorganized i.e. illegible and unreadable.

It costs from $50 to $150 to make a poster depending on how you have it printed. Assembling your own poster on mounting boards is cheapest and one piece, color dye emulsion prints that you can roll up to transport are the most expensive. If you have poster made for you it can cost from $300 to $3,000 (average of $550.00 at the University of Washington) depending on how much of it you do yourself.[d]

Portability is worth considering. The poster should fit into carry-on luggage so that even if your suitcase is lost, you can still present your work. If all your poster panels can stack and be packaged together, so much the better.

A great poster is easy to assemble on site and can be flexible in assembly in case the poster space is smaller than advertised. If you cannot mount the poster by yourself or the poster is awkward for one person to mount on the materials provided, be sure you arrange for someone to help you. Often the person next to you will be glad to exchange labor. A map of how the poster should look when it is done is handy when you need to work quickly, are distracted or nervous.

We recycle our poster boards by peeling off the old data and text and glueing on new material. Of course this means that you stick to the same style but it also saves time, money and trees.

Posters can be made in many styles. Roll-up single piece prints, individual boards, hinged boards that fold together all have their pluses. The style you chose is a matter of cost and personal taste.

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[c] 

VI. FONT CHOICE:

sizes,

Font sizes need to be big to be effective. A good rule is to stand back from your own poster: if you, who are familiar with the material, cannot easily read it from 6 feet away,[e] your audience will certainly not be able to.

highlighting with text format,

Indents set text apart and are great for short lists.

Justification of text in the center of a line will draw attention.

basic font choice and highlighting with font variations,

Choose a basic font whose “e’s” and “a’s” stay open at all sizes and that is supported by your printer. Bookman, Helvetica, and Geneva are examples of good choices.[f] If your font is not supported by the printer, you will get ragged edges on all your letters.

Highlighting a few parts of the text is done easily with:

- capitals as in the “go CHILDREN slow” or the “Stop,...” street signs,
- Zapf dingbats instead of numbers for simple lists of things,
- wrapped letters that arc around an image,
- switch styles (bold, italics, shadow, etc.).

V. COLOR

ways to add color,

Mounting boards are a fast way to add a color border to poster elements. Choosing a color that does not compete with your data is wise.

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[d] These are US dollar prices. We are uncertain of the equivalent Australian costs, but a crude estimate can be obtained from the August 2001 exchange rate: AUD$1.00 = USD$0.52.

[e] 6 feet is approximately 2 metres. Legibility at this distance requires a minimum font size of 24 points or larger.

[f] Research indicates that sans-serif fonts (eg Arial, Helvetica, and Geneva) are good for headings, but serif fonts (eg Times New Roman, and Times) are better for text.

LaserFoil is a new product that allows you to make your printed words from a laser printer come out in color. Available in mat, glossy, and “prism” finishes, LaserFoil can add pizzaz to a poster.

Colored yarn can be effective in visually linking poster elements.

Colored graphic tape or dots, and white arrows (Chartpak, Lettraset) can be quickly applied to poster elements to draw attention to the elements you wish to.

contrast,

Proper contrast will reduce eye strain and make the poster more legible and interesting visually. Again, be careful that the color does not outclass the visual impact of your data: too much contrast is hard on the eyes and can distract the reader from your data.

Adding light color backgrounds to your figures can make the poster attractive. For example, using white lettering and lines on a blue background can make your poster eyecatching. Like a painting, poster elements can also be double matted to add interesting contrast.

fidelity of reproduction,

Images do not stay the same between one medium and the next and this is especially true for color quality. Although it is efficient to use computer-generated color slides as poster elements, you lose some fidelity in doing so. For example, the edges of letters will blur slightly in going from a slide to a printed image or vice versa. Also, the colors you see on your monitor are usually not what comes out on the slide or on the final, printed poster element. You can “adjust” your monitor and check professional color books that show what the slide film recorders will print. However, it will not be an exact match from screen to print no matter what you do. Automatic film recorders used to print computer images also vary from model to model and from run to run just like photographic printing machines do. To keep the color “true”, request custom printing. A good rule of thumb is to switch media as few times as possible.

VI. FINAL CHECK BEFORE YOU ASSEMBLE THE POSTER

Have some people look over your poster before you put it all together. If they are confused, it is far better to fix it now than to lose people at the meeting. Pay particular attention to things that may not be necessary: eliminate everything that you can!

VII. POSTER ASSEMBLY

It is trivial to assemble a poster once you have decided on and made all the individual elements. Be sure to give yourself enough time to assemble the poster. Keeping your hands and the work surfaces clean helps to produce a great looking poster.

List of materials and tools needed.

individual poster elements (8" X 10") (print 2 of each in case of goofs in gluing),[g]

mounting board (I use 10" X 12"),[h]

colored paper panels about 1/4" larger than your poster elements that will be double borders around the data,

adhesive, e.g. 3M Sprayment

sharp Exacto knife or razor blade,[i]

sharp paper cutter,

ruler,

soft pencil and eraser,

T-square (optional but very handy)

large surface covered with paper or newsprint to work on,

clean paper and some tape to wrap the poster in for travel.

I like to take a map of the final layout with me so that I don't make a mistake in putting the poster up. Some people number the backs of their poster elements. I always take my own tacks: I prefer the stainless steel 1/2" ones so I know the poster will stay up for the whole meeting and that I can actually get them into the poster board.[j]

Good luck and have fun making your poster and showing it. Displaying your finished work is a big accomplishment so take time to enjoy it and your interactions at the meeting. Remember that enthusiasm is contagious. Be on time and enthusiastic about showing your poster to colleagues at the assigned times during the meeting - it a fine chance to advertise yourself and your work!

---

[g] Professor Mandoli is referring to the US paper size Large Post Quarto (commonly called Quarto). You can use the Australian A4 size (297 × 210 mm).

[h] Large coloured cardboard can be cut to a size (eg 317 × 230 mm) that will frame A4 sheet (297 × 210 mm).

[i] The Australian "Stanley knife" is similar to the American "Exacto knife": other similar products also exist.

[j] Many conferences now require the use of "Velcro" to fasten posters to felt- or fabric-covered boards: check with the conference organisers.

Chapter 7: Delivering Oral Presentations

General

The importance of the verbal presentation should not be under-estimated. You will be used to make presentations as part of job interviews and as part of your future careers. IUPAC has noted:[26]

> "No method of presenting research results of individual views can have more impact, and arouse more attention, than a face-to-face presentation …"

The ability to communicate verbally is a totally different skill from that used in written communication. Whereas the information **content** in a written paper can be extremely dense — the reader has the luxury of reading and re-reading your paper — the success of a verbal presentation often depends on the **rate** of information delivery — once the listener has been overwhelmed by information overload, you will not receive another opportunity to convey your message.

The most often-given advice (incorrectly) given to notice speakers is "Practise, practise, practise". However, practise is only the **second**-most important method of improving your verbal presentations. The most important way of improving yourself is to **ask for (honest!) criticism of your talks and to act on that criticism**. This chapter discusses some of the more technical aspects of how to deliver a oral presentation. Other chapters discuss the use of "presentation software" and other programs to prepare visual aids for your talk.

Learn from professionals

If you wish to improve your delivery, it is instructive to study advertisements. The art of conveying a message to a listener (or reader) is big business for advertising agencies. They have learnt through trail-and-error (and some systematic research) what will work and what will not. We should learn from their experiences. In particular, we should ask ourselves:

- what makes a person/character sound believable?
- what makes a person/character sound sincere?
- what makes a person/character sound authoritative?

- what makes a person/character sound enthusiastic?

Pitch of voice

In most human societies, children speak quickly with a high tone. As they mature, both male and female voices deepen in pitch and tone. Adults usually speak slower than children.

A low voice pitch, coupled with a slow(er) delivery is associated with authoritative statements. This is clearly heard in the style of news readers, in "voice-overs" for TV/cinema advertisements, and in operatic "king" roles[a]. We even use the term "majestic" to describe the deep tones of James Earl Jones who provided the voices of Mufasa in "The Lion King"[b] and Darth Vader in "Star Wars".[c] On the other hand, be careful that you do not speak too slowly as your listeners may fall asleep: the perfect delivery is a fine balance and is an art, not a science!

While some of us might have a naturally deep speaking voice, that is not so for most. Nevertheless, with practise, we can all lower the pitch of our voice: Baroness Thatcher[d] has cultivated a speaking voice that is mid-way in pitch between the average female and male range. The aim here is not to affect or "put-on" a deep voice, but to breathe deeply using the diaphragm instead of the chest and to speak slowly "from the gut".[e]

Variation of vocal stress and pace can be used to convey emphasis.

The habitual rising terminal (HRT)

A particular feature of Australian spoken English is the habitual rising terminal (HRT), which refers to a rising pitch at the end of a sentence. This should be avoided because a HRT is used in most non-Australian English-speaking societies to indicate a question, whereas in Australia the HRT is often used both for questions and statements-of-fact.

---

a Operatic "king" roles are almost invariably sung by a base or baritone singers (hardly ever by the higher-pitched tenors).

b "The Lion King", Walt Disney Pictures, 1994.

c "Star Wars", Twentieth Century Fox, 1977.

d Mrs Thatcher was Prime Minister of the United Kingdom, 1979-1990.

e In many ways, this is similar to the breathing exercises practised by sufferers of asthma.

Use of language

The aim of your presentation is to convey a message to your audience. Anything, which interferes with this communication, should be avoided.

“Ur … “ and other nervous sounds

Table 51 list some sounds, which are commonly used to hide nervousness or to fill silences, when we are seeking the right word or phrase to use. Audiences have been known to count these nervous sounds instead of listening to the speaker’s presentation! You can avoid these sounds by speaking more slowly or by pausing.

Table 51. Examples of nervous sounds (to be avoided).

“ … ur … “	“ … you know … “
“ … um … “	“ … OK? … “

Superfluous phrases and clichés

Politicians and other “media personalities” often use “fillers” because they can put their brain into “auto-pilot mode”, while thinking of the right word or phrase to use. Superfluous phrases and clichés are merely fillers and contribute nothing to the content of your presentation. You can avoid these brain-less words by memorising appropriate words and phrases as part of your preparation for the presentation. Table 16 shows how these phrases can be replaced by simpler words or phrases.

Table 52. Examples of superfluous phrases and clichés (to be avoided).	
in point of fact	last but not least
needless to say	in this day and age
as you know	at this moment in time
the moment of truth	slowly but surely
stand up and be counted	

Jargon

In the right situation, jargon is a very powerful tool, as it is a specialised language, with specific meaning. As with all language, you need to judge if its use will help or hinder your presentation to a particular audience.

Idioms

Idioms enrich our everyday language. Often they are specific to a particular region or society. Listeners from other regions, countries, or societies might not understand Australian idioms. Only use idioms if you are sure that your audience will understand what you are saying.

Use of body language

In gorilla society, looking directly at another individual is a gesture of aggression, but we are not gorillas. In human interactions, looking directly at another individual conveys interest: “I am interested in you and interested in what you are saying”. Try to maintain eye contact with your audience. This means looking at your listeners rather than looking at and reading from a set of notes. All your important points should be written on your overhead transparencies (slides) so that there should be no need for you to have a set of notes!

Smile and be friendly: invite your audience to like you. They will be more receptive to what you have to say and be more willing to try to understand the more difficult concepts.

Invite your audience to agree with you. In your introduction, it is important to tell them things that they (should) already know. This builds a sense of rapport and ensures that your talk is starting from knowledge that is shared by your and audience yourself.[f]

Be confident. You will know more about the subject mater of your talk than your audience. It is natural to be nervous when facing a large audience, but do not confuse this with fear. The audience has come to **listen** to you, to learn something new, and not to laugh. They are more than willing to tolerate nervousness: there is nothing to fear from them.

You have nothing to hide. You have nothing to fear from your audience. Try to keep an open stance: do not cross your arms in front of your body. Try not to fidget as fidgetiness shows lack of confidence and lack of self-belief.

There is a natural tendency to lean forward to talk to your friends and back away from your enemies. Try to move forward towards the audience. This includes leaning forward so that your head and shoulders are closer to the audience than your feet.

What clothes should I wear?

The advice in this section was published by Jean Gaffney in the official magazine of the Australian Computer Society.[g]

Suited for success

Let's face it. Scientists aren't known for high fashion. Not that there's anything wrong with the way scientists dress, but if you've ever been to a major scientific conference for example, you know you're not looking at a group of people who make fashion a priority in their busy lives.

But there are occasions – an important presentation to the CEO or executive committee, perhaps – when it wouldn't hurt to dress up.

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[f] There is sound educational principle that underlies this common prior-knowledge base. In *constructivistic* theory, learners (your listeners) *construct* new knowledge, starting from their prior knowledge. You want your listeners to start from the same knowledge base as yourself, so that you can lead them to the same (ie your) conclusions.

[g] See References [27,28]. Reproduced here with minor changes by permission of IDG Communications Pty. Ltd.

Don’t neglect grooming. If you have long hair, pull it back into a ponytail. If you have a beard or moustache, make sure they are well-trimmed. And as always, your fingernails should be clean and trimmed.

As its name implies, a necktie has the job of tying a suit and shirt together. The current trend is muted or subtle patterns; think toned-down instead of in-your-face. If you haven’t bought a new tie in a while, it’s probably time for a trip to the mall.

Put on a woven shirt with a standard collar and cuffs. (A button-down collar is fine for everyday wear but not for your dressiest look.) Right now, French blue is popular, and this is less formal than white.

Dressy clothes are generally made of fine wools, cottons and silks. They should have very little texture and not very colourful. Look for shoes and belts made of soft, smooth leather.

For men, minimum jewellery is best – a watch and wedding band are enough.

You can’t afford to look outdated when you are trying to promote the latest technology or scientific discovery. While a classic suit has two buttons and is always in style, the more current suit has three buttons and cuffed trousers, and lacks a centre vent. Gaffney says black isn’t appropriate for men’s business wear. She recommends choosing a medium-to-dark tone of blue, grey, taupe or olive.

If you don’t need to wear a suit to work everyday, one is enough. But you should at least three shirts and three ties that go with the suit to stretch the wardrobe. Above all else, make sure the suit fits well. If the collar doesn’t hug your neck, the front gapes or the jacket is too tight or too loose around your waist, you’ll look like you’re borrowing someone else’s clothes. Sleeves are another often-overlooked tailoring detail – they should reach your wristbone.

Your belt and shoes should match or at least be in the same colour family; dark brown, medium brown or cordovan are good choices. Wear over-the-calf-length socks so when you cross your legs, no bare skin shows. Socks with a subtle pattern are a “do”; cartoon characters or holidays designs are a “don’t”.

Here are some tips for everyday wear:

- Heavier wools, cotton and leather are appropriate materials for casual wear; textures such as knits, flannel, corduroy and grained leather are OK. Clothing can also have more pattern and colour.

- Your regular work attire probably calls for a polo shirt or a long-sleeve cotton shirt in a solid colour, check or plaid. You may even be able to get away with a more casual wear such as a shirt without a collar.
- Khaki pants are dressier than jeans, but only if they're pressed. A belt makes casual wear more businesslike.
- The difference between casual shoes and more formal footwear is that the casual ones tend to have thicker soles and look bulkier.

Dress to impress

While scientists may roam the office in shorts and sandals these days, almost everyone has been in a business situation that called for dressing up a bit more than usual.

Having offered men pointers on what to wear to an important meeting on the previous page, we turn our attention to the women. Women generally have more wardrobe and colour options than men, but freedom of choice also brings greater opportunity for making the wrong decision.

Jean Gaffney offers the following tips for finding the right look for the occasion:

Hair and makeup should be polished and refined. If you have long hair, put it up or pull it back. Choose subtle, natural makeup colours and avoid wearing bright eye shadow or harsh eyeliner. Likewise, skip this season's trendy nail polish colour and stick to natural shades or deep tones of red.

Choose conservative, understated jewellery in metal tones and leave the plastic hoops and dangling earrings at home. Limit rings to one per hand. Any purse or briefcase you carry should be made of leather.

The next time you need to buy new glasses, consider that tinted lenses impede making eye contact. Get non-reflective coating so light doesn't bounce off you.

An important business meeting calls for a suit – either a coordinated jacket and pants or the more formal jacket and skirt. There's nothing more practical than investing in a jacket, skirt and pants in the same colour and fabric, and mixing and matching the pieces with other garments. For example, you can pair the shirt or pants with a sweater set and use the jacket to top other slacks or a skirt. Just be sure your suit doesn't have contrasting buttons or trim that will limit your options.

Choose nicely shaped classic clothing in wool, silk or other fine fabrics. If you wear a skirt, the hem should graze the kneecap or fall just below.

Women can work with a much broader colour palette than men, but keep in mind that the degree of boldness should match your personality. Pick a neutral solid colour or subtle pattern and wear an accent colour near your face. For example, you can highlight a grey, black, beige or navy suit with a bright blouse or scarf. Good accent colours include red, blue, green, yellow, orange, turquoise, pink and purple.

Pick a blouse, sweater or shirt made of silk or very fine wool knit. Stay away from bulky sweaters or lots of texture. A jewel neck or open collar is fine as long as it's tasteful and not too low-cut – Erin Brockovich is not the look you want to emulate. You should never bare your arms in a presentation, so don't wear a sleeveless shell unless you plan to keep your jacket on.

Even when it's 35 °C outside, hosiery and close-toed shoes are still musts. Wear leather shoes with a low heel and a thin sole, not clogs or platform shoes. Suntan-coloured nylons don't work for everyone – the key is to pick a colour that matches your skin tone.

Cultural and societal aspects

This Chapter concludes with a note of caution. The advice in this Chapter is based on the expectations of a "western", English-speaking society. The use (and effectiveness) of body language, voice pitch and pace, eye contact, etc may be extremely different, especially for many non-English-speaking societies. For that all-important presentation, you should seek advice from someone (eg an expatriate or an embassy official) who is familiar with both your culture and the culture of the group to whom you are making your presentation.

References and further reading

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Chapter 8: Writing for Assignments and Examinations

General

The submission of an assignment or examination paper is also an exercise in communication. The examiner wants to discover what you know about a subject while you want to display your knowledge. Mere knowing is not sufficient to pass an assessment unless you can show that you know the subject.

Before you can work out and/or write the answer to an assignment or examination question, you need to know what you are being asked to do. The main bulk of this Chapter discusses how to identify the problem, and provides some hints on "examination techniques". Table 53 lists problem-solving skills that are necessary to solve problems in chemistry.[29]

Table 53. Skills needed to solve problems in chemistry.

Identification of pertinent data in a problem
Identification of relationships between variables in a problem
Knowing when information is missing and needs to be looked up
Depicting problems with schematic drawings
Extracting the definition of a problem from the given wording
Formulating the problem in mathematical terms based on the given wording
Knowing how to assemble small steps to solve a complicated problem

Types of Problems

Table 54. Classification of problems encountered in chemistry.

