2 The Core Chapter: Sections and Elements of a Document

This chapter covers the requirements for each of the sections and elements required in the various types of documents you may have to prepare as a postgraduate. Any one document will not need all of the sections described in this chapter.

Many sections are described under most or all of the following headings:
- **Purpose**
- **Difficulties**
- **How to Write It**
- **Common Mistakes**
- **The Tense of the Verb**
- **Checklist**

For a specific type of document, use the relevant chapter for that document type in combination with this chapter.

The sections are listed in the approximate order in which they are usually found in a document.

The following sections and elements of a document are covered in this chapter. Some elements are cross-referenced to other chapters that give a detailed treatment of that element.

Title of Section or Element	Location of More Specific Material
Letter of Transmittal or Covering Letter	Chapter 10: *A Formal Letter* (*Hardcopy or Online*), page 125
Title	*Title*, Chapter 6: *A Journal Paper*, page 19
Running Title	*Running Title*, Chapter 6: *A Journal Paper*, page 20
Title Page	
Authorship and Affiliation (particularly in a journal paper)	*Authorship and Affiliation*, Chapter 6: *A Journal Paper*, page 87
Abstract/Summary/Executive Summary	Chapter 3: *Abstract, Summary, Executive Summary*, page 53
	Abstract, Chapter 6: *A Journal Paper*, page 88
Keywords	*Keywords*, Chapter 6: *A Journal Paper*, page 87

Title of Section or Element	Location of More Specific Material
Acknowledgements	*Acknowledgements*, Chapter 6: *A Journal Paper*, page 102
Table of Contents	
List of Illustrations	
Glossary of Terms and Abbreviations *or* List of Symbols	
Introduction	*Introduction*, Chapter 6: *A Journal Paper*, page 91
Background	
Theory	
Objectives	
Purpose Statement	
Scope Statement	
Procedure Statement	
Problem Statement	
Literature Review	Chapter 4: *A Literature Review*, page 63
Schedule of Tasks *or* Time Management (*or similar*)	
Allocation of Responsibilities	
Ownership/Confidentiality	
Requirements	
Costs	
Materials and Methods	*Materials and Methods*, Chapter 6: *A Journal Paper*, page 93
Results	*Results*, Chapter 6: *A Journal Paper*, page 96
Discussion	*Discussion*, Chapter 6: *A Journal Paper*, page 98
Conclusions	*Conclusions*, Chapter 6: *A Journal Paper*, page 101
Recommendations	
Suggestions for Future Research	
References *or* List of References	Chapter 15: *Referencing*, page 169
List of Personal Communications	Chapter 15: *Referencing*, page 175
Bibliography	Chapter 15: *Referencing*, page 86
Appendices	
Index	
Illustrations: Figures and Tables	

Many of these sections are described under most or all of the following headings:

1. **Purpose** or the aim of each of the sections.
2. **Difficulties** when writing the section.
3. **How to write** the section.
4. **Common mistakes** to avoid.
5. **The tense of the verb to use.**
   See Appendix 2 for guidelines for using tense in technical documents, as well as definitions and examples of the various tenses of the verb.
6. **Checklist.**

Letter of Transmittal, Covering letter

Letters that accompany a document. See Chapter 10: *Formal Letters* (*Hardcopy or Online*), pages 32.

The Title

> **For a journal paper title – see *Title*, Chapter 6: A Journal Paper**, page 86.

Purpose

- To give the reader immediate access to the main point or subject matter.
- To give informative, not generalised, information.
- To describe the contents of paper in the fewest possible words. Note: This can lead to a clumsy string of nouns. See *Noun Trains*, Chapter 207, page 214.

Difficulties

Devising a title that is:

- Short enough
- Contains all of the key information
- Makes sense (i.e. is not ambiguous, does not contain problematic syntax)

How to write it

> For the rules of capitalisation in a title, see *Title case*, Chapter 16: *Conventions*, page 196.