Type	Data	Methods	Outcomes / Goals	Skills bonus
1	Given	Familiar	Given	Recall of algorithms.
2	Given	Unfamiliar	Given	Looking for parallels to known methods.
3	Incomplete	Familiar	Given	Analysis of problem to decide what further data are required.
4	Incomplete	Unfamiliar	Given	Weighing up possible methods and then deciding on data required.
5	Given	Familiar	Open	Decision making about appropriate goals. Exploration of knowledge networks.
6	Given	Unfamiliar	Open	Decisions about goals and choices of appropriate methods. Exploration of knowledge and technique networks.
7	Incomplete	Familiar	Open	Once goals have been specified by the student, the data are seen to be incomplete.
8	Incomplete	Unfamiliar	Open	Suggestion of goals and methods to get there; consequent need for additional data. All of the above skills.

Johnstone[30] has classified eight types of problems, which can be encountered in chemistry based on the information available to the solver, whether the method of solution is known or unknown, and whether the answer (goal) is predetermined. Table 54 is taken from Johnstone's introduction[30] to Crawford and Heaton's book *Problem Solving in Analytical*

Chemistry,[31] but is applicable to all areas of chemistry. If you can recognise what you know and do not know about a problem, then you are halfway to a solution.[a] (What you do not know is what you need to determine in order to solve the problem!)

"Rubber-Stamp" Problems (Type 1)

This is the simplest type of problem: for example, naming a compound, balancing a chemical equation, or drawing the structure of a molecule. Many textbook (and many high-school exam!) questions are of this type. Data are supplied and the goal is to obtain a predetermined "correct" answer. Mastery of this type of problem is normally achieved through practice-and-drill (repetitive) exercises. Most university-level examination questions will not be of this type, but you will need these as "building blocks" to answer more-complicated problems.

Slightly More Complicated Problems (Type 2)

The level of difficulty may be increased by requiring you to use several familiar methods in a sequence (Type 2). For example, you may be required to combine several weighing, dilution, and stoichiometric calculations in a complicated titration problem.

Simple problems with incomplete data (Type 3)

Many assignments consist of Type 3 questions, as you need to look up missing data in tables or reference books. The discussion sections of most laboratory reports also have a component of Type 3 questions, as you need to compare your results with those in the scientific literature: you need to decide what external information is required and the sources from which that information can be obtained.

Problems with specified outcomes (Type 4)

This type of problem is typified by the "road-map" problem. You know where you want to go, but need to find the "best" way to get there. Many chemical synthesis problems are of this type. As noted above (Table 53), the best way of solving these problems is to break the complicated problem into small steps, solve each small step (ie problems of Types 1-3) and then to reassemble the small steps to obtain the solution to the overall problem. Often, the

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[a] Educationalists and psychologists refer to this awareness as "metacognition" or the ability to recognise and identify knowledge. The other "half" of problem solving is to apply the correct knowledge and skills to the problem.

use of a flowchart of other schematic drawing will help you identify the steps required for the solution.

More Complicated Problems (Types 5–8)

As you progress through university and in your work as a graduate scientist, you will increasingly encounter problems of Types 5–8.

Checking the Answer

This advice may seem a cliché, but in the rush and panic of the exam, a simple mistake (for example, a minus sign or an incorrect unit) can be overlooked. You should quickly check you answer to avoid some common mistakes.

Table 55. Common mistakes that can be easily detected and avoided.

"Common sense"	Does your answer match your "everyday" experiences? For example, do you expect a sample to have mass in excess of 10^6 g (ie 1 tonne)?
Units	When doing any calculation, check your units. For example, the formula for a change in Gibbs free energy is $\Delta G = \Delta H - T\,\Delta S$ but the enthalpy H is usually expressed in **kilo**joules mol^{-1} whereas the entropy S is in units of joules K^{-1} mol^{-1}.
Minus signs	Do you have to **subtract** a **negative** number (ie add the absolute value)?

Examination Techniques

Examiners are human too. They can get tired and grumpy when marking examination papers. Making their job easier will help them give you as many marks as possible.

Table 56. Easy methods to lose marks in examinations.

- Make sure that your writing is unreadable.
- Write in pencil so that again your writing is unreadable.
- Write in green or red pen so that your writing is difficult to read.
- Spread your answer to question 1 across as many pages as possible.
- Do not indicate which answer belongs to which question.
- Mix up your capital and lower case letters so that the examiner thinks you mean megamolar (MM = 10^{6} mol L^{-1}) instead of millimetres (mm = 10^{-3} m).
- Do not write your name on the answer booklet so that the examiner does not know who you are.
- Spend two-and-a-half hours on question 2 and then try to answer the other nine questions in the last half-hour.

References and further reading

K. Crawford and A. Heaton, *Problem Solving in Analytical Chemistry*, Royal Society of Chemistry, London, 1998.

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Chapter 9: Doing the Right Thing

General

You are training to be a professional scientist. Amongst other things, professionals take responsibility for their own work and acknowledge the contributions of others. Table 58 and Table 59 are brief checklists to ensure that the demarcation between your work and that of others is clear. (Of course, being a professional also involves responsibilities to your employer, to your clients or patients, to society, to the profession and, most importantly, to yourself: these are not addressed in this Chapter.)

The Faculty of Science and Technology at Deakin University has adopted the following statement on the distinction between doing the right thing (ethical conduct) and doing the wrong thing (plagiarism and academic misconduct).[a] Other universities have similar statements.

Table 57. Faculty Statement on Plagiarism.

Plagiarism is a serious issue that can attract severe penalty for anyone who breeches the rules. Please note the following statement on plagiarism (approved by Faculty Board in 2001).

Plagiarism is the copying of another person's ideas or expressions without appropriate acknowledgment and presenting these ideas or forms of expression as your own. It includes not only written works such as books or journals but data or images that may be presented in tables, diagrams, designs, plans, photographs, film, music, formulae, web sites and computer programs. **Plagiarism also includes the use of (or passing off) the work of lecturers or other students as your own**.

The University regards plagiarism as an extremely serious academic offence. The penalties associated with plagiarism are severe and extend from cancelling all marks for the specific assessment item or for the entire unit through to exclusion from your course. These are detailed in Part 2 of Regulation 4.1 (1) Student Discipline.

Therefore, whenever you are including a reference to another person's research or ideas

[a] Adopted by Faculty Board in 2001.

(whether by direct quotation or by paraphrasing) you must appropriately cite the source of that reference. If you are ever in doubt about the most appropriate form of referencing, you should consult your lecturer.

Students should also be aware that there are laws in place to protect the ideas and expressions (ie the intellectual property) of individuals and/or groups and their right to be attributed as the authors of their work. These are known as “copyright” and “moral rights” and are included in the Copyright Act. Plagiarism offences may also be breaches of the Copyright Act and students may be subject to penalties independent of the University’s regulations and procedures.

Unauthorised collaboration is a related form of cheating. Unauthorised collaboration (including collusion) involves working with others with the intention of deceiving examiners about who actually completed the work. If there has been any collaboration in preparing individual assessment items, this must be disclosed. In the case of group project work, lecturers provide guidelines on what level of collaboration is appropriate and how the work of each participant in the project is to be presented. If you have any doubt about what constitutes authorised and unauthorised collaboration you should consult your lecturer.

Please be aware that if the Faculty Academic Progress and Discipline Committee finds a student has committed an act of academic misconduct (plagiarism and/or exam cheating) it may impose one or more of the following penalties:

- A reprimand;
- A fine not exceeding $500;
- Allocated a zero mark in the relevant task or such other mark as is appropriate;
- Allocate a zero mark in the relevant unit or such other mark as is appropriate;
- Allocate a zero mark in such other units in which the student is enrolled as the Faculty Academic Progress and University Discipline Committee may determine;
- Suspend the student for up to one year;
- Exclude the student for a minimum period of one year.

The following Tables are guides for producing ethical work. If each of the statements about your submitted work is true, then you are doing the Right Thing”. If you are unsure about any of the statements, then you are probably doing “the Wrong Thing” and need to change your work practices.

Table 58. A checklist for an individual to do the Right Thing.

- This report is my own work.
- I have acknowledged (ie referenced) any ideas that I have obtained through reading and talking to others.
- I have indicated where I have directly quoted from other sources.
- I have indicated where I have directly copied a diagram from other sources.
- Where appropriate, I have asked permission to quote passages or copy diagrams.
- I take full legal and moral responsibility for this report.

Table 59. A checklist for a team to do the Right Thing.

- This report is the work of my team.
- We have acknowledged (ie referenced) any ideas that we have obtained through reading and talking to others.
- We have indicated where we have directly quoted from other sources.
- We have indicated where we have directly copied a diagram from other sources.
- Where appropriate, we have asked permission to quote passages or copy diagrams.
- All team members have had the opportunity to see and approve the final version of this report.
- All team members take full legal and moral responsibility for this report.

Chapter 10: References and Reading List

The referencing style discussed in Chapter 4: Use of References in Chemistry, does not include the titles of journal articles, and uses abbreviated journal names. The following bibliography includes both the titles of journal articles and the full journal names for your information. (This additional information is required in the bibliographies of theses under the regulations of many universities.)

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Appendix A: The SI System of Units

The authoritative guide to the use of SI units in chemistry is the “Green Book” by Mills *et al.*[5] and summarised on the IUPAC website.[a]

Base SI units and physical quantities

A physical quantity is the product of a numerical value (a pure number) and a unit. Physical quantities are organized in a dimensional system built upon seven base quantities. The International System of Units (SI) is based on the seven base units having the same dimensions as the associated physical quantities. Their names and symbols are as follows:

Table 60. Base SI units

Base Physical Quantity	Symbol for Quantity	Name of SI Unit	Symbol for SI Unit
length	*l*	metre	m
mass	*m*	kilogram	kg
time	*t*	second	s
electric current	*I*	ampere	A
thermodynamic temperature	*T*	kelvin	K
amount of substance	*n*	mole	mol
luminous intensity	I_v	candela	cd

The symbol for a physical quantity is a single letter of the Latin or Greek alphabet printed in italic (sloping) type. It may be modified by subscripts and/or superscripts of specified meaning, or further characterized in particular cases through annotations in parentheses put directly behind the symbol. The symbol for a unit is printed in roman (upright) type. Neither symbol should be followed by a full stop (period). The physical quantity ‘amount of

[a] See Reference [5] and <http://iupac.chemsoc.org/reports/1993/homann/>. The summary tables have been reproduced here with permission from the International Union of Pure and Applied Chemistry (IUPAC).

substance' or 'chemical amount' is proportional to the number of elementary entities — specified by a chemical formula — of which the substance is composed. The proportionality factor is the reciprocal of the Avogadro constant L (6.022×10^{23} mol^{-1}).[b] The amount of substance should no longer be called 'number of moles'.

Table 61. Examples of relations between "amount of substance" and other physical quantities

2 moles of N_2 contain 12.044×10^{23} molecules of N_2, amount of N_2 = $n(N_2)$ = number of N_2 molecules / L (see note b);
1.5 moles of Hg_2Cl_2 have a mass of 708.13 g;
1 mole of photons with frequency 1014 Hz has an energy of 39.90 kJ;
1 mole of electrons, e^-, contains 6.022×10^{23} electrons, has a mass of 5.468×10^{-7} kg, and a charge of -96.49 kC.

[b] Many books (especially American texts) use the symbols N and N_A (instead of L) for the Avogadro constant (6.022×10^{23} mol^{-1}).

SI prefixes

Prefixes to form the names and symbols of the decimal multiples and submultiples of SI units.[c]

Table 62. SI prefixes

Multiple	Prefix	Symbol
10^{-24}	yocto	y
10^{-21}	zepto	z
10^{-18}	atto	a
10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	µ
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
10	deca	da
10^{2}	hecto	h
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T
10^{15}	peta	P
10^{18}	exa	E
10^{21}	zeta	Z
10^{24}	yotta	Y

[c] Decimal multiple and submultiples of the unit of mass are formed by attaching prefixes to gram, examples: mg, not µkg; Mg, not kkg.

SI derived units

Table 63. Examples of SI derived units with special names and symbols

Physical Quantity	Name of SI Unit	Symbol for SI Unit	Expression in Terms of SI Base Units	
frequency	hertz	Hz	s^{-1}	
force	newton	N	m kg s^{-2}	
pressure, stress	pascal	Pa	m^{-1} kg s^{-2} = N m^{-2}	
energy, work, heat	joule	J	m^2 kg s^{-2} = N m = Pa m^3	
power	watt	W	m^2 kg s^{-3} = J s^{-1}	
electric charge	coulomb	C	s A	
electric potential	volt	V	m^2 kg s^{-3} A^{-1} = J C^{-1}	
electric capacitance	farad	F	m^{-2} kg^{-1} s^4 A^2 = C V^{-1}	
electric resistance	ohm	Ω	m^2 kg s^{-3} A^{-2} = V A^{-1}	
electric conductance	siemens	S	m^{-2} kg^{-1} s^3 A^2 = $Ω^{-1}$	
magnetic flux	weber	Wb	m^2 kg s^{-2} A^{-1} = V s	
magnetic flux density	tesla	T	kg s^{-2} A^{-1} = V s m^{-2}	
inductance	henry	H	m^2 kg s^{-2} A^{-2} = V A^{-1} s	
Celsius temperature[d]	degree Celsius	℃	K	
plane angle	radian	rad	1	rad and sr may be included or omitted in expressions for the derived units
solid angle	steradian	sr	1	

[d] The Celsius temperature is defined by θ/°C = T/K – 273.15.

Units outside the SI units, but used with the SI units

Table 64. Units outside the SI units, but used with the SI units

Physical Quantity	Unit	Symbol for the Unit	Value in SI Units	SI Unit
time	minute	min	60	s
time	hour	h	3600	s
time	day	d	86 400	s
plane angle	degree	°	$(\pi / 180)$	rad
volume	litre	l, L	10^{-3}	m^3
mass	tonne	t	10^3	kg
length	angstrom	Å	10^{-10}	m
pressure	bar	bar	10^5	Pa
energy	electronvolt[e]	eV	1.60218×10^{-19}	J
mass	unified atomic mass unit[e]	u	$1.660\ 54 \times 10^{-27}$	kg

[e] These units are defined in terms of best value of certain physical constants.

Other Units

These units were used in older literature. They are given here for the purpose of identification and conversion to SI units.

Table 65. Other Units

Physical Quantity	Unit	Symbol for the Unit	Value in SI Units	SI Unit
force	dyne	dyn	10^{-5}	N
pressure	standard atmosphere	atm	101 325	Pa
pressure	torr (mmHg)	Torr	133.322	Pa
energy	erg	erg	10^{-7}	J
energy	thermochemical calorie	cal_{th}	4.184	J
magnetic flux density	gauss	G	10^{-74}	T
electric dipole moment	debye	D	$3.335\ 64 \times 10^{-30}$	C m
viscosity	poise	P	10^{-1}	$N\ s\ m^{-2}$
kinematic viscosity	stokes	St	10^{-4}	$m^2\ s^{-1}$

Appendix B: Non-Roman Alphabets

The correct use of special letters and symbols is required to convey meaning. Many of these special letters and symbols are similar to our (normal) Roman letters but the incorrect use of Roman letters will lead to confusion. For example, "**2 × 3**", means "two times three", but it is unclear if the writer intended the same for "**2 χ 3**" and "**2 x 3**", or if there is a typing mistake for "two times chi plus (or minus) three" or for "two times x plus (or minus) three".

This appendix lists some common non-Roman letters, and mathematical and scientific symbols.[a] In Microsoft Word, many of these can be found under the "**insert symbol** " menu option. The Macintosh keystroke and some PC keystrokes are also listed.

Table 66. Some mathematical and scientific symbols.

Name	Symbol	Macintosh keystroke	ANSI or ASCII code[b]
degrees	°	option + SHIFT+ 8	0176
Name	**Symbol**	**Macintosh keystroke in Symbol font**	**ANSI or ASCII code in Symbol font[b]**
infinity	∞	option + 8	0165
is proportional to		option + m	0181
multiplication sign	×	option + y	0180
resonance arrow	↔	option + shift + e	0171
reverse-reaction arrow	←	option + shift + u	0172
reaction arrow	→	option + shift + ‘	0174

[a] Professor Roy Jensen's website <http://web.uvic.ca/~royj> has more complete and systematic listings of special letters and symbols for PCs.

[b] For ANSI codes, the leading zero must be typed. If the leading zero is not typed, Windows interprets the code as an ASCII code. Hold down the ALT key, and type the3- or 4-digit code on the number pad (not the numbers on the top of the keyboard).

Table 66 continued. Some mathematical and scientific symbols.

Name	Symbol	Macintosh keystroke in Symbol font	ANSI or ASCII code in Symbol font[b]
if and only if	⇔	option + shift + 2	0219
is implied by		option + shift + 3	0220
implies		option + shift + 5	0222
one quarter	$^1/_4$	no Mac keystroke[c]	0188
one half	$^1/_2$	no Mac keystroke[c]	0189
three quarters	$^3/_4$	no Mac keystroke[c]	0190

Table 67. The Greek Alphabet.

Name	Lower case letter	Upper case letter	Keystroke in Symbol font
alpha	α	Α	a
beta	β	Β	b
gamma	γ	Γ	g
delta	δ	Δ	d
epsilon	ε	Ε	e
zeta	ζ	Ζ	z
eta	η	Η	h
theta	θ	Θ	q
iota	ι	Ι	I
kappa	κ	Κ	k

[c] There is no Macintosh keystroke for this symbol, but the same effect can be constructed using superscript and subscript numbers separated by a solidus (/). This superscript-subscript is recommended for PCs so that the electronic document will be transferable across platforms.

Table 67 continued. The Greek Alphabet.

Name	Lower case letter	Upper case letter	Keystroke in Symbol font
lambda	λ	Λ	l
mu	μ	M	m
nu	ν	N	n
xi	ξ	Ξ	x
omikron	ο	O	o
pi	π	Π	p
rho	ρ	P	r
sigma	σ	Σ	s
tau	τ	T	t
upsilon	υ	Υ	u
phi	φ	Φ	f
khi	χ	X	c
psi	ψ	Ψ	y
omega	ω	Ω	w

Table 68. Some other letters.

Name	Symbol	Macintosh keystroke in Symbol font	ANSI or ASCII code[d]
	å	option + a	0229, 134
	Å	option + shift + a	0197, 143
	ü	option + u, u	129
	Ü	option + u, shift + u	154
	ø	option + o	0248
	Ø	option + shift + o	0216
	é	option + e, e	0233
	É	option + e, shift + e	0201

“Charmap” instructions for PCs

These instructions will allow the copying-and-pasting of special characters on the **PC** using **Windows** into various programs.[e]

- Click **Start**, **Run**, and type **Charmap**. This will start the character map feature, which lists all of the characters available for a specific font;
- Choose a standard font like **Arial**, **Symbol** or **Times New Roman**;
- Make sure that the unicode characters are turned on (eg choose **Advanced View**, and then next to **Character set**, chose **Unicode**;
- Scroll down to the character that you want and select it. Copy-and-paste to your desired document.

[d] For ANSI codes, the leading zero must be typed. If the leading zero is not typed, Windows interprets the code as an ASCII code.

[e] The PC Charmap feature is explained by M. Horton of Perris High School, Perris, CA, USA (*Superscripts*, Chemistry Education Discussion List, 29 June 2002 <http://mailer.uwf.edu/Lists/wa.exe?A2=ind0206&L=chemed-l&D=1&F=&S=&P=22204>.)

“Key Caps” instructions for MacIntoshes

These instructions will allow the copying-and-pasting of special characters on the **Mac** using **Mac OS** into various programs.

- From the **Apple** menu, select **Key Caps**. This will start the character map feature, which lists all of the characters available for a specific font;
- Choose a standard font like **Arial**, **Helvetica**, **Symbol**, **Times** or **Times New Roman**;
- Select the character that you want and choose **insert**, or copy-and-paste to your desired document.

Appendix C: Some Hints on the Use of the Microsoft Word Program

General

Microsoft Word is a very widely used word-processing program. However, it has some rather annoying features. This Appendix provides a brief overview of how to customise the more-annoying features (which default to American usage and conventions) and to use Paragraph Styles for formatting your headings and paragraphs. This Appendix is extracted from notes prepared by Jenny Lee.[a]

Customising Microsoft Word

When it comes to preparing text to go into type, the recent versions of Microsoft Word are too clever for their own good. They have numerous 'helpful' features that do not translate into other programs, and some that can cause serious trouble. At the same time, they have a large number of useful features that are buried away in places where they aren't obvious to a casual user. I'm feeling kind, so I'll start with the useful features.

Customising the Spelling and Grammar Checks

Although there are times when I curse those wiggly green and red lines, they can save a lot of trouble. They are particularly useful for picking up difficult-to-detect errors such as spaces before commas, or missing spaces after full stops.

To activate the continuous grammar and spelling checks, open **Tools > Spelling > Options**. This pops up a menu that looks like the one below, from which you can select the options you want. These are my preferred settings. They give you alerts where you need them, but avoid alerting on a range of terms that are unlikely to be in the dictionary.

[a] These notes have been prepared by Jenny Lee as part of the course materials for the Bachelor of Arts — major sequence in Professional Writing, at Deakin University. Reproduced here with permission.

Figure 10. Recommended settings for the grammar and spelling checks in Microsoft Word.

There is, however a catch: Word, being an American program, tends to default to the US dictionary.

The quickest way of overcoming this for an individual document is to:

- Select the whole document (**Edit > Select All** from the drop-down menus; the keyboard shortcuts are **Command + A** on the Mac and **Control + A** in Windows);
- Go to **Tools > Language**. This will pop up a dialog box that looks something like the one below (this is the Mac version):

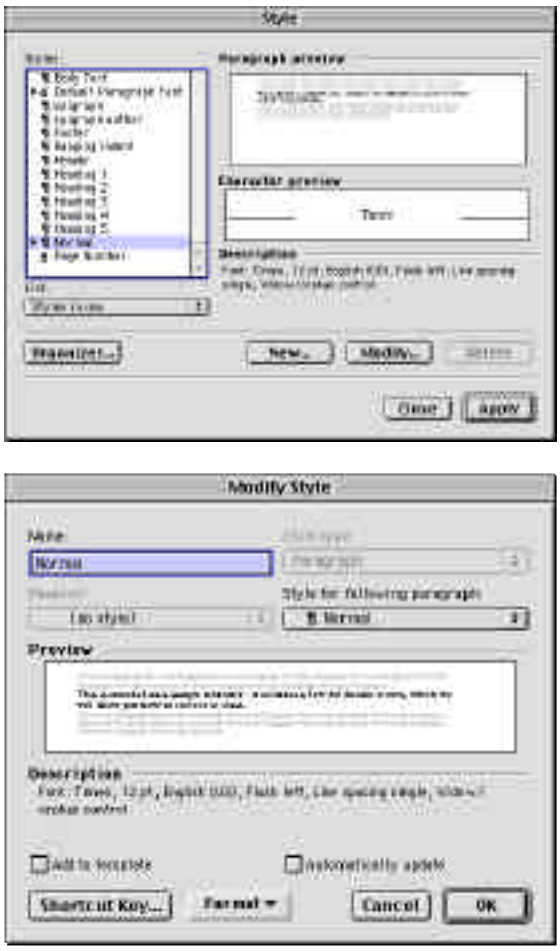
Figure 11. Recommended settings for the "language" for the specking dictionary in Microsoft Word.

Unfortunately, Microsoft thinks Australian English is US English with '-ise' endings, which is not at all helpful. Grit your teeth, select '**English (UK)**' and click on '**Default'**.

To stop your computer reverting to US English when you open a new document, though, you need to take more radical action.

Customising your dictionary in Normal style

Figure 12. Recommended settings for the "language" and spelling options for new (default) documents in Microsoft Word.



All Word files are based on document templates, which set the default characteristics of the font, page size and dictionary. They can be distinguished from ordinary Word files by their suffix, which is **.dot** rather than **.doc**. The default template is called 'normal.dot'; this is the template that opens when you request a blank document. If you were working on your home machines, I'd recommend going into the Normal template and fixing up all its irritating

features at once, but the most we can do in the labs is to fix up a document that you can then email to yourself and save as a template.

Your first step is to make sure that the 'Normal' style uses the right dictionary. You can do this by going into **Format > Style**. This will throw up a dialog box that looks like the one in the upper panel of **Figure 12**.

To set English (UK) as the default, select '**Normal'** in the left-hand box and click on '**Modify'**. This then opens a new dialog box (lower panel of **Figure 12**). Somewhat counter-intuitively, the language lives under '**Format'**. If you click on the arrow to the right of '**Format'**, it will drop down '**Language'** among a range of other options. Open it and select '**English (UK)**'.

At this point, it might be tempting to change the font in Normal, which usually defaults to Times (an ugly typeface, and not terribly legible on screen). Unfortunately, Times is one of only three typefaces that are completely portable across the Windows–Macintosh divide; the others are **Arial** and **Courier** (the old typewriter face).[b] If you find Times truly unreadable, you can increase the type size by selecting **Format > Font** and taking it up to a bigger point size. Or, if you want to replace it, use one of the other two. (You can do various things to change your documents out of Times while you're working on them, as we'll see later.)

Page format and headers

There are a few other useful things that you can do while you're in your document:

- **Change the default page size**: Word defaults to US Letter, which is not *quite* the same as A4. To correct this, go **File > Page Setup** and change the size to A4.
- **Add page numbers to your headers** by opening **View > Header and Footer** and clicking on the # sign; this will insert your page number, and you can tab across to place it where you want it.
- **Remove unwanted Autocorrect features**: This needs a section on its own (see below).

After you've made all these changes, use '**Save as'** to save the document. Make sure it is saving back into your home directory, not onto the desktop.

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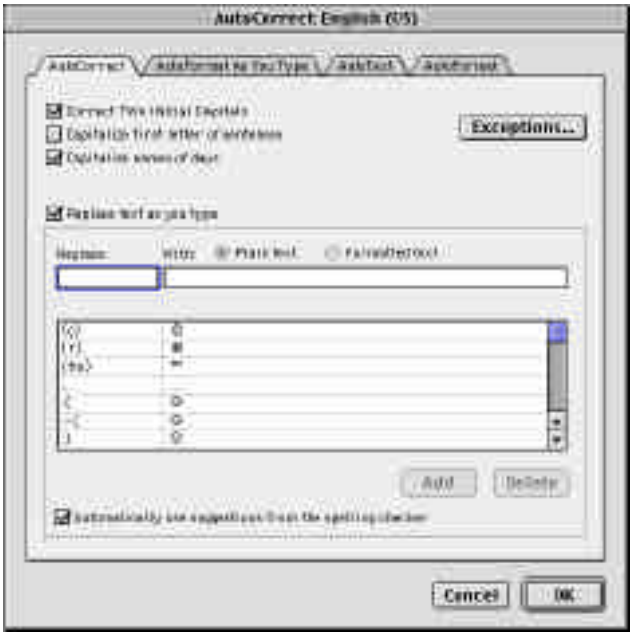
[b] See the discussion about **Fonts** on page 20, and Reference [6].

Customising Autocorrect

The Autocorrect feature is a classic example of Word being too clever by half. It has a wide range of interfering habits, some of which can be disastrous when files are moved from one platform or program to another. The main problem is that it automatically generates fancy characters and formats that don't translate well. If you're editing a scholarly book, for example, and you use the feature that turns Internet addresses into hyperlinks, the hyperlinks are likely to drop out in transit; in one book I was editing, this left me with 162 footnotes containing the message '**ERROR: File not found**'. The automatic bulleting on lists doesn't translate, either.

Figure 13. Recommended settings for the "AutoCorrect" options in Microsoft Word.



Autocorrect is on the Tools menu. To disable unwanted functions, open the **Autocorrect** dialog box, which looks like the one in **Figure 13**. These are my preferred settings. '**Replace text as you type'** is worth a look, just so that you know what is going on in there. For example, you may not want to generate the ellipsis character (…) automatically. But remember that anything you change in the Normal style will apply to any other documents based on it, so it's best not to try anything too flash.

Figure 14. Recommended settings for the "AutoFormat" options in Microsoft Word.

The tabs at the top of the **AutoCorrect** dialog box open three more dialog boxes, and you need to make changes here too. Let's start with '**Autoformat as you type**' (**Figure 14**): As you can see, my preference is to turn virtually all of these features off. The automatic bulleted lists, superscripts and hyperlinks are particularly irritating.

The next tab, '**Autotext**', opens up another set of functions (see **Figure 15**). I turn these off as well by unchecking the top box ('**Show AutoComplete tip**').

Now to the final dialog box (see Figure 16). Again, you can get rid of all the entries apart from '**smart quotes**' and '**Preserve Styles**'.

Figure 15. Recommended settings for the "AutoText" options in Microsoft Word.

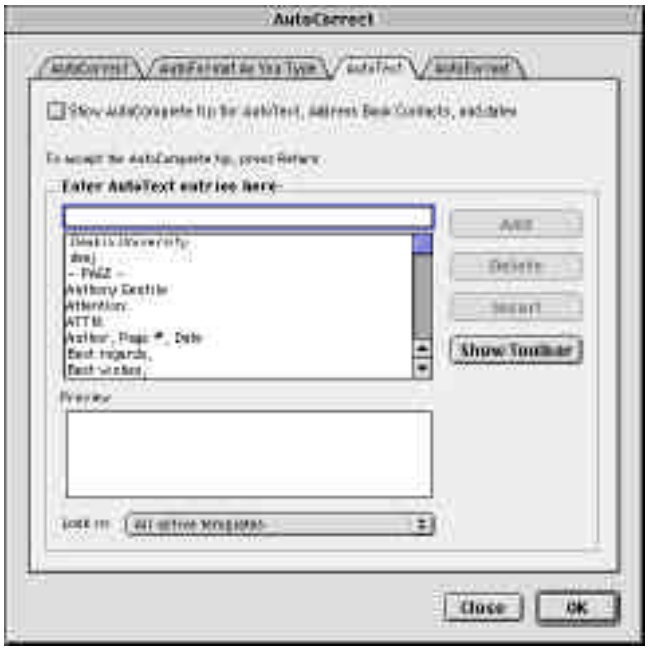


Figure 16. Recommended settings for the "AutoFormat" options in Microsoft Word.

More about spellcheck options

Let's go back into **Tools > Spelling and Grammar > Options**.

Figure 17. Varying the level of formality of the writing style in Microsoft Word.

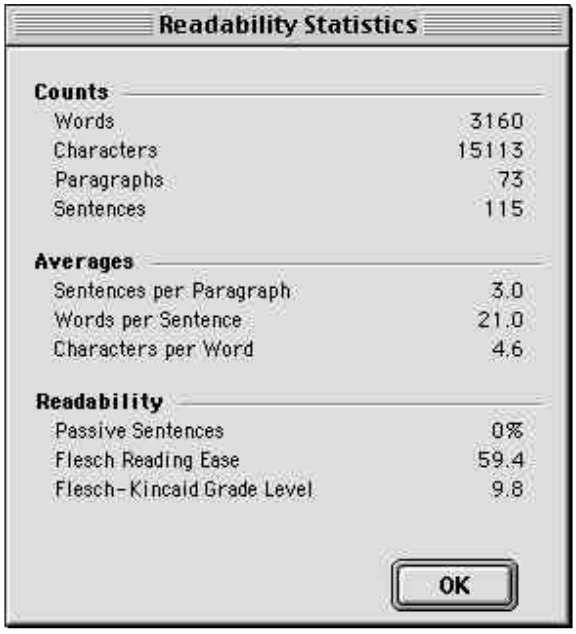
Note that you can set the level of formality of the writing style by changing the setting in the relevant box (**Figure 10** and **Figure 17**, near the bottom). The options range from '**casual**' through '**standard**' to '**formal**' and '**technical**'.

One of the most useful features of the spellcheck for editing, though, is the '**Show Readability Statistics**' option.

Readability statistics

The readability statistics supplied by Word give a blunt-axe measure of the educational level of your assumed audience. Once you have turned this feature on, the statistics will appear after you complete your spellcheck.

Figure 18. Readability statistics in Microsoft Word.



I remain slightly sceptical of these measurements, as they don't indicate anything about the quality of the writing. They're mainly sensitive to sentence and word length. I'm sure you could produce complete gobbledegook that would get a big tick. On the other hand, if you take them with a grain of salt, they at least tell you if you are in the right ball-park.

The information appears in a box like the one in **Figure 18**. The crucial figures here are the last two. Both are based on sentence and word length, but they process it arithmetically in different ways.

The **Flesch-Kincaid Grade Level** is a guesstimate of the audience's US school grade level. The **Flesch Reading Ease** score is basically a mark out of 100. Standard documents for adults are expected to be in the 60–70 per cent range. (I typed in 'The cat sat on the mat', and it gave a score of 100. Then I typed in 'The projector is not correctly set up because the lens has been cross-threaded, the retro-wiring is faulty and the cartridge has a crack in it; we suggest that you rectify these faults at your earliest convenience and notify the purchasers in writing when the required action has been completed.' That got a score of 25.8; seems logical.)

If you turn the readability statistics option on before you start editing, it will give you some idea of the magnitude of the task facing you. (It also makes a good bargaining chip if an author is getting insistent about his or her stylistic peculiarities.) If you record the starting

figure and cross-check it against the rating when you have finished editing, you will also get some idea of what effect your editing is having on the readability of the document.

Devising Text Styles

When you are setting up documents for publishing, whether as writer or editor, a crucial part of the process is devising text styles that produce the typographical effects you want with as little manual intervention as possible. There are several reasons for doing this:

- **Ease of text preparation**: If writers are careful about the way they design their styles, the styles will follow each other automatically in the correct sequence in the most common operations without the writer's having to style each paragraph.

- **Standardisation**: If you use styles to set formats, you don't have to cast back to remember how you formatted a particular kind of body text, or a heading of a particular weight. Even if you change your mind about how you want the text formatted, redefining the style in one context will change all the corresponding parts of the text. This eliminates a major source of confusion and inconsistency.

- **Portability**: Manual formatting can cause serious problems if you want to take your text through to a desktop publishing system, as the formatting commands can override the designer's styles. But if the text is styled automatically, the designer only has to change the attributes of your styles so that they match the corresponding styles in the text design.

- **Access to reference tools**: In the later versions of Word, the program records the headings and shows them when you slide the sidebar, which makes it easier to move around your document. Headings can also be used to prepare tables of contents automatically, or to display a document map (which you get to through **View—>Document Map**).

Devising Styles

The first step is to look for regularities in the formatting of the document and decide which need separate styles assigned to them. Some tips:

- It's more important that the styles be readily distinguishable than that they look pretty. You might even want to assign different typefaces to different styles, for example, to make sure that you don't mistake them for one another.

- For similar reasons, keep your style names descriptive.

- There's no point setting up a whole new style for a kind of text that only occurs once in a work; in these cases, it's best to flag the passage and pass specific instructions on to the designer.

In plain text, devising styles is pretty simple – a couple of heading styles, a style for normal body text with a first-line indent, one for your 'full out' paragraphs under headings and quotes, and maybe an indented quote style or a hanging indent for bullet points. But what if you strike an MS with about a thousand entries that look like this?

Figure 19. An example of text requiring customised paragraph styles in Microsoft Word.

Charmaine's Ice Cream

Fitzroy 370 Brunswick Street **9417 5379** Melway 2C B6
Mon–Wed 4 p.m.–11 p.m.; Thurs–Fri 11 a.m.–11 p.m.; Sat–Sun 10 a.m.–11 p.m.

St Kilda 69 Fitzroy Street **9534 2540** Melway 57 K9
Mon–Thurs noon–9 p.m.; Fri–Sat noon–midnight; Sun noon–10 p.m.

Southgate Shop G24 Lower Level **9699 4172** Melway 2F F7
Mon–Thurs 10 a.m.–late; Fri–Sun 10 a.m.–11 p.m. (may close earlier in winter)

With three fabulous locations, Charmaine's range of ice-creams is now within reach of almost everyone. There are always 24 on display, and new flavours battle for space with old favourites. The chocolate & chilli ice-cream is always a conversation point; then there are recent arrivals such as pistachio and gingerbread ice-cream. Opening hours at the Fitzroy and Southgate stores depend on the weather: the hotter the evening, the later they open.

Here, you're obviously going to have to work out a way of dealing with those locations and opening times so that they are spaced out correctly, and you don't want to use a full line break, which will waste space. My solution was a dedicated style for each – an 'address' style with no space after the line, and an 'hours' style with a half-line space built in – with the defaults set up so that the styles would come out in the right sequence when anyone composed a simple entry. Well, that was the theory, anyway.

Similar problems arise with highly stylised forms of text such as recipes, entries in manuals and so on. All these require a bit of ingenuity.

Reformatting standard styles in Word

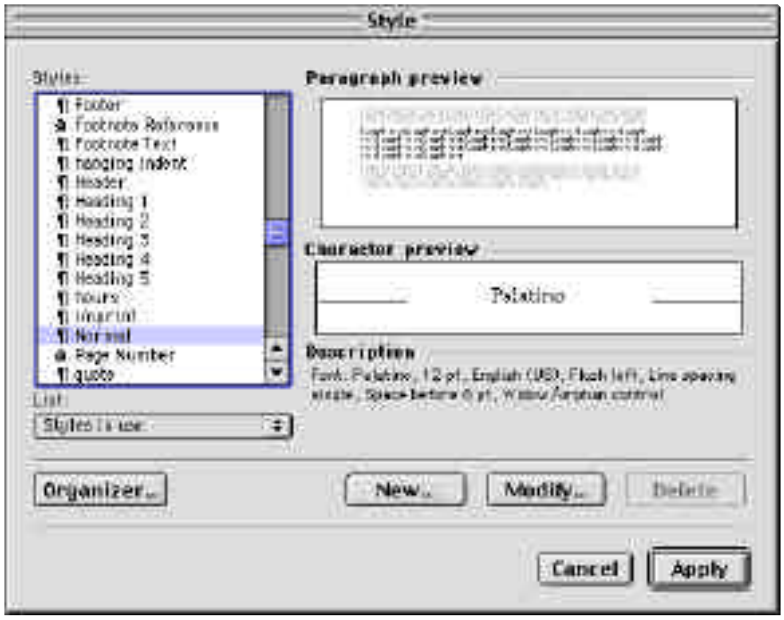
The recent versions of Word come with a large number of ready-made styles, and you can customise them to suit your own requirements.