- Work out the information that a reader would need to gain immediate access to the main point or subject matter of your document.
- It should not be too general, not be too detailed and should contain the necessary key information.
- After your efforts to make it short, make sure that it makes sense. The structure can be lost during the quest for the minimum number of words, making it muddled and ambiguous.
- If the title is a long string of words, it may be effective to rewrite it into two parts using a colon. See *A Hanging Title*: Chapter 6: *A Journal Paper*, page 86.

Running Title

The short title required by journals for the tops of the pages. See Chapter 6: *A Journal Paper*, page 87.

A Conference Poster Title

See also *Planning the Poster*, Chapter 14: *A Conference Poster*, page 155.

- **A poster title needs to contain the key information but also to draw the attention of the poster viewers.** For this reason, it can be shorter, more punchy and possibly more querying or controversial than a title for a journal paper. Questions as titles can be provocative but they can also imply that your results are in question. If the title is too long, it will take up too much space and overwhelm the poster since the letters will be large.

  Long, informative and suitable for a journal paper.

  Dropping rates of elaiosome-bearing seeds during transportation by ants (*Formica polyctena* Foerst.): implications for distance dispersal.

  Gives the conclusion; shorter; more direct.

  Dispersal distance of elaiosome-bearing seeds is determined by ants' dropping rates.

  A question attracts the viewers' attention, but it could imply that your results are ambiguous.

  Do ants' dropping rates determine the distance dispersal of elaiosome-bearing seeds?

  Too short to contain the required information but possibly suitable for a poster.

  Do ants affect the dispersal of seeds?

- People at conferences can be interested in new methodology. If you have used a novel method, show it in the title.

  A new method for detoxification of mycotoxin-contaminated food.

- Place the title at the top of your poster. Don't be tempted to try a trendy configuration such as placing it vertically up one side.

Common mistakes

1. Uninformative. Too general or too colloquial; no good indication of the content.
2. Too long and clumsy.
3. Misleading or ambiguous; does not accurately reflect the content.

Checklist for the *Title*

☐ Does it give the reader immediate access to the main point or subject matter of your work?
☐ Does it use the fewest possible words and still make sense?
☐ Is it too long?
☐ Is it too general?
☐ Is it too detailed?
☐ Does it make sense?

The Title Page

This is usually the covering page (first page) of a longer document.

Purpose

To give the title and information about yourself and your institution and any declaration that you may need to make.

How to write it

In general, it should state:

- The title of your document.
- Your name and department, university or institution. (For guidelines on multiple authorship, see *Authorship and Affiliation*, page 87, Chapter 6: *A Journal Paper*)
- The date of submission.
- The name of the relevant person, organisation or tertiary level course to which it is being submitted.
- *Other possible elements:*
  - A declaration that it is your own work may be needed.
    Typical wording:

    I declare that this report is my own unaided work and was not copied from or written in collaboration with any other person.
    Signed…

  - *For a thesis*: The degree for which the thesis is being submitted and the institution.
    Typical wording:

    A dissertation submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in the University of Middletown

- **Layout**
  - Graduate courses will often have specific instructions about how to lay out the title page.
  - It should make a pleasing arrangement, not crowded, with plenty of empty space.
  - It should be free of gimmicks such as *ClipArt* pictures.

> **Checklist for the *title page***
>
> Does the Title Page show the following:
> - ☐ An informative title
> - ☐ Your name
> - ☐ The name of your department/faculty/organisation
> - ☐ The date of submission
> - ☐ *Possibly*: a declaration that it is your own work
> - ☐ *For a thesis*: the degree for which the thesis is being submitted and the name of the institution to which the thesis is being submitted?

Authorship and Affiliation (Particularly in a Journal Paper)

See *Authorship and Affiliation*, Chapter 6: A Journal Paper, page 87.

Abstract (can also be called a Summary)

> The *Abstract* or *Summary* is important for the understanding of the whole document. It is often poorly written and does not give adequate information.
>
> **For a journal paper *Abstract*, see *Abstract*, Chapter 6: *A Journal Paper*, page 87.
>
> **For overview information in documents other than a journal paper**, see Chapter 3: *An Abstract