You can see the range of styles in the default style sheet by clicking on the arrow beside the 'style' box in the formatting toolbar (or the formatting palette in Mac Word 2001). (If you can't see the toolbar or palette, go to **View —> Toolbar —> Formatting** (Word for Windows, Word 98 for Mac) or **View —> Formatting Palette** (Word 2001 for Mac). If you are in a new document and haven't already specified a style, the word 'Normal' will probably be showing in the style box.

To change the style of your current paragraph, you can simply scroll down to the style you want in that box: when you release the mouse button, the selected style will be applied.

To reformat styles, go to **Format —> Style.** This will throw up a dialog box that looks like this:

Figure 20. The paragraph styles dialog box in Microsoft Word.

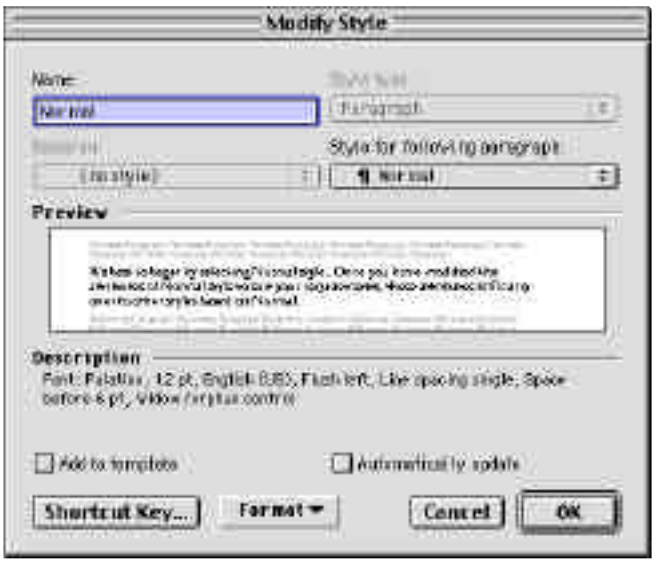


It's best to begin by selecting Normal style. Once you have modified the attributes of Normal style to suit your requirements, these attributes will carry over to other styles based on Normal.

Select **Normal** in the list of styles on the left-hand side of the dialog box. The bottom part of the screen will now display the attributes of Normal style — font, point size, spacing between paragraphs and tabs, if any.

With the Format Style box still open, select **Modify.** This throws up a new dialog box, which looks like this:

Figure 21. Modifying the paragraph styles in Microsoft Word.



You can now reset the attributes of Normal style. For example, if you want to change font, select **Format —> Font** from the bottom command line.

Select the base font and character size that you wish to use, then click OK. This will return you to the Modify Style box.

Similarly, **Format —> Paragraph** on the bottom command line will allow you to set indents and spacing between paragraphs. This is also the time to select your preferred line justification and line spacing options for ordinary text. For work on the screen, it's a good idea to use single line spacing, because it means you can see more of the text at once. You can always increase the spacing before printing out your final copy.

Format —> Language is where you can check that your dictionary is set to English (UK).

When all this is done, click **OK**. This will take you back to the Format Style dialog box. You can now begin defining new styles or modifying styles based on Normal.

Devising new styles

This process is very similar to redefining existing styles. To start, go to **Format —> Style —> New**. This will throw up a new dialog box, highlighting the box where the name of your new style is to go. Type in the name you wish to use.

To get the style into the right ball park, it's a good idea to go to the '**Based on**' box and select a style that's got some resemblance to the style you want to create. For the main body text styles it will be Normal, but once you have defined a few of your own styles, you can base the more esoteric styles on styles that already have most of the characteristics of the new style you want.

For example, the style for epigraphs, which are indented on both sides, is very similar to that for quotes, which are only indented on the left. So, if you select '**quote**' in the '**Based on**' box, you will only have to impose a right indent to have your style ready-made.

You can now go to the '**format**' menu inside the dialog box and start modifying the attributes of the style – font, paragraph attributes, tabs, language and so on.

Note: Format —> Paragraph has a second set of attributes hidden behind it, which you might want to use when you are defining specific styles other than 'Normal'. These are the controls on line and page breaks. You might, for example, want to make sure a page break is inserted before every chapter heading, or click 'Keep with next' to make sure that a subheading will never fall right at the bottom of the page.

Once you've set up a style to your satisfaction, click **OK** in the Modify box. This will return you to the main Format Style box, where you can start on another style, select 'Apply' to apply the style to the current paragraph, or click 'Close' to exit the format style box without applying the style.

Style sequences

In '**Modify style**' or '**New style**', the **Style for following paragraph** box allows you to set things up so that after you've typed in a paragraph in one style, the next paragraph automatically defaults into the style most commonly used in that context. For example, from the headings, you might want to default into '**body full out**', or from '**body full out**' into '**body text**'. If you do not specify a style in this box, the program will default to making the next paragraph the same style as the one you are already in.

Setting the style defaults doesn't help much when you're editing an existing text, but it helps to streamline composition when you're writing.

You can save yourself some back-tracking by thinking carefully about the order in which you define your new styles. For example, it's best to define your '**body text**' style before '**body full out**'; that way you can immediately set '**body text**' as the default for the next paragraph in '**body full out**'. And you should define '**body full out**' before you go into defining your heading styles, as they will almost invariably default to '**body full out**' for the next paragraph.

Turning off 'Automatically update style'

Check to make sure that the '**automatically update style**' box just above the '**Format**' box is NOT ticked. If it's ticked, the machine will update the style whenever you reformat a paragraph, and your style sheet will become totally unstable. This is a case of Microsoft getting too darn clever for anyone's good.

Keyboard shortcuts

Once the attributes of a style are set up, you can assign a shortcut key to the style. This is worth doing if you are going to be using the style repeatedly. It's best to hold down the 'control' or 'option' key and strike two easily remembered letters – for example, 'B, F' for body full out, or 'B, T' for body text. Make sure that you're not overwriting a different command shortcut that you might need more often.

Adding styles to templates

You may or may not wish to add the style to a general template; this depends on how often you're likely to use it. It's best to avoid having a build-up of rarely used styles on your templates. If you do want to add a style, tick the little box labelled '**Add to Template**' on the far left of the '**New Style**' or '**Modify Style**' box.

You can set up a variety of templates for different kinds of documents. In Word 2001 for Mac, Microsoft, helpful as ever, offers a range of standard templates in the Project Gallery at the top of the **File** menu.

You can also edit templates by opening them up through the '**Open**' command rather than through '**Project Gallery**'. They live on the hard disk under Office, but it can take a while to find them.

If you wish to save a set of styles as a new template, delete all the text you don't want in the document, then go to **Save as —> Format —> Document template. Make sure you give the template a descriptive name that will make it easy to identify next time.**

Word will default to adding the template to the 'My Templates' folder, which means it will be available to you when you set up a new file. In WinWord and early versions of Word for the Mac, you can select templates through the **File —> New** command; in Word 2001 for the Mac, go to **Project Gallery —> My Templates**.

Watch your file names when saving documents based on templates; the template will often want to default to saving under an irrelevant file name. Also, if you're saving an ordinary document, check that the file extension is .doc, not .dot; .dot indicates that it is still in template format.

Simplifying style sheets

You can inherit extremely complicated style sheets with documents if they come from an author's machine.

To attach your own style sheet to a document, you can go to **Tools —> Templates and Add-ins —> Attach**. This will show a list of templates, both your own and the ones in the project gallery. Select the template you want, tick 'Automatically update document styles' and then click OK. This will attach your template and override the existing styles.

Appendix D: Use of the EndNote Program

General

The EndNote Program will prepare a list of references for a piece of written work from a database library of references.[a] This Appendix only provides a brief review of **how to enter information into the database**: full details can be found in the documentation for the EndNote Program.

Authors

The family name of each author must be spelt out in full. First names can either be spelt out or initialised. EndNote will normally assume that the last name is the family name. Alternatively, family names can be listed first, and then a comma followed by the first names or initials.

Table 69. Examples of unambiguous names.

Brown, T.C.	King, Keith D.	Mudjijono[b]
R.G. Gilbert	Allan E.K. Lim	

Where possible ambiguities exist the family name must be listed first, then a comma followed by the first names or initials, and if required, a second comma followed by “Junior”, “Senior”, etc. Other examples of unambiguous family names are “double-barrelled” or “triple-barrelled” names, often involving “de” “den”, “di”, “le”, “van”, “von”, etc.

[a] See **Chapter 4: Use of References in Chemistry**.

[b] In some cultures (eg Indonesian culture), many individuals only have a single name, without any separate “first” or “family” names.

Table 70. Examples of names with possible ambiguities.		
Balint-Kurti, G.G.	Del Bene, J.E.	van den Besten, Jacinta
Bauschlicher, C.W., Jnr.	Schaefer, Henry Fritz, III	van Kampen, N.G.

Titles of journal articles

Some journals capitalise the first letter of all major words in the titles of articles. This should be resisted. For consistency, “sentence-capitalisation” should be used for all titles of articles. The full-stop (or “period”) at the end of the title should **not** be entered.

Table 71. Examples of titles of journal articles.

Amine oxidation. Part XI. Oxidation of some substituted tertiary alkylamines and some *N*,*N*-dimethylphenethylamines with potassium hexacyanoferrate(III)

Book Review: *Chemical Kinetics and Dynamics* by J.I. Steinfeld, J.S. Francisco, and W.L. Hase

Die berechung von molekulgeometrien gespannter konjugierter kohlenwasserstoffe

Quasiclassical trajectory study of collisional energy transfer in toluene systems. II. Helium bath gas: energy and temperature dependences, and angular momentum transfer

Mixed-metal cluster chemistry. Site-selective reactions of $CpWIr_3(CO)_{11}$ with PPh_3 and bidentate phosphines: X-ray crystal structures of $CpWIr_3(\mu\text{-dppe})(\mu\text{-CO})_3(CO)_6$, $CpWIr_3(\mu\text{-dppm})(\mu\text{-CO})_3(CO)_6$ and $CpWIr_3(\mu\text{-dppa})(\mu\text{-CO})_3(CO)_6$

Page numbers for journal articles

The first page number of a journal article must always be entered. A range of page numbers indicating the first and last pages is preferred, where the number of the last page must be given in full.

Table 72. Examples of page numbers.		
Correct		**Incorrect**
47243		47243-93
3541-3545	preferred	3541-5

Titles of books

The first letter of all major words in the titles of books should be capitalised. The titles should not be italicised in the database. Sub-titles **may** use “sentence-capitalisation”. Formatting of the book title (use of quotation marks or italisation) will be performed automatically by the EndNote Program when compiling the reference list. The full-stop (or “period”) at the end of the title should **not** be entered.

Table 73. Examples of book titles.
Chemometrics in Analytical Spectroscopy
Molecular Spectra and Molecular Structure. II. Infrared and Raman Spectra of Polyatomic Molecules
NMR in Chemistry: A multinuclear introduction
S.I. Chemical Data
Surface Organometallic Chemistry: Molecular Approaches to Surface Catalysis

Keywords

The “keyword” entry will not be used to prepare any list of references. However, keywords can be used to search the database when looking for citation or reference. Some journals provide a list of keywords separated by a solidus (/). The use of the solidus is discouraged as it may cause confusion.

Table 74. Use of the solidus may cause confusion.

radical / radical reaction	two separate keyword terms being “radical” and “radical reaction”
radical/radical reaction	a reaction between two radicals

Table 75. Some possible but less-obvious keywords.

journal	this should be used whenever the name of the journal does not include the word “journal”, eg: *Organometallics*, *Pure and Applied Chemistry*
graduate text	
undergraduate text	
review	
conference	this should be used whenever the name of the conference does not include the word “conference”, eg: “Annual Research and Development Topics”, “International Symposium on Gas Kinetics”

Use “terms” lists

The **terms list** feature enables you to construct lists of commonly used terms and/or names.

Table 76. You should use these “terms” lists.

Author	You should collect a list of commonly cited authors. Use of this list will minimise misspellings.
Journal	This “list” consists of a table linking: • the full journal name; • one possible abbreviation (eg Royal Society of Chemistry abbreviations[c]); and • a second possible abbreviation (eg the *Chemical Abstracts* abbreviations). Entries from this Journal list (table) can be substituted for the journal name when the bibliography is formatted. Hence a **styles** option can select the full journal name, when formatting for a CV, or the Royal Society of Chemistry abbreviations can be used for submission to RSC journals, or the *Chemical Abstracts* abbreviations can be used for submission to American Chemistry Society journals.
Keywords	This list ensures that a consistent set of keywords is used.

[c] See the Appendix “Appendix H: Abbreviations of Journal Names“.

Appendix E: The "Vancouver style" of referencing for biomedical journals

Introduction

The use of the "Vancouver style" of referencing is required in over 500 Biomedical and Biochemical journals. In 1979, the Vancouver Group first published its requirements for manuscripts submitted to biomedical journals. The fifth edition of those requirements,[21] printed in 1997 and updated in 1999 and 2000,[22] is an attempt to reword and reorganize the previous edition to increase clarity and address concerns about rights, privacy, descriptions of methods, and other matters. A major revision is scheduled for 2001. The remainder of this Appendix is an extract[a] from the May 2000 revision.[22]

References

References should be numbered consecutively in the order in which they are first mentioned in the text. Identify references in text, tables, and legends by Arabic numerals in parentheses. References cited only in tables or figure legends should be numbered in accordance with the sequence established by the first identification in the text of the particular table or figure.

Use the style of the examples below, which are based on the formats used by the National Library of Medicine (NLM) in *Index Medicus.* The titles of journals should be abbreviated according to the style used in *Index Medicus.* Consult the *List of Journals Indexed* in *Index Medicus,* published annually as a separate publication by the library and as a list in the January issue of *Index Medicus.* The list can also be obtained through the library's web site (http://www.nlm.nih.gov).

Avoid using abstracts as references. References to papers accepted but not yet published should be designated as "in press" or "forthcoming"; authors should obtain written permission to cite such papers as well as verification that they have been accepted for publication. Information from manuscripts submitted but not accepted should be cited in the text as "unpublished observations" with written permission from the source.

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[a] The extract is reproduced here under a general permission from the International Committee of Medical Journal Editors (ICMJE) to distribute the material for educational, not-for-profit purposes.

Avoid citing a “personal communication” unless it provides essential information not available from a public source, in which case the name of the person and date of communication should be cited in parentheses in the text. For scientific articles, authors should obtain written permission and confirmation of accuracy from the source of a personal communication.

The references must be verified by the author(s) against the original documents.

The Uniform Requirements style (the Vancouver style) is based largely on an ANSI standard style adapted by the NLM for its databases. Notes have been added where Vancouver style differs from the style now used by NLM.

Articles in Journals

1. Standard journal article

List the first six authors followed by et al.

(Note: NLM now lists up through 25 authors; if there are more than 25 authors, NLM lists the first 24, then the last author, then et al.)

- Vega KJ, Pina I, Krevsky B. Heart transplantation is associated with an increased risk for pancreatobiliary disease. Ann Intern Med 1996 Jun 1;124 (11):980-3.[b]

As an option, if a journal carries continuous pagination throughout a volume (as many medical journals do) the month and issue number may be omitted.

(Note: For consistency, the option is used throughout the examples in Uniform Requirements. NLM does not use the option.)

- Vega KJ, Pina I, Krevsky B. Heart transplantation is associated with an increased risk for pancreatobiliary disease. Ann Intern Med 1996;124:980-3.[b]

More than six authors:

- Parkin DM, Clayton D, Black RJ, Masuyer E, Friedl HP, Ivanov E, et al. Childhood leukaemia in Europe after Chernobyl: 5 year follow-up. Br J Cancer 1996;73:1006-12.[b]

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[b] This NLM-approved practise can lead to confusion about ranges of page numbers. The authors recommend that the full page number be used: ie 980-983, instead of 980-3.

2. Organization as author

- The Cardiac Society of Australia and New Zealand. Clinical exercise stress testing. Safety and performance guidelines. Med J Aust 1996; 164: 282-4.[b]

3. No author given

- Cancer in South Africa [editorial]. S Afr Med J 1994;84:15.

4. Article not in English

(Note: NLM translates the title to English, encloses the translation in square brackets, and adds an abbreviated language designator.)

- Ryder TE, Haukeland EA, Solhaug JH. Bilateral infrapatellar seneruptur hostidligere frisk kvinne. Tidsskr Nor Laegeforen 1996;116:41-2.[b]

5. Volume with supplement

- Shen HM, Zhang QF. Risk assessment of nickel carcinogenicity and occupational lung cancer. Environ Health Perspect 1994;102 Suppl 1:275-82.[b]

6. Issue with supplement

- Payne DK, Sullivan MD, Massie MJ. Women's psychological reactions to breast cancer. Semin Oncol 1996;23(1 Suppl 2):89-97.

7. Volume with part

- Ozben T, Nacitarhan S, Tuncer N. Plasma and urine sialic acid in non-insulin dependent diabetes mellitus. Ann Clin Biochem 1995;32(Pt 3):303-6.[b]

8. Issue with part

- Poole GH, Mills SM. One hundred consecutive cases of flap lacerations of the leg in ageing patients. N Z Med J 1994;107(986 Pt 1):377-8.[b]

9. Issue with no volume

- Turan I, Wredmark T, Fellander-Tsai L. Arthroscopic ankle arthrodesis in rheumatoid arthritis. Clin Orthop 1995;(320):110-4.[b]

10. No issue or volume

- Browell DA, Lennard TW. Immunologic status of the cancer patient and the effects of blood transfusion on antitumor responses. Curr Opin Gen Surg 1993:325-33.[b]

11. Pagination in Roman numerals

- Fisher GA, Sikic BI. Drug resistance in clinical oncology and hematology. Introduction. Hematol Oncol Clin North Am 1995 Apr;9(2):xi-xii.

12. Type of article indicated as needed

- Enzensberger W, Fischer PA. Metronome in Parkinson's disease [letter]. Lancet 1996;347:1337. Clement J, De Bock R. Hematological complications of hantavirus nephropathy (HVN) [abstract]. Kidney Int 1992;42:1285.

13. Article containing retraction

- Garey CE, Schwarzman AL, Rise ML, Seyfried TN. Ceruloplasmin gene defect associated with epilepsy in EL mice [retraction of Garey CE, Schwarzman AL, Rise ML, Seyfried TN. In: Nat Genet 1994;6:426-31]. Nat Genet 1995;11:104.

14. Article retracted

- Liou GI, Wang M, Matragoon S. Precocious IRBP gene expression during mouse development [retracted in Invest Ophthalmol Vis Sci 1994;35:3127]. Invest Ophthalmol Vis Sci 1994;35:1083-8.[b]

15. Article with published erratum

- Hamlin JA, Kahn AM. Herniography in symptomatic patients following inguinal hernia repair [published erratum appears in West J Med 1995;162:278]. West J Med 1995;162:28-31.[b]

Books and Other Monographs

(Note: Previous Vancouver style incorrectly had a comma rather than a semicolon between the publisher and the date.)

16. Personal author(s)

- Ringsven MK, Bond D. Gerontology and leadership skills for nurses. 2nd ed. Albany (NY): Delmar Publishers; 1996.

17. Editor(s), compiler(s) as author

- Norman IJ, Redfern SJ, editors. Mental health care for elderly people. New York: Churchill Livingstone; 1996.

18. Organization as author and publisher

- Institute of Medicine (US). Looking at the future of the Medicaid program. Washington: The Institute; 1992.

19. Chapter in a book

(Note: Previous Vancouver style had a colon rather than a p before pagination.)

- Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, editors. Hypertension: pathophysiology, diagnosis, and management. 2nd ed. New York: Raven Press; 1995. p. 465-78.[b]

20. Conference proceedings

- Kimura J, Shibasaki H, editors. Recent advances in clinical neurophysiology. Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology; 1995 Oct 15-19; Kyoto, Japan. Amsterdam: Elsevier; 1996.

21. Conference paper

- Bengtsson S, Solheim BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sep 6-10; Geneva, Switzerland. Amsterdam: North-Holland; 1992. p. 1561-5.[b]

22. Scientific or technical report

Issued by funding/sponsoring agency:

- Smith P, Golladay K. Payment for durable medical equipment billed during skilled nursing facility stays. Final report. Dallas (TX): Dept. of Health and Human Services (US), Office of Evaluation and Inspections; 1994 Oct. Report No.: HHSIGOEI69200860.

Issued by performing agency:

- Field MJ, Tranquada RE, Feasley JC, editors. Health services research: work force and educational issues. Washington: National Academy Press; 1995. Contract No.: AHCPR282942008. Sponsored by the Agency for Health Care Policy and Research.

23. Dissertation

- Kaplan SJ. Post-hospital home health care: the elderly's access and utilization [dissertation]. St. Louis (MO): Washington Univ.; 1995.

24. Patent

- Larsen CE, Trip R, Johnson CR, inventors; Novoste Corporation, assignee. Methods for procedures related to the electrophysiology of the heart. US patent 5,529,067. 1995 Jun 25.

Other Published Material

25. Newspaper article

- Lee G. Hospitalizations tied to ozone pollution: study estimates 50,000 admissions annually. The Washington Post 1996 Jun 21;Sect. A:3 (col. 5).

26. Audiovisual material

- HIV+/AIDS: the facts and the future [videocassette]. St. Louis (MO): Mosby-Year Book; 1995.

27. Legal material

Public law:

- Preventive Health Amendments of 1993, Pub. L. No. 103-183, 107 Stat. 2226 (Dec. 14, 1993).

Unenacted bill:

- Medical Records Confidentiality Act of 1995, S. 1360, 104th Cong., 1st Sess. (1995).

Code of Federal Regulations:

- Informed Consent, 42 C.F.R. Sect. 441.257 (1995).

Hearing:

- Increased Drug Abuse: the Impact on the Nation's Emergency Rooms: Hearings Before the Subcomm. on Human Resources and Intergovernmental Relations of the House Comm. on Government Operations, 103rd Cong., 1st Sess. (May 26, 1993).

28. Map

- North Carolina. Tuberculosis rates per 100,000 population, 1990 [demographic map]. Raleigh: North Carolina Dept. of Environment, Health, and Natural Resources, Div. of Epidemiology; 1991.

29. Book of the Bible

- The Holy Bible. King James version. Grand Rapids (MI): Zondervan Publishing House; 1995. Ruth 3:1-18.

30. Dictionary and similar references

- Stedman's medical dictionary. 26th ed. Baltimore: Williams & Wilkins; 1995. Apraxia; p. 119-20.

31. Classical material

- The Winter's Tale: act 5, scene 1, lines 13-16. The complete works of William Shakespeare. London: Rex; 1973.

Unpublished Material

32. In press

(Note: NLM prefers “forthcoming” because not all [submitted] items will be printed.)

- Leshner AI. Molecular mechanisms of cocaine addiction. N Engl J Med. In press 1996.

Electronic Material

33. Journal article in electronic format

- Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis [serial online] 1995 Jan-Mar [cited 1996 Jun 5];1(1):[24 screens]. Available from: URL: http://www.cdc.gov/ncidod/EID/eid.htm

34. Monograph in electronic format

- CDI, clinical dermatology illustrated [monograph on CD-ROM]. Reeves JRT, Maibach H. CMEA Multimedia Group, producers. 2nd ed. Version 2.0. San Diego: CMEA; 1995.

35. Computer file

- Hemodynamics III: the ups and downs of hemodynamics [computer program]. Version 2.2. Orlando (FL): Computerized Educational Systems; 1993.

Appendix F: Detailed Examples of Different Parts of Reports

The "Method" Section

The "Method" section should contain essential information for a competent scientist to redo your experiment and to reproduce your results. All essential information must be included, while all unncessary details should be omitted.

A synthetic chemistry example

Table 77 gives an example of a "Method" section taken from a report on the synthesis of 2-chloro-2-methylpropane (*tert*-butyl chloride).

Table 77. Example of a "Method" section taken from a report on the synthesis of 2-chloro-2-methylpropane (*tert*-butyl chloride).

A mixture of *t*-butanol (19.874 g, 0.268 mol) and conc. hydrochloric acid (68 mL, 10 M) was shaken in a separating funnel for 20 minutes with occassional relief of pressure.

The lower aqueous layer was removed. The organic layer was washed with saturated sodium hydrogencarbonate and water, dried ($CaCl_2$) and distilled to yield 2-chloro-2-methylpropane (*t*-butyl chloride) as a colourless liquid (9.142 g, 36.9% yield, bp 46-47°C).

Notice the following points about what has been omitted from or included in the sample "Method" section in Table 77:

- Although the laboratory procedure stated "approximately 20 g", the actual amount of reagent, which is used, is reported;[a]

[a] The report is not the same as the laboratory procedure. They are distinct documents, serving different purposes. It is wrong to copy the laboratory procedure into the laboratory report.

- The brand(s), size(s) and shape(s) of glassware can be deduced from the reported the amounts and reagents that have been used: unncessary details have been omitted;
- Use of a separating funnel and distillation are standard procedures: unncessary details have been omitted;
- Although relieving any build-up of pressure from the separating funnel is standard procedure, its inclusion is a a useful reminder about safety in the laboratory;
- The IUPAC-preferred name “sodium hydrogencarbonate” has been used instead of “sodium bicarbonate” or “baking soda”;
- Both the IUPAC-preferred name “2-chloro-2-methylpropane” and the older common name “*t*-butyl chloride” has been given for the convenience of the reader;
- The physical description of the product is useful information as is the boiling-point range of the collected product (it is slightly less than the literature value of 51°C);
- The entire “Method” section has consistent use of past-tense verbs: it is reporting *what has been done* (in the past).

A physical chemistry (kinetics) example

Table 78 gives an example of a “Method” section taken from a report on a kinetics study of the very low-pressure pyrolysis of acetyl chloride.

Table 78. Example of a “Method” section taken from a report on a kinetics study of the very low-pressure pyrolysis of acetyl chloride.

Acetyl chloride (Merck, analytic grade) was throughly degassed (three freeze-pump-thaw cycles) and vacuum distilled bulb-to-bulb. The method of very low-pressure pyrolysis (VLPP) and the details of the VLPP reactor has been described in detail in the literature,[1,2] but a brief summary is given here for the convenience of the reader.

The basic experimental apparatus consists of a continuous-flow reactor. The reactor pressures are kept sufficiently low that only gas/wall collisions are significiant and exit of molecules from the reactor vessel occurs through effusion rather than diffusion. The reactor is a cylindical quartz-walled chamber with a volume of 160.2 mL. The flow of gases into the reactor is controlled by a micrometer valve to give flow rates within the range 10^{14}-10^{17} molecules s^{-1}. The flow rates at the lower end of the range were used in this study. The reactor vessel is housed inside a thermostated furnance and operates under

steady-state flow: the pressure in the reactor is calculated from the flow rate. The reactor system is pumped by high-speed vacuum pumps to maintain a background pressure of *ca.* 10^{-6}-10^{-5} Pa. An ion vacuum guage monitors this background pressure. Reactant and product gases effuse into the ionisation chamber of a quadrupole mass spectrometer for direct analysis.

In view of the possible heterogeneity of the acetyl chloride reaction,[3] the quartz walls of the reactor were coated by passing CH_3CH_2Br (May and Baker) through the system at 1100 K. This renewed the carbon coating on the reactor walls to minimise wall catalysis.[4] Independence of the observed reaction rate coefficients on the exit aperature size and flow rate, verified that the reaction is unimolecular and occurs essentially in the gas phase.[1]

The overall decomposition of acetyl chloride over the temperature range 670-1220 K was monitored by its major fragment CH_3CO^+ mass spectral peak at *m/e* = 43 using CO_2 (*m/e* = 44) as an internal standard.

1 D. M. Golden, G. N. Spokes and S. W. Benson, *Angew. Chem. Int. Ed.*, 1973, **12**, 534.

2 K. D. King and R. D. Goddard, *Int. J. Chem. Kinet.*, 1975, **7**, 109.

3 V. R. Stimson and J. W. Tilley, *Aust. J. Chem.*, 1977, **30**, 81.

4 D. M. Golden, L. W. Piszkiewicz, M. J. Perona and P. C. Beadle, *J. Am. Chem. Soc.*, 1974, **96**, 1645.

Notice the following points about what has been omitted from or included in the sample "Method" section in Table 78:

- The very low-pressure pyrolysis (VLPP) is a specialised technique which may not be familiar to all readers, hence a brief description is given. A diagram (not shown here) would also be helpful;
- The brands and other details of the equipment have been reported previously in the cited references: they are omitted from this report;
- The sources of the reagents, acetyl chloride and bromoethane are specific to this study and are included in the report.

- The second paragraph is written in the present tense because it is a general description of an *existing* VLPP reactor: the details were true at the time of the experiment and continue to be true at the time of reporting (ie the present). However the past tense is used for the sentence on the flow rates (“the lower end of the range ”) which were specific to the reported study (which occurred in the past).

Reports about computational chemistry

Reports about computational chemistry procedures and results follow the same principles as reports about “wet chemistry”:

> *All essential information, required by a competent scientist to reproduce your results, must be included, while all unncessary details should be omitted.*

IUPAC has prepared lists of the information which should be included in a report about computational chemistry procedures and results.[b]

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[b] References [32-34]: J. E. Boggs, *Pure Appl. Chem.*, 1998, **70** (4), 1015-1018 <http://www.iupac.org/reports/1998/7004boggs/guidelinesa4.pdf>;
D. J. Raber and W. C. Guida, *Pure Appl. Chem.*, 1998, **70** (10), 2047-2049 <http://www.iupac.org/reports/1998/7010raber/>;
J. J. P. Stewart, *Pure Appl. Chem.*, 2000, **72** (8), 1405-1575 <http://www.iupac.org/publications/pac/2000/7208/7208pdfs/7208stewart_1449.pdf>.

Table 79. Example of a "Method" section taken from a computational chemistry report on a series of conjugated molecules.

The geometries and energies of ethylene, 2*E*-butadiene and 2*Z*-butadiene and 2*E*,3*E*-pentadienyl radical were calculated using Gaussian 98,[1] at the HF/6-31G* level of theory. UHF/6-31G* was used for 2*E*,3*E*-pentadienyl radical. In addition, single-point calculations were performed for all three molecules at the CCSD level of theory. Pictorial representations of the LUMOs and HOMOs at (U)HF/3-21G* level of theory were prepared using Spartan.[2]

1 M. J. Frisch, G. W. Trucks, H. B. Schlegel, G. E. Scuseria, M. A. Robb, J. R. Cheeseman, V. G. Zakrzewski, J. A. Montgomery, R. E. Stratmann, J. C. Burant, S. Dapprich, J. M. Millam, A. D. Daniels, K. N. Kudin, M. C. Strain, O. Farkas, J. Tomasi, V. Barone, M. Cossi, R. Cammi, B. Mennucci, C. Pomelli, C. Adamo, S. Clifford, J. Ochterski, G. A. Petersson, P. Y. Ayala, Q. Cui, K. Morokuma, D. K. Malick, A. D. Rabuck, K. Raghavachari, J. B. Foresman, J. Cioslowski, J. V. Ortiz, A. G. Baboul, B. B. Stefanov, G. Liu, A. Liashenko, P. Piskorz, I. Komaromi, R. Gomperts, R. L. Martin, D. J. Fox, T. Keith, M. A. Al-Laham, C. Y. Peng, A. Nanayakkara, C. Gonzalez, M. Challacombe, P. M. W. Gill, B. G. Johnson, W. Chen, M. W. Wong, J. L. Andres, C. Gonzalez, M. Head-Gordon, E. S. Replogle and J. A. Pople, Gaussian 98 (Revision A.7), Pittsburgh PA, 1998. Program is available from Gaussian, Inc.

2 Spartan (4.0), Irvine, CA. Program is available from Wavefunction, Inc.,18401 Von Karman Ave., Ste. 370, Irvine, CA 92612 U.S.A <http://www.wavefun.com>.

Notice the following points about what has been omitted from or included in the sample "Method" section in Table 79:

- Many types of quantum calculations are now considered to be "standard methods" and no details are included in the description;
- The use of standard acronyms is common practice in many areas of chemistry. You should consult textbooks and other resources for the names and meaning of the terminology. Good resources for computational chemistry include References [33-35].

Figure Captions or Titles

Captions or titles should have suffient information to explain the diagram. Simple figures can have simple captions, but more complicated figures require more details in the caption: see Table 80.

Table 80. Examples of figure captions or titles, taken from recent journal articles.

The apparatus used for the luminol demonstration.

Percentage of bachelor degree graduates in full-time employment of those available for full-time employment, 1982-2001.

Triplet and singlet states of O_2.

Spectrum of liquid oxygen.

(I) Substituted urea, (II) diacetyl monoxime, (III) diacetyl, (IV, V, VI) postulated products for the reaction of diacetyl with urea and its derivatives in acidic conditions.

The dendrimers of Moore and Newkome invoke images of snowflakes and trees. Moore uses an AB_2 monomer at the branching group (*), while Newkome uses an AB_3 monomer. Both dendrimers are G2 dendrimers.

(a, top) ^{13}C NMR spectrum of $Cp_2W_2Ir_2(\mu\text{-}CO)_3(CO)_6(PPh_3)$ (**2**) in $CDFCl_2$ at 153 K at 125.7 MHz. (b, bottom) Variable-temperature ^{13}C NMR spectroscopic study of $Cp_2W_2Ir_2(\mu\text{-}CO)_3(CO)_6(PPh_3)$ (**2**) in CD_2Cl_2 at 75.4 MHz.

General view (SHELXTL-PLUS) of a molecule of **2** showing 30% probability displacement ellipsoids and the atom numbering. (Symmetry transformations used to generate equivalent atoms: a = -x + 1, -y + 1, -z).

Contour maps of the electron density of (a) SCl_2 and (b) H_2O. The density increases from the outermost 0.001 au isodensity contour in steps of 2×10^n, 4×10^n, and 8×10^n au with n starting at -3 and increasing in steps of unity. The lines connecting the nuclei are the bond paths, and the lines delimiting each atom are the intersection of the respective interatomic surface with the plane of the drawing. The same values for the contours apply to subsequent contour plots in this paper.

Table Captions or Titles

Captions or titles should be informative. The caption must explain what information is presented in the table. Table 81 lists qexamples of table captions from recent journal articles.

Table 81. Examples of table captions or titles, taken from recent journal articles.

Intermolecular van der Waals radii (r_{ij}^{VDW} / nm).

Some luminol chemiluminescence reactions.

Selected flow analysis methodology for the determination of urea — direct procedures.

Crystal data and structure refinement for **2** and **5**.

Selected bond lengths [Å] and angles [deg] for $H_3SiOSiH_3^-$ derived from electron diffraction and PM3 and HF/LANL2MB geometry optimizations.

Breakdown of bachelor degree graduates available for full-time employment, by field of study, 2001 (%).

Application and areas of inquiry in dendrimer science.

A comparison of calculated and experimental entropy values.

Cross tabulation of percentage of students who have knowledge about Web addresses (URLs) and general Web usage.

Appendix G: Reliability of WWW Reference Materials

Reliability of Web Resources

Search engines such as *Alta Vista*, *Google* and others can find a lot of information on the World Wide Web. Almost anyone with access to an *Internet Service Provider* (ISP) can put "information" on the WWW. How do we know what information is, or is not, reliable?

Evaluating the information that you find (Note [a])

So you have found a site or document that seems to be useful? How reliable is that information likely to be? Just because it's on the 'net does not mean it's correct or reliable. It helps to know who wrote or created that information and what institution they represent. If no one is willing to put their name to the document, it arouses suspicion. On the other hand, if an official government agency or accredited education institution publishes information and clearly labels it as an official publication, then it is likely to be more reliable.

The ideal situation is when a document carries an author, affiliation, and a date. For example, go to
<http://www.wam.umd.edu/~toh/NetscapeHandout.html>.
This page is clearly labeled. Moreover, it contains, at the bottom, hyperlinks to the author's personal home page, to his email address, and to the "mother" document (the document in the next higher level of the organizational structure of related documents, which in this case turns out to be a list of similar tutorial handouts).

Other usually reliable pages are official educational (.edu or .edu.au or similar) government (.gov or .gov.au or similar) sites.

In contrast, go to
<http://www.members.shaw.ca/nomalathionplease/info.htm>,
which is a page found by running a search for "malathion pesticide". You can see why the

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[a] Information here in the sub-sections "Evaluating the information that you find" and "A simple test for reliability of a web resource" has been inspired by and adapted from References [36,37]: T. C. O'Haver, Towson University, *Chemical Informatics: How to find it on the 'net* <http://www.towson.edu/csme/mctp/Courses/PhysicalScience/Chem122Spring96/Informatics.html>, 1996 (accessed 24 June 2003); M. Horton, Perris High School (Perris, CA), *Website Analysis Form* <http://mysite.verizon.net/res6pa7x/WebsiteAnalysisForm.doc>, c.2003 (accessed 20 November 2003). Used with permission of the authors.

search engine hit on this page, but you can't tell anything about who created it or when, or who they work for.

Table 82. Examples of domain names can be a guide to reliability of information

Normally reliable sites		Normally sites which may or may not be reliable	
These sites are owned and controlled by government or quasi-government agencies, scientific organisations, schools or universities.		Note that some commerical or organisational sites are highly reliable, but others are not. These sites need to be evaluated on a case-by-case basis.	
acs.org	iupac.org	.club	.ltd
edu	law	.com	.name
edu.au	mil	.family	.org
gov	raci.org	.info	
gov.au	rsc.org		
The above lists are very imcomplete: they are intended only as a guide.			

A simple test for reliability of a web resource

What can you do in the case of an “anonymous” web page? Here is a simple method to learn something about the source of the information in such cases. It is based on the structure of the address: each segment of the address separated by a slash (/) represents a directory in the file system of the host computer (the same as the nested folders on Macintosh and Windows computers). The idea is to "move up" the directory structure, by sequentially deleting each segment of the address, starting with the last (right-most) segment. For example:

1. Go up to the Location field at the top of the Netscape window (if there is none, select Show Location from the Options menu).
2. Edit the address there by selecting and deleting the last part of the address (info.htm). That is, drag the mouse over info.htm and press the delete key. This leaves
   http://www.members.shaw.ca/nomalathionplease/
   in the location field.

3. Press the RETURN key. This activates the truncated address, which will take you either to the "index" page for that directory or a listing of files in that directory (including the document you were just viewing).

4. Keep on deleting the next segment of the address. When you get to
http://www.members.shaw.ca/
you have arrived at the "root" directory, from which you can *usually* tell something about the host organization.

In searching this set of pages and exploring the related pages, notice that you are unable find a specific person or registered organisation who claims responsibility for the information. **If no one is willing to accept responsibility for the information, it is probably unreliable.**

Table 83. A checklist to help decide if a website is (or is not) reliable

What extension does the website have? ❑ .com ❑ .net ❑ .org ❑ .mil ❑ .gov ❑ .edu or ❑ other extension? What does that extension tell you about the website?

What is the complete URL? Are there any words in the URL that suggest a target audience (i.e. college, school, kids) What do the words tell you about the website?

Who owns the website? What might that tell you about the information on the website?

Who is the author of the webpage? What are his/her credentials? What might this tell you about the content of the website? How many?

Area there any money-making strategies or commercial advertisements on the website? Does the website offer to sell you anything? What might this tell you about the content of the website?

Do the author or the owner of the website have any reason to lie or try to deceive you? What might this tell you about the content of the website?

Are there any references on the website? Check the references. Did the author leave anything out or misinterpret anything? What might this tell you about the content of the website?

When was the site created? How many times has it been visited? What might this tell you about the content of the website?

Are there any errors on the page (i.e. information, spelling, pictures, etc.) What might this tell you about the content of the website?

Does the author list an email address or other contact information?

Overall, how reliable would you consider this information to be? ❑ Extremely biased ❑ Some honest mistakes ❑ Incomplete ❑ Good, but not expert ❑ Extremely expert?

Adapted from a checklist by M. Horton, Perris High School, Perris, CA.[b] Used with permission of the author.

[b] M. Horton, Perris High School (Perris, CA), *Website Analysis Form* <http://mysite.verizon.net/res6pa7x/Website%20AnalysisForm.doc>, c.2003 (accessed 20 November 2003). Used with permission of the author.

You get what you pay for

Some internet serice providers (ISPs) give a valuable service by giving free Internet access to people who can not otherwise afford it. However, the information on Web sites hosted by these free (and some commercial) ISPs is extremely dubious and should be regarded as **unreliable**, as there is no mechanism for ensuring the quality and reliability of the information.

Table 84. Examples of domain names which are usually unreliable sources of information

aol.com	iname.com
earthlink.net	juno.com
excite.com	mindspring.com
go.com	myself.com
groovenation.net	usa.net
hotmail.com	yahoo.com

Recall that the primary purpose of these sites is to provide a service to their users. Any information provision is a minor purpose and hence the rule is “user beware”. Some of the information on these sites are very valuable, but it is very difficult separating the good from the bad.

Appendix H: Abbreviations of Journal Names

Journal names should be abbreviated in a systematic and consistent manner. Abbreviations should follow the system found in *Chemical Abstracts*, or by the flagship journals of the major chemistry professional organisations, eg the American Chemical Society's the *Journal of the American Chemical Society* or the Royal Society of Chemistry's *Journal of the Chemical Society*. The following list of abbreviations of journal names is adapted from the document *Journal Abbreviations*.[a]

Note that the document *Journal Abbreviations*[35] should be used with care. For example, the Royal Society of Chemistry journal *The Analyst* , is listed in *Journal Abbreviations*[35] as "*Analyst* (Cambridge, U. K.)" instead of "*Analyst*".

Abbreviated journal name	**Full journal name (incomplete listing)**
Acc. Chem. Res.	Accounts of Chemical Research
Acta Acad. Abo, Ser. B	
Acta Biochim. Biophys. Acad. Sci. Hung.	
Acta Biochim. Iran.	
Acta Biochim. Pol.	Acta Biochimica Polonica
Acta Chem. Scand., Ser. A	Acta Chemica Scandinavica, Series A
Acta Chem. Scand., Ser. B	Acta Chemica Scandinavica, Series B
Acta Chim. Acad. Sci. Hung.	
Acta Crystallogr., Sect. A	Acta Crystallographica, Section A: Foundations of Crystallography
Acta Crystallogr., Sect. B	Acta Crystallographica, Section B: Structural Science
Acta Crystallogr., Sect. C	Acta Crystallographica, Section C: Crystal Structure Communications

[a] Reference [35]: Royal Society of Chemistry, *Journal Abbreviations*, <http://www.rsc.org/is/journals/authrefs/jabbr.htm>, (accessed 3 November 2001) is based on information from the Chemical Abstracts Service (CAS) of the American Chemical Society (ACS). The abbreviations are reproduced here with permission from the Royal Society of Chemistry, the Chemical Abstracts Service and the American Chemical Society.

Abbreviated journal name	Full journal name (incomplete listing)
Acta Metall.	
Acta Phys. Acad. Sci. Hung.	
Acta Phys. Chem.	
Acta Vitaminol. Enzymol.	
Adv. Act. Anal.	
Adv. Alicyclic Chem.	
Adv. Anal. Chem. Instrumen.	
Adv. ACS Abstr.	Advance ACS Abstracts
Adv. At. Mol. Opt. Phys.	Advances in Atomic, Molecular and Optical Physics
Adv. Carbohydr. Chem. Biochem.	Advances in Carbohydrate Chemistry and Biochemistry
Adv. Catal.	Advances in Catalysis
Adv. Chem. Kinet. Dynamics	Advances in Chemical Kinetics and Dynamics
Adv. Chem. Phys.	Advances in Chemical Physics
Adv. Chromatogr.	Advances in Chromatography
Adv. Colloid Interface Sci.	Advances in Colloid and Interface Science
Adv. Enzymol. Relat. Areas Mol. Biol.	Advances in Enzymology and Related Areas of Molecular Biology
Adv. Free Radical Chem.	Advances in Free Radical Chemistry
Adv. Heterocycl. Chem.	Advances in Heterocyclic Chemistry
Adv. Inorg. Bioinorg. Mech.	
Adv. Inorg. Chem. Radiochem.	
Adv. Lipid Res.	Advances in Lipid Research
Adv. Macromol. Chem.	Advances in Macromolecular Chemistry
Adv. Magn. Reson.	
Adv. Molten Salt Chem.	
Adv. Org. Chem.	Advances in Organic Chemistry
Adv. Organomet. Chem.	Advances in Organometallic Chemistry
Adv. Photochem.	Advances in Photochemistry

Abbreviated journal name	Full journal name (incomplete listing)
Adv. Phys. Chem.	Advances in Physical Chemistry
Adv. Phys. Org. Chem.	Advances in Physical Organic Chemistry
Adv. Protein Chem.	Advances in Protein Chemistry
Adv. Quantum Chem.	Advances in Quantum Chemistry
Adv. Struct. Res. Diffr. Methods	
Afinidad	Afinidad
Agric. Biol. Chem.	
Agrokem. Talajtan	Agrokemia es Talajtan
AIChE J.	AIChE Journal
Akad. Nauk SSSR	
Am. J. Distance Educ.	American Journal of Distance Education
Am. J. Pharm.	
Am. J. Phys.	American Journal of Physics
Am. J. Sci.	American Journal of Science
Am. Lab.	American Laboratory
Ambix	Ambix
An. Acad. Bras. Cienc.	Anais da Academia Brasileira de Ciencias
An. Bromatol.	Anales de Bromatologia
Anal. Bioanal. Chem.	Analytical and Bioanalytical Chemistry
Anal. Biochem.	Analytical Biochemistry
Anal. Chem.	Analytical Chemistry
Anal. Chim. Acta	Analytica Chimica Acta
Anal. Commun.	Analytical Communications
Anal. Instrum.	Analytical Instrumentation
Anal. Lett.	Analytical Letters
Anal. Proc.	Analytical Proceedings

Abbreviated journal name	Full journal name (incomplete listing)
Anal. Sci.	Analytical Sciences
Analusis	Analusis
Analyst	The Analyst (See note [b])
Angew. Chem.	Angewandte Chemie
Angew. Chem., Int. Ed. Engl.	Angewandte Chemie, International Edition in English
Angew. Makromol. Chem.	Angewandte Makromolekulare Chemie
Ann. Acad. Sci. Fenn., Ser. A2	
Ann. Chim. (Paris)	Annales de Chimie (Paris)
Ann. Chim. (Rome)	Annali di Chimica (Rome)
Ann. Chim. Phys.	Annales de Chimie et de Physique
Ann. Endocrinol.	
Ann. N.Y. Acad. Sci.	Annals of the New York Academy of Science
Ann. Operations Res.	Annals of Operations Research
Ann. Pharm. Fr.	Annales Pharmaceutiques Francaises
Ann. Phys. (N.Y.)	Annals of Physics (New York)
Ann. Phys., Series 9	Annales de Physique, Series 9
Ann. Soc. Sci. Bruxelles, Ser. 2	
Ann. Univ. Mariae Curie Sklodowska, Sect. AA	
Annu. Rep. Anal. At. Spectrosc.	
Annu. Rep. Chem. Soc.	Annual Reports of the Chemical Society
Annu. Rep. Med. Chem.	Annual Reports in Medicinal Chemistry
Annu. Rep. N.M.R. Spectrosc.	
Annu. Rep. Prog. Chem., Sect. A, Inorg. Chem.	Annual Reports on the Progress of Chemistry, Section A: Inorganic Chemistry

[b] *The Analyst* (ISSN 0003-2654) refers to the journal published by the Royal Society of Chemistry. There may be lesser-known journals of the same or similar name.

Abbreviated journal name	Full journal name (incomplete listing)
Annu. Rep. Prog. Chem., Sect. B, Org. Chem.	Annual Reports on the Progress of Chemistry, Section B: Organic Chemistry
Annu. Rep. Prog. Chem., Sect. C, Phys. Chem.	Annual Reports on the Progress of Chemistry, Section C: Physical Chemistry
Annu. Rev. Biochem.	Annual Review of Biochemistry
Annu. Rev. Ind. Eng. Chem.	
Annu. Rev. Phys. Chem.	Annual Review of Physical Chemistry
Appl. Optics	Applied Optics
Appl. Phys.	Applied Physics
Appl. Spectrosc.	Applied Spectroscopy
Arch. Pharm. (Weinheim, Ger.)	Archiv der Pharmazie (Weinheim, Germany)
Arch. Pharm. Chemi, Sci. Ed.	
Arm. Khim. Zh.	Armyanskii Khimicheskii Zhurnal
Arzneim. Forsch.	Arzneimittel-Forschung
Aspects Homogeneous Catal.	
Astron. J.	Astronomical Journal
At. Absorbt. Newsl.	
Aust. J. Biol. Sci.	
Aust. J. Chem.	Australian Journal of Chemistry
Aust. J. Educ. Chem.	Australian Journal of Education in Chemistry
Aust. J. Educ. Tech.	Australian Journal of Educational Technology
Aust. J. Phys.	Australian Journal of Physics
Azerb. Khim. Zh.	Azerbaidzhanskii Khimicheskii Zhurnal
Ber. Bunsenges. Phys. Chem.	Berichte der Bunsengesellschaft für Physikalische Chemie
Biochem. Biophys. Res. Commun.	Biochemical and Biophysical Research Communications
Biochem. Educ.	Biochemical Education
Biochem. J.	Biochemical Journal
Biochem. Pharmacol.	Biochemical Pharmacology

Abbreviated journal name	Full journal name (incomplete listing)
Biochem. Prep.	
Biochem. Soc. Trans.	Biochemical Society Transactions
Biochemistry	Biochemistry
Biochemistry (Eng. Transl.)	Biochemistry (English Translation)
Biochim. Biophys. Acta	Biochimica et Biophysica Acta
Biochimie	Biochimie
Bioconjugate Chem.	Bioconjugate Chemistry
Biofizika	Biofizika
Bioinorg. Chem.	
Biokhimiya	Biokhimiya (Moscow)
Bioorg. Chem.	Bioorganic Chemistry
Bioorg. Khim.	Bioorganicheskaya Khimiya
Biopolymers	Biopolymers
Biotechnol. Bioeng.	Biotechnology and Bioengineering
Biotechnol. Prog.	Biotechnology Progress
Bochu Kagaku	
Boll. Soc. Ital. Biol. Sper.	Bollettino - Societa Italiana di Biologia Sperimentale
Br. Corros. J.	British Corrosion Journal
Br. J. Pharmacol.	British Journal of Pharmacology
Br. Polym. J.	
Bul. Inst. Politeh. Iasi.	
Bull. Acad. Sci. USSR, Div. Chem. Sci.	
Bull. Chem. Soc. Jpn.	Bulletin of the Chemical Society of Japan
Bull. Inst. Chem. Res., Kyoto Univ.	
Bull. Pol. Acad. Sci., Chem.	Bulletin of the Polish Academy of Sciences, Chemistry
Bull. Sci., Cons. Acad. Sci. Arts RSF Yougosl., Sect. A	

Abbreviated journal name	Full journal name (incomplete listing)
Bull. Soc. Chim. Belg.	Bulletin des Societes Chimiques Belges
Bull. Soc. Chim. Fr.	Bulletin de la Societe Chimique de France
Bunseki Kagaku	Bunseki Kagaku
C.R. Acad. Sci., Sér. II Méc. Phys. Chim. Astron.	Comptes Rendus de l'Académie des Sciences. Série II, Mécanique, Physique, Chimie, Astronomie
C.R. Hebd. Séances Acad. Sci.	Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences
C.R. Hebd. Séances Acad. Sci. C. Sci. Chim.	Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences. Série C, Sciences Chimiques
C.R. Séances Acad. Sci., Sér. C, Sci. Chim.	Comptes Rendus des Séances de l'Académie des Sciences. Série C, Sciences Chimiques
C.R. Seances Soc. Biol. Ses Fil.	
Can. Chem. News	Canadian Chemical News
Can. J. Biochem.	Canadian Journal of Biochemistry
Can. J. Chem.	Canadian Journal of Chemistry
Can. J. Chem. Eng.	Canadian Journal of Chemical Engineering
Can. J. Pharm. Sci.	
Can. J. Phys.	Canadian Journal of Physics
Can. J. Spectrosc.	
Carbohydr. Res.	Carbohydrate Research
Carbon	Carbon
Catal. Rev.	
Cellul. Chem. Technol.	
Cereal Chem.	Cereal Chemistry
Cesk. Farm.	Ceskoslovenska Farmacie
Chelates Anal. Chem.	
Chem. Age (London)	
Chem. Anal. (Warsaw)	Chemia Analityczna (Warsaw)

Abbreviated journal name	Full journal name (incomplete listing)
Chem. Aust.	Chemistry in Australia
Chem. Ber.	Chemie Berichte
Chem. Br.	Chemistry in Britian
Chem. Chron.	Chemika Chronika
Chem. Commun.	Chemical Communications
Chem. Econ. Eng. Rev.	
Chem. Educ. Res. Pract. Eur.	Chemistry Education: Research and Practice in Europe
Chem. Eng. (Rugby, Engl.)	Chemical Engineer (Rugby, England)
Chem. Eng. Commun.	Chemical Engineering Communications
Chem. Eng. J. (Lausanne)	Chemical Engineering Journal (Lausanne)
Chem. Eng. News	Chemical and Engineering News
Chem. Eng. Progr.	Chemical Engineering Progress
Chem. Eng. Sci.	Chemical Engineering Science
Chem. Erde	Chemie der Erde
Chem. Health Saf.	Chemical Health and Safety
Chem. Heterocycl. Compd. (Engl. Transl.)	
Chem. Ind. (Duesseldorf)	Chemische Industrie (Duesseldorf)
Chem. Ind. (London)	Chemistry & Industry (London)
Chem. Ind. Int. (Engl. Transl.)	
Chem. Ing. Tech.	
Chem. Int.	Chemistry International
Chem. Listy	Chemicke Listy
Chem. Mater.	Chemistry of Materials
ChemNZ	ChemNZ

Abbreviated journal name	Full journal name (incomplete listing)	
Chem. N.Z.	Chemistry in New Zealand	(see note [c])
Chem. Nat. Compd. (Engl. Transl.)		
Chem. Pharm. Bull.	Chemical and Pharmaceutical Bulletin	
Chem. Phys.	Chemical Physics	
Chem. Phys. Carbon	Chemistry and Physics of Carbon	
Chem. Phys. Lett.	Chemical Physics Letters	
Chem. Phys. Lipids	Chemistry and Physics of Lipids	
Chem. Prum.	Chemicky Prumysl	
Chem. Res. Toxicol.	Chemical Research in Toxicology	
Chem. Rev.	Chemical Reviews	(See note [d])
Chemistry Review	Chemistry Review	(See note [e])
Chem. Scr.		
Chem. Soc. Rev.	Chemical Society Reviews	
Chem. Stosow.		
CHEMTECH	CHEMTECH	
Chem. Tech. (Leipzig)	Chemische Technik (Leipzig)	
Chem. Technol.		
Chem. Week	Chemical Week	
Chem. Weekbl.		
Chem. Ztg.		
Chem. Zvesti		
Chemeda: Aust. J. Chem. Educ.	Chemeda: Australian Journal of Chemical Education	

[c] *ChemNZ* (ISSN 0111-0586) is a chemical education journal, not to be confused with *Chemistry in New Zealand.*

[d] *Chemical Reviews* (ISSN 0009-2665) refers to the journal published by the American Chemical Society.

[e] *Chemistry Review* (ISSN 0959-8464) is a chemical education journal published by the University of York (UK).

Abbreviated journal name	Full journal name (incomplete listing)
ChemSA	ChemSA
Chim. Acta Turc.	Chimica Acta Turcica
Chim. Actual.	Chimie Actualites
Chim. Ind. (Milan)	Chimica e l'Industria (Milan)
Chimia	Chimia
Chromatographia	Chromatographia
Clin. Biochem.	Clinical Biochemistry
Clin. Chem.	Clinical Chemistry
Clin. Chem. (Winston Salem, N.C.)	
Clin. Chim. Acta	Clinica Chimica Acta
Collect. Czech. Chem. Commun.	Collection of Czechoslovak Chemical Communications
Colloid J. USSR (Engl. Transl.)	
Colloid Polym. Sci.	Colloid and Polymer Science
Combust. Flame	Combustion and Flame
Comments At. Mol. Phys.	Comments on Atomic and Molecular Physics
Commun. Assoc. Comput. Machin.	Communications of the Association for Computing Machin.
Commun. Fac. Sci. Univ. Ankara	
Commun. R. Soc. Edinburgh, Phys. Sci.	
Comput. Phys. Commun.	Computer Physics Communications
Comput. Phys. Reports	Computer Physics Reports
Comput. Chem.	Computers and Chemistry
Comput. Chem. Educ.	Computers and Chemistry Education
Coord. Chem. Rev.	Coordination Chemistry Reviews
Corros. Sci.	Corrosion Science
Cosmet. Perfum.	
CRC Crit. Rev. Biochem.	

Abbreviated journal name	Full journal name (incomplete listing)	
Crit. Rev. Anal. Chem.	Critical Reviews in Analytical Chemistry	
Croat. Chem. Acta	Croatica Chemica Acta	
Curr. Sci.	Current Science	
Dalton Trans.	Dalton Transactions	(See note [f])
DEFAZET Dtsch. Farben Z.		
Denki Kagaku yobi Kogyo Butsuri Kagaku	Denki Kagaku oyobi Kogyo Butsuri Kagaku	
Discuss. Faraday Soc.	Discussions of the Faraday Society	
Distance Educ.	Distance Education	
Dokl. Akad. Nauk Arm. SSR	Doklady - Akademiya Nauk Azerbaidzhana	
Dokl. Akad. Nauk SSSR	Doklady Akademii Nauk	
Dokl. Bolg. Akad. Nauk	Dokladi na Bulgarskata Akademiya na Naukite	
Dokl. Chem. (Engl. Transl.)		
Dokl. Chem. Technol. (Engl. Transl.)		
Dokl. Phys. Chem. (Engl. Transl.)		
Dopov. Akad. Nauk Ukr. RSR, Ser. B		
Double Liaison		
Dtsch. Lebensm. Rundsch.	Deutsche Lebensmittel-Rundschau	
Dyn. Mass Spectrom.		
Educ. Chem.	Education in Chemistry	
Egypt. J. Chem.	Egyptian Journal of Chemistry	
Electroanal. Chem.	Electroanalytical Chemistry	
Electrochem.	Electrochemistry	
Electrochim. Acta		
Elektrokhimiya	Elektrokhimiya	

[f] *Journal of the Chemical Society, Dalton Transactions* changed its name to *Dalton Transactions* in 2003.

Abbreviated journal name	Full journal name (incomplete listing)
Endeavour	Endeavour
Energy Fuels	Energy and Fuels
Environ. Sci. Technol.	Environmental Science and Technology
Erdoel Kohle, Erdgas, Petrochem., Brennst. Chem.	
Essays Biochem.	Essays in Biochemistry
Eur. J. Biochem.	European Journal of Biochemistry
Eur. J. Inorg. Chem.	European Journal of Inorganic Chemistry
Eur. Polym. J.	European Polymer Journal
Experientia	Experientia
Faraday Discuss. Chem. Soc.	Faraday Discussions of the Chemical Society
Faraday Symp. Chem. Soc.	Faraday Symposia of the Chemical Society
FEBS Lett.	FEBS Letters
Fermentn, Spirt. Prom.	
Fette, Seifen. Anstrichm.	
Finn Chem. Lett.	
Fiz. Khim. Mekh. Mater.	
Fiz. Met. Metalloved.	Fizika Metallov i Metallovedenie
Flavour Ind.	
Fluid Phase Equilibria	Fluid Phase Equilibria
Fluorine Chem. Rev.	
Food Manuf.	
Fortschr. Chem. Org. Naturst.	
Fortschr. Hochpolym. Forsch.	
Fresenius J. Anal. Chem.	Fresenius Journal of Analytical Chemistry
Fresenius Z. Anal. Chem.	Fresenius Zeitschrift Fuer Analytische Chemie
Fuel	Fuel
G. Microbiol.	

Abbreviated journal name	Full journal name (incomplete listing)	
Gazz. Chim. Ital.	Gazzetta Chimica Italiana	
Gen. Cytochem. Methods		
Geokhimiya	Geokhimiya	
Ger. Chem. Eng. (Engl. Transl.)		
Gidrokhim. Mat.	Gidrokhimicheskie Materialy	
Glas. Hem. Drus., Beograd		
Glass Technol.	Glass Technology	
God. Vissh. Khim. Tekhnol. Inst., Sofia	Godishnik na Visshiya Khimiko-Tekhnologicheski Institut, Sofiya	
Grasas Aceites (Seville)	Grasas y Aceites (Seville)	
Helv. Chim. Acta	Helvetica Chimica Acta	
Heterocycles	Heterocycles	
High Energy Chem. (Engl. Transl.)		
Hist. Stud. Phys. Sci.		
Hoppe Seyler's Z. Physiol. Chem.		
Hua Hsueh		
Hua Hsueh Tung Pao		
Huaxue Tongbao	Huaxue Tongbao	
Huaxue Xuebao	Huaxue Xuebao	(See note [g])
Hung. J. Ind. Chem.	Hungarian Journal of Industrial Chemistry	
Hwahak Kwa Kongop Ui Chinbo		
Ind. Eng. Chem., Fundam.		
Ind. Eng. Chem., Process. Des. Dev.		
Ind. Eng. Chem., Prod. Res. Dev.		
Ind. Eng. Chem. Res.	Industrial and Engineering Chemistry Research	

[g] *Acta Chimica Sinica* – Chinese Edition (ISSN 0567-7351).

Abbreviated journal name	Full journal name (incomplete listing)
Ind. Lab. (Engl. Transl.)	
Indian J. Agric. Chem.	Indian Journal of Agricultural Chemistry
Indian J. Biochem. Biophys.	Indian Journal of Biochemistry and Biophysics
Indian J. Chem.	Indian Journal of Chemistry
Indian J. Chem., Sect. A	Indian Journal of Chemistry, Section A: Inorganic, Bioinorganic, Physical, Theoretical and Analytical Chemistry
Indian J. Chem., Sect. B	Indian Journal of Chemistry, Section B: Organic Chemistry, Including Medicinal Chemistry
Indian J. Pure Appl. Phys.	Indian Journal of Pure and Applied Physics
Inorg. Chem.	Inorganic Chemistry
Inorg. Chim. Acta	Inorganica Chimica Acta
Inorg. Mater. (Engl. Transl.)	
Inorg. Synth.	Inorganic Synthesis
Instr. Sci. Tech.	Instrumentation Science and Technology
Int. Chem. Eng.	
Int. Flavours Food Addit.	
Int. J. Appl. Radiat. Isot.	
Int. J. Chem. Kinet.	International Journal of Chemical Kinetics
Int. J. Mass Spectrom.	International Journal of Mass Spectrometry
Int. J. Mass Spectrom. Ion Phys.	International Journal of Mass Spectrometry and Ion Physics
Int. J. Mass Spectrum. Ion Processes	International Journal of Mass Spectrometry and Ion Processes
Int. J. Pept. Protein Res.	International Journal of Peptide and Protein Research
Int. J. Quantum Chem.	International Journal of Quantum Chemistry
Int. J. Quantum Chem., Symp.	
Int. J. Sulfur Chem.	
Int. J. Vitam. Nutr. Res.	

Abbreviated journal name	Full journal name (incomplete listing)
Int. Rev. Phys. Chem.	International Reviews in Physical Chemistry
Intra Sci. Chem. Rep.	
Inz. Chem.	
Ion Exch. Solvent Extr.	Ion Exchange and Solvent Extraction
Isr. J. Chem.	Israel Journal of Chemistry
Istanbul Univ. Fen Fak. Mecm., Seri C	
Ital. J. Biochem.	Italian Journal of Biochemistry
Itsuu Kenkyusho Nempo	
Izv. Akad. Nauk Kaz. SSR, Ser. Khim.	Izvestiya Akademii Nauk Respubliki Kazakhstan, Seriya Khimicheskaya
Izv. Akad. Nauk SSSR, Neorg. Mater.	
Izv. Akad. Nauk SSSR, Ser. Khim.	
Izv. Akad. Nauk Turkm. SSR, Ser. Fiz. Tekh., Khim. Geol. Nauk	
Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk	
J. Agric. Food Chem.	Journal of Agricultural and Food Chemistry
J. Am. Chem. Soc.	Journal of the American Chemical Society
J. Am. Leather Chem. Assoc.	Journal of the American Leather Chemists Association
J. Am. Oil Chem. Soc.	Journal of the American Oil Chemists' Society
J. Am. Soc. Mass Spectrom.	Journal of the American Society for Mass Spectrometry
J. Anal. At. Spectrom.	Journal of Analytical Atomic Spectrometry
J. Anal. Chem. USSR (Engl. Transl.)	
J. Appl. Behav. Anal.	Journal of Applied Behavior Analysis
J. Appl. Chem. Biotechnol.	

Abbreviated journal name	Full journal name (incomplete listing)	
J. Appl. Chem. USSR (Engl. Transl.)		
J. Appl. Crystallogr.	Journal of Applied Crystallography	
J. Appl. Polym. Sci.	Journal of Applied Polymer Science	
J. Assoc. Off. Anal. Chem.	Journal of the Association of Official Analytical Chemists	
J. Assoc. Public Anal.	Journal of the Association of Public Analysts	
J. Aust. Ceramic Soc.	Journal of the Australian Ceramic Society	
J. Biochem. (Tokyo)	Journal of Biochemistry (Tokyo)	
J. Biochem. Biophys. Methods	Journal of Biochemical and Biophysical Methods	
J. Biol. Chem.	Journal of Biological Chemistry	
J. Biolumin. Chemilumin.	Journal of Bioluminescence and Chemiluminescence	(See note [h])
J. Carbohydr. Chem.	Journal of Carbohydrate Chemistry	
J. Catal.	Journal of Catalysis	
J. Chem. Educ.	Journal of Chemical Education	
J. Chem. Educ.: Software	Journal of Chemical Education: Software	
J. Chem. Educ.: Webware	Journal of Chemical Education: Webware	
J. Chem. Eng. Data	Journal of Chemical and Engineering Data	
J. Chem. Inf. Comput. Sci.	Journal of Chemical Information and Computer Sciences	
J. Chem. Phys.	Journal of Chemical Physics	
J. Chem. Res. (M)		
J. Chem. Res. (S)		
J. Chem. Soc.	Journal of the Chemical Society	
J. Chem. Soc., Chem. Commun.	Journal of the Chemical Society, Chemical Communications	

[h] *Journal of Bioluminescence and Chemiluminescence* has changed its name to *Luminescence.*

Abbreviated journal name	Full journal name (incomplete listing)
J. Chem. Soc., Dalton Trans.	Journal of the Chemical Society, Dalton Transactions (See note [i])
J. Chem. Soc., Faraday Trans. 1	Journal of the Chemical Society, Faraday Transactions 1
J. Chem. Soc., Faraday Trans. 2	Journal of the Chemical Society, Faraday Transactions 2
J. Chem. Soc., Perkin Trans. 1	Journal of the Chemical Society, Perkin Discussions 1
J. Chem. Soc., Perkin Trans. 2	Journal of the Chemical Society, Perkin Discussions 2
J. Chem. Thermodyn.	Journal of Chemical Thermodynamics
J. Chim. Phys.	Journal de Chimie Physique
J. Chim. Phys. Phys. Chim. Biol.	Journal de Chimie Physique et de Physico-Chimie Biologique
J. Chin. Chem. Soc. (Taipei)	Journal of the Chinese Chemical Society (Taipei)
J. Chromatogr.	Journal of Chromatography
J. Chromatogr. Sci.	Journal of Chromatographic Science
J. Coll. Sci. Teach.	Journal of College Science Teaching
J. Colloid Interface Sci.	Journal of Colloid and Interface Science
J. Comput. Chem.	Journal of Computational Chemistry
J. Comput. Phys.	Journal of Computational Physics
J. Coord. Chem.	Journal of Coordination Chemistry
J. Cryst. Mol. Struct.	
J. Doc.	
J. Electroanal. Chem.	Journal of Electroanalytical Chemistry
J. Electroanal. Chem. Interfacial Electrochem.	Journal of Electroanalytical Chemistry and Interfacial Electrochemistry
J. Electrochem. Soc.	Journal of the Electrochemical Society
J. Electrochem. Soc. India	Journal of the Electrochemical Society of India
J. Environ. Monit.	Journal of Environmental Monitoring
J. Fac. Sci. Univ. Tokyo	

[i] *Journal of the Chemical Society, Dalton Transactions* changed its name to *Dalton Transactions* in 2003.

Abbreviated journal name	Full journal name (incomplete listing)
J. Fluorine Chem.	Journal of Fluorine Chemistry
J. Food Sci.	Journal of Food Science
J. Franklin Inst.	
J. Gen. Chem. USSR (Engl. Transl.)	
J. Geophys. Res.	Journal of Geophysical Research
J. Hazard. Mater.	Journal of Hazardous Materials
J. Heterocycl. Chem.	Journal of Heterocyclic Chemistry
J. Histochem. Cytochem.	Journal of Histochemistry and Cytochemistry
J. Indian Chem. Soc.	Journal of the Indian Chemical Society
J. Indian Inst. Sci.	Journal of the Indian Institute of Science
J. Inorg. Chem. USSR (Engl. Transl.)	
J. Inst. Brew.	Journal of the Institute of Brewing
J. Inst. Chem. (India)	
J. Inst. Fuel	
J. Labelled Compd. Radiopharm.	Journal of Labelled Compounds and Radiopharmaceuticals
J. Less Common Met.	
J. Lipid Res.	Journal of Lipid Research
J. Liq. Chromatogr.	Journal of Liquid Chromatography and Related Techniques
J. Lumin.	Journal of Luminescence
J. Macromol. Sci., Chem.	Journal of Macromolecular Science, Pure and Applied Chemistry
J. Macromol. Sci., Phys.	Journal of Macromolecular Science, Physics
J. Magn. Reson.	Journal of Magnetic Resonance
J. Math. Phys.	Journal of Mathematical Physics
J. Med. Chem.	Journal of Medicinal Chemistry

Abbreviated journal name	Full journal name (incomplete listing)
J. Microcol. Separ.	Journal of Microcolumn Separations
J. Mol. Biol.	Journal of Molecular Biology
J. Mol. Catal.	Journal of Molecular Catalysis
J. Mol. Spectrosc.	Journal of Molecular Spectroscopy
J. Mol. Struct.	Journal of Molecular Structure
J. Mol. Struct. (Theochem)	Journal of Molecular Structure (Theochem)
J. Nat. Prod.	Journal of Natural Products
J. Neurochem.	Journal of Neurochemistry
J. Nonmet. Semiconduct.	
J. Oil Colour Chem. Assoc.	
J. Org. Chem.	Journal of Organic Chemistry
J. Org. Chem. USSR (Engl. Transl.)	
J. Organomet. Chem.	Journal of Organometallic Chemistry
J. Pharm. Biomed. Anal.	Journal of Pharmaceutical and Biomedical Analysis
J. Pharm. Pharmacol.	Journal of Pharmacy and Pharmacology
J. Pharm. Sci.	Journal of Pharmaceutical Sciences
J. Pharmacol.	
J. Pharmacol. Exp. Ther.	Journal of Pharmacology and Experimental Therapeutics
J. Photochem.	Journal of Photochemistry
J. Phys. A: Math. Gen. Phys.	Journal of Physics A: Mathematical and General
J. Phys. B: At. Mol. Opt. Phys.	Journal of Physics B: Atomic, Molecular and Optical Physics
J. Phys. Chem.	Journal of Physical Chemistry
J. Phys. Chem. A	Journal of Physical Chemistry A
J. Phys. Chem. B	Journal of Physical Chemistry B
J. Phys. Chem. Ref. Data.	Journal of Physical and Chemical Reference Data
J. Phys. Chem. Solids	Journal of Physics and Chemistry of Solids

Abbreviated journal name	Full journal name (incomplete listing)
J. Phys. Colloid Chem.	Journal of Physical and Colloid Chemistry
J. Phys. E.	
J. Polym. Sci., Polym. Chem. Ed.	
J. Polym. Sci., Polym. Phys. Ed.	
J. Polym. Sci., Polym. Symp.	
J. Prakt. Chem.	Journal für Praktische Chemie/Chemiker-Zeitung
J. Protein Chem.	Journal of Protein Chemistry
J. Quant. Spectrosc. Radiat. Transfer	Journal of Quantitative Spectroscopy and Radiative Transfer
J. Radioanal. Nucl. Chem.	Journal of Radioanalytical and Nuclear Chemistry
J. Raman Spectrosc.	Journal of Raman Spectroscopy
J. Recreational Math.	Journal of Recreational Mathematics
J. Res. Comput. Educ.	Journal of Research on Computing in Education
J. Res. Inst. Catal., Hokkaido Univ.	
J. Res. Nat. Bur. Stand., Sect A	
J. Res. Pract. Information Tech.	Journal of Research and Practice in Information Technology
J. Sci. Educ. Tech.	Journal of Science Education and Technology
J. Sci. Food Agric.	Journal of the Science of Food and Agriculture
J. Sci. Hiroshima Univ., Ser. A2	
J. Sci. Ind. Res.	Journal of Scientific and Industrial Research
J. Soc. Dyers Colour.	Journal of the Society of Dyers and Colourists
J. Soc. Leather Technol. Chem.	Journal of the Society of Leather Technologists and Chemists
J. Solid State Chem.	Journal of Solid State Chemistry
J. Solution Chem.	Journal of Solution Chemistry
J. Stat. Phys.	Journal of Statistical Physics
J. Steroid Biochem. Mol. Biol.	Journal of Steroid Biochemistry and Molecular Biology

Abbreviated journal name	Full journal name (incomplete listing)
J. Struct. Chem. (Engl. Transl.)	
J. Text. Inst.	
J. Therm. Anal.	Journal of Thermal Analysis
J. Vac. Sci. Technol.	Journal of Vacuum Science and Technology
Kagaku Kogaku	Kagaku Kogaku
Kanazawa Daigaku Yakugakubu Kenkyu Nempo	
Kem. Kemi	Kemia - Kemi
Kem. Tidskr.	Kemisk Tidskrift
Khim. Geterotsikl. Soedin.	Khimiya Geterotsiklicheskikh Soedinenii
Khim. Ind. (Sofia)	
Khim. Neft. Mashinostr.	Khimicheskoe i Neftyanoe Mashinostroenie
Khim. Prir. Soedin.	Khimiya Prirodnykh Soedinenii
Khim. Promst. (Moscow)	Khimicheskaya Promyshlennost (Moscow)
Khim. Volokna	Khimicheskie Volokna
Khim. Vys. Energ.	Khimiya Vysokikh Energii
Kinet. Catal. (Engl. Transl.)	
Kinet. Katal.	Kinetika i Kataliz
Kjemi	Kjemi
Kobunshi Kagaku	
Kogyo Kagaku Zasshi	
Kolloidn. Zh.	Kolloidnyi Zhurnal
Koord. Khim.	Koordinatsionnaya Khimiya
Kristallografiya	Kristallografiya
Kunstst. Plast. (Solothurn, Switz.)	
Lab. Pract.	Laboratory Practice
Laboratoriumsdiagn.	
Langmuir	Langmuir

Abbreviated journal name	Full journal name (incomplete listing)
Laser Chem.	Laser Chemistry
Latv. PSR Zinat. Akad. Vestis, Kim. Ser.	
Liebigs Ann. Chem.	Justus Liebigs Annalen der Chemie
Lipids	Lipids
Luminescence	Luminescence (See note [j])
Macromol. Synth.	
Macromolecules	Macromolecules
Magy. Kem. Foly.	Magyar Kemiai Folyoirat
Magy. Kem. Lapja	Magyar Kemikusok Lapja
Makromol. Chem.	Makromolekulare Chemie
Manuf. Chem. Aerosol News	
Mater. Sci. Eng.	Materials Science and Engineering
Meded. Vlaam. Chem. Ver.	
Mekh. Polim.	
Mem. Fac. Sci. Kyushu Univ., Ser. C	Memoirs of the Faculty of Science, Kyushu University, Series C: Chemistry
Mem. Inst. Protein Res., Osaka Univ.	
Mem. Inst. Sci. Ind. Res., Osaka Univ.	Memoirs of the Institute of Scientific and Industrial Research, Osaka University
Mendeleev Chem. J. (Engl. Transl.)	
Methods	Methods
Methods Biochem. Anal.	
Methods Comput. Phys.	Methods in Computational Physics
Methods Free Radical Chem.	

[j] *Journal of Bioluminescence and Chemiluminescence* has changed its name to *Luminescence.*

Abbreviated journal name	Full journal name (incomplete listing)
Microchem. J.	Microchemical Journal
Mikrochim. Acta	Mikrochimica Acta
Mol. Cell. Biochem.	Molecular and Cellular Biochemistry
Mol. Cryst. Liq. Cryst.	Molecular Crystals and Liquid Crystals
Mol. Photochem.	Molecular Photochemistry
Mol. Phys.	Molecular Physics
Monatsh. Chem.	Monatshefte für Chemie
Nahrung	Nahrung
Nat. Prod. Rep.	
Nature	Nature
Naturwissenschaften	Naturwissenschaften
Neftekhimiya	Neftekhimiya
New J. Chem.	New Journal of Chemistry
Nippon Kagaku Kaishi	Nippon Kagaku Kaishi
Nippon Nogei Kagaku Kaishi	Nippon Nogei Kagaku Kaishi
Nouv. J. Chim.	
Nucleosides, Nucleotides	Nucleosides and Nucleotides
Numer. Math.	Numerische Mathematik
Oesterr. Chem. Zig.	
Online (Weston. Conn.)	
Orbital	
Org. Magn. Reson.	
Org. Mass. Spectrom.	Organic Mass Spectrometry
Org. Prep. Proced. Int.	Organic Preparations and Procedures International
Org. Process Res. Dev.	Organic Process Research and Development
Org. React. (N.Y.)	Organic Reactions (New York)
Org. React. (USSR)	
Org. React. Mech.	Organic Reaction Mechanisms

Abbreviated journal name	Full journal name (incomplete listing)
Org. Synth.	Organic Syntheses
Organometallics	Organometallics
Paint Manuf.	
Pak. J. Sci.	Pakistan Journal of Science
Pak. J. Sci. Res.	Pakistan Journal of Scientific Research
Pak. J. Sci. Ind. Res.	Pakistan Journal of Scientific and Industrial Research
Parabola	Parabola (See note [k])
Periodia Polytech., Chem. Eng.	Periodica Polytechnica, Chemical Engineering
Pestic. Sci.	Pesticide Science
Philos. Mag. A	Philosophical Magazine A: Physics of Condensed Matter: Defects and Mechanical Properties
Philos. Mag. B	Philosophical Magazine B: Physics of Condensed Matter: Structural, Electronic, Optical and Magnetic Properties
Philos. Trans. R. Soc. London, A	Philosophical Transactions of the Royal Society of London, Series A: Physical Sciences and Engineering
Phosphorus Sulfur	Phosphorus and Sulfur
Phosphorus, Sulfur and Silicon	Phosphorus, Sulfur and Silicon
Phosphorus, Sulfur Silicon Relat. Elem.	Phosphorus, Sulfur and Silicon and the Related Elements
Photochem. Photobiol.	Photochemistry and Photobiology
Phys. Chem. Chem. Phys.	Physical Chemistry Chemical Physics
Phys. Chem. Glasses	Physics and Chemistry of Glasses
Phys. Rev.	Physical Review
Phys. Rev. A	Physical Review A: General Physics
Phys. Rev. E	Physical Review E

[k] *Parabola* (ISSN 1446-9723) is published by the University of NSW, Australia.

Abbreviated journal name	Full journal name (incomplete listing)
Phys. Rev. Lett.	Physical Review Letters
Phys. Sci. Educ. Rev.	Physical Sciences Educational Reviews
Phys. Scr.	Physica Scripta
Phys. Today	Physics Today
Phys. Z. Sowjetunion	Physikalische Zeitschrift der Sowjetunion
Physica	Physica
Phytochemistry	Phytochemistry
Pigm. Resin Technol.	Pigment and Resin Technology
Pis'ma Zh. Eksp. Teor. Fiz.	Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki
Plast. Polym.	
Pol. J. Chem.	Polish Journal of Chemistry
Polyhedron	Polyhedron
Polym. Age	
Polym. Commun.	Polymer Communications
Polym. Sci. USSR (Engl. Transl.)	
Polymer	Polymer
Postepy Biochem.	Postepy Biochemii
Powder Technol.	Powder Technology
Prikl. Biokhim. Mikrobiol.	Prikladnaya Biokhimiya i Mikrobiologiya
Priroda (Moscow)	Priroda (Moscow)
Proc. Am. Soc. Brew. Chem.	
Proc. Camb. Phil. Soc.	Proceedings of the Cambridge Phil. Soc.
Proc. Indian Acad. Sci., Sect. A	
Proc. Indian Acad. Sci., Sect. B	
Proc. Natl. Acad. Sci. USA	Proceedings of the National Academy of Sciences of the United States of America
Proc. Natl. Acad. Sci., India, Sect. A	Proceedings of the National Academy of Sciences, India, Section A: Physical Sciences

Abbreviated journal name	Full journal name (incomplete listing)
Proc. R. Soc. Edinburgh, Sect. A	
Proc. R. Soc. London	Proceedings of the Royal Society (London)
Proc. R. Soc. London, A	Proceedings of the Royal Society of London, Series A: Mathematical and Physical Sciences
Proc. R. Soc. London, B	Proceedings of the Royal Society of London, Series B: Biological Sciences
Proc. Soc. Exp. Biol. Med.	Proceedings of the Society for Experimental Biology and Medicine
Proc., K. Ned. Akad. Wet., Ser. B	
Proc., K. Ned. Akad. Wet., Ser. C	
Process Biochem.	Process Biochemistry (Barking, UK)
Processing	Processing
Prog. Bioorg. Chem.	
Prog. Colloid Polym. Sci.	Progress in Colloid and Polymer Science
Prog. Inorg. Chem.	Progress in Inorganic Chemistry
Prog. Med. Chem.	Progress in Medicinal Chemistry
Prog. Nucl. Magn. Reson. Spectrosc.	Progress in Nuclear Magnetic Resonance Spectroscopy
Prog. Nucleic Acid Res. Mol. Biol.	Progress in Nucleic Acid Research and Molecular Biology
Prog. Phys. Org. Chem.	Progress in Physical Organic Chemistry
Prog. React. Kinet.	Progress in Reaction Kinetics
Prog. Solid State Chem.	Progress in Solid State Chemistry
Prog. Stereochem.	
Prog. Surf. Membr. Sci.	
Prog. Surf. Sci.	Progress in Surface Science
Prog. Theor. Phys.	Progress of Theoretical Physics
Prog. Thin Layer Chromatogr. Relat.	

Abbreviated journal name	Full journal name (incomplete listing)
Przem. Chem.	Przemysl Chemiczny
Pure Appl. Chem.	Pure and Applied Chemistry
Pyrethrum Post	Pyrethrum Post
Quad. Ing. Chim. Ital.	Quaderni dell'Ingegnere Chimico Italiano
Quantum Chem. Program Exchange	Quantum Chemistry Program Exchange
Quantum Chem. Program Exchange Bull.	Quantum Chemistry Program Exchange Bulletin
Quim. Nova	Quimica Nova
Radiat. Phys. Chem.	Radiation Physics and Chemistry
Radiat. Res.	Radiation Research
Radiochim. Acta	Radiochimica Acta
Radiokhimiya	Radiokhimiya
React. Kinet. Catal. Lett.	Reaction Kinetics and Catalysis Letters
Recent Dev. Chem. Nat. Carbon Compd.	
Recent Prog. Horm. Res.	Recent Progress in Hormone Research
Recherches	Recherches
Recl. Trav. Chim. Pays Bas	Receuil des Travaux Chimiques des Pays-Bas
Rend. Accad. Sci. Fis. Mat., Naples	
Rep. Prog. Appl. Chem.	
Res. Sci. Educ.	Research in Science Education
Residue Rev.	
Reun. Int. de Chim. Phys.	Reunion Internationale de Chimie Physique, rapports et discussions
Rev. Anal. Chem.	Reviews in Analytical Chemistry
Rev. Asoc. Bioquim. Argent.	
Rev. Chim. (Bucharest)	Revista de Chimie (Bucharest)

Abbreviated journal name	Full journal name (incomplete listing)
Rev. Mod. Phys.	Reviews of Modern Physics
Rev. Phys. Chem. Jpn.	
Rev. Port. Quim.	Revista Portuguesa de Quimica
Rev. Pure Appl. Chem.	Reviews of Pure and Applied Chemistry
Rev. Roum. Biochim.	Revue Roumaine de Biochimie
Rev. Roum. Chim.	Revue Roumaine de Chimie
Rev. Sci. Instrum.	Review of Scientific Instruments
Rev. Soc. Quim. Mex.	Revista de la Sociedad Quimica de Mexico
Ric. Sci.	
Rubber Chem. Technol.	Rubber Chemistry and Technology
Russ. Chem. Rev. (Engl. Transl.)	
Russ. J. Inorg. Chem. (Engl. Transl.)	
Russ. J. Phys. Chem. (Engl. Transl.)	
S. Afr. J. Chem.	South Afrikan Journal of Chemistry
Sankyo Kenkyusho Nempo	Sankyo Kenkyusho Nempo
Sb. Ved. Pr., Vys. Sk. Chemickotechnol., Pardubice	Sbornik Vedeckych Praci, Vysoka Skola Chemickotechnologicka Pardubice
Sch. Sci. Rev.	School Science Review
Schweiz. Apoth. Ztg.	Schweizerische Apotheker-Zeitung
Sci. Cult.	Science and Culture
Sci. Pap. Coll. Gen. Educ., Univ. Tokyo	
Sci. Pap. Inst. Phys. Chem. Res. (Jpn.)	
Sci. Rep. Res. Inst., Tohoku Univ.	
Sci. Rep. Tohoku Univ., Ser. 1	

Abbreviated journal name	Full journal name (incomplete listing)
Sci. Sinica	
Science	Science
Science and the Future	Science and the Future
Scientific American	Scientific American
Sel. Annu. Rev. Anal. Sci.	
Semicond. Insul.	
Sep. Purif. Methods	Separation and Purification Methods
Sep. Sci.	Separation Science
Sep. Sci. Technol.	Separation Science and Technology
SIAM Rev.	Society for Industrial and Applied Mathematics Reviews
Soap. Cosmet., Chem. Spec.	Soap, Cosmetics, Chemical Specialties
Sov. Electrochem. (Engl. Transl.)	
Sov. J. Bioorg. Chem. (Engl. Transl.)	
Sov. J. Coord. Chem. (Engl. Transl.)	
Sov. Phys. Crystallogr. (Engl. Transl.)	
Sov. Radiochem. (Engl. Transl.)	
Spec. Publ. Chem. Soc.	Special Publication - Royal Society of Chemistry
Spectrochim. Acta	Spectrochimica Acta
Spectrochim. Acta Part A	Spectrochimica Acta, Part A: Atomic Spectroscopy
Spectrochim. Acta Part B	Spectrochimica Acta Part B: Molecular and Biomolecular Spectroscopy
Spectrosc. Lett.	Spectroscopy Letters
Spreadsheets Educ.	Spreadsheets in Education
Steroids	Steroids
Steroids Lipids Res.	
Struct. Bonding (Berlin)	Structure and Bonding (Berlin)

Abbreviated journal name	Full journal name (incomplete listing)
Stud. Univ. Babes Bolyai, Chem.	
Sub Cell. Biochem.	
Surf. Colloid Sci.	Surface and Colloid Science
Surf. Sci.	Surface Science
Synth. Commun.	Synthetic Communications
Synth. React. Inorg. Metal Org. Chem.	Synthesis and Reactivity in Inorganic and Metal-Organic Chemistry
Synthesis	Synthesis
Taehan Hwahakhoe Chi	
Talanta	Talanta
Technol. Rep. Osaka Univ.	Technology Reports of the Osaka University
Teor. Eksp. Khim.	Teoreticheskaya i Eksperimental'naya Khimiya
Teor. Osn. Khim. Tekhnol.	Teoreticheskie Osnovy Khimicheskoi Tekhnologii
Tetrahedron	Tetrahedron
Tetrahedron Lett.	Tetrahedron Letters
Tetrahedron: Asymmetry	Tetrahedron: Asymmetry
Text. Res. J.	Textile Research Journal
Theor. Chim. Acta	Theoretica Chimica Acta
Theor. Exp. Chem. (Engl. Transl.)	
Thermochim. Acta	Thermochimica Acta
Tin Its Uses	Tin and Its Uses
Today's Chemist at Work	Today's Chemist at Work
Top. Curr. Chem.	Topics in Current Chemistry
Top. Stereochem.	Topics in Stereochemistry
Tr. Inst. Elektrokhim., Ural. Nauchn. Tsentr.	
Trans. Faraday Soc.	Transactions of the Faraday Society
Trans. Inst. Met. Finish.	Transactions of the Institute of Metal Finishing

Abbreviated journal name	Full journal name (incomplete listing)
Transition Met. Chem. (Weinheim, Ger.)	
Trant. J. Br. Ceram. Soc.	
Trends Anal. Chem.	Trends in Analytical Chemistry
Trends Biochem. Sci.	Trends in Biochemical Sciences
Ukr. Biokhim. Zh.	Ukrainskii Biokhimicheskii Zhurnal
Ukr. Khim. Zh. (Russ. Ed.)	Ukrainskii Khimicheskii Zhurnal (Russian Edition)
UniServe Sci. News	UniServe Science News
Usp. Khim.	Uspekhi Khimii
UV Spectrum. Group Bull.	
Uzb. Khim. Zh.	Uzbekskii Khimicheskii Zhurnal
Vestn. Leningr. Univ., Fiz., Khim.	
Vestn. Mosk. Univ., Ser. 2: Khim.	Vestnik Moskovskogo Universiteta, Seriya 2: Khimiya
Vestn. Slov. Kem. Drus.	Vestnik Slovenskega Kemijskega Drustva
Vestsi Akad. Navuk BSSR. Ser. Khim. Navuk	Vestsi Akademii Navuk Belarusi, Seryya Khimichnykh Navuk
Veszpremi Vegyip, Egy. Kozl.	
Vitam. Horm. (N.Y.)	Vitamins and Hormones (New York)
Vopr. Med. Khim.	Voprosy Meditsinskoi Khimii
Vysokomol. Soedin., Ser. A	Vysokomolekulyarnye Soedineniya, Seriya A
Vysokomol. Soedin., Ser. B	Vysokomolekulyarnye Soedineniya, Seriya B: Kratkie Soobshcheniya
Xenobiotica	Xenobiotica
Yakugaku Zasshi	Yakugaku Zasshi
Yuki Gosei Kagaku Kyokaishi	Yuki Gosei Kagaku Kyokaishi
Z. Anal. Chem.	Zeitschrift für Analytische Chemie
Z. Anorg. Allg. Chem.	Zeitschrift für Anorganische und Allgemeine Chemie
Z. Chem.	Zeitschrift für Chemie

Abbreviated journal name	Full journal name (incomplete listing)
Z. Electrochem.	Zeitschrift für Electrochemie
Z. Kristallogr.	Zeitschrift für Kristallographie
Z. Lebensm. Unters. Forsch.	Zeitschrift für Lebensmittel-Untersuchung und Forschung
Z. Naturforsch.	Zeitschrift für Naturforschung
Z. Naturforsch., A	Zeitschrift für Naturforschung, A: Physical Sciences
Z. Naturforsch., B	Zeitschrift für Naturforschung, B: Chemical Sciences
Z. Naturforsch., C	Zeitschrift für Naturforschung, C: Biosciences
Z. Phys.	Zeitschrift für Physik
Z. Phys. Chem.	Zeitschrift für Physikalische Chemie
Z. Phys. Chem. (Leipzig)	Zeitschrift für Physikalische Chemie (Leipzig)
Z. Phys. Chem. (Munich)	Zeitschrift für Physikalische Chemie (Munich)
Z. Phys. Chem. N. F.	Zeitschrift für Physikalische Chemie Neue Folge
Z. Phys. D	Zeitschrift für Physik D - Atoms, Molecules and Clusters
Z. Vitam., Horm., Fermentforsch.	
Z. Wiss. Photogr., Photophys., Photochem.	
Zavod. Lab.	Zavodskaya Laboratoriya
Zb. Pr. Chemickotechnol. Fac. SVST	
Zentralbl. Pharm., Pharmakother.	
Zh. Anal. Khim.	Zhurnal Analiticheskoi Khimii
Zh. Eksp. Teor. Fiz.	Zhurnal Eksperimental’noi i Teoreticheskoi Fiziki
Zh. Evol. Biokhim. Fiziol.	Zhurnal Evolyutsionnoi Biokhimii i Fiziologii
Zh. Fiz. Khim.	Zhurnal Fizicheskoi Khimii
Zh. Nauchn. Prikl. Fotogr. Kinematogr.	
Zh. Neorg. Khim.	Zhurnal Neorganicheskoi Khimii

Abbreviated journal name	Full journal name (incomplete listing)
Zh. Obshch. Khim.	
Zh. Org. Khim.	Zhurnal Organicheskoi Khimii
Zh. Prikl. Khim. (Leningrad)	Zhurnal Prikladnoi Khimii (S. Peterburg)
Zh. Prikl. Spektrosk.	Zhurnal Prikladnoi Spektroskopii
Zh. Strukt. Khim.	Zhurnal Strukturnoi Khimii
Zh. Vses. Khim. Ova im D.I. Mendeleeva	Zhurnal Vsesoyuznogo Khimicheskogo Obshchestva im. D. I. Mendeleeva

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What topics should be covered in more detail, or additional topics added?
Any other comments or suggestions?

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About the Author

Kieran Fergus Lim (林百君) has had an interest in communication, chemical education and the use of information technology for learning, for many years . He has held appointments as an Adjudicator for the NSW Department of Education (Debating and Public Speaking Section), the City of Sydney Eisteddfod, the NSW Independent Schools' Debating Association, and the NSW Debating Association.

Dr Lim has a PhD in theoretical chemistry from University of Sydney and has held lectureships at Stanford University, University of New England and University of Melbourne. He is currently an Associate Professor in Chemical Sciences at Deakin University. Dr Lim is a receipient of the Royal Australian Chemical Institute's *Division of Chemical Education Citation* for significant contributions to chemical education (2002) and the Faculty of Science and Technology's *Excellence in Teaching Award* (1996 and 2000). Dr Lim is a member of the editorial boards of the journals *Spreadsheets in Education* and the *Australian Journal of Education in Chemistry*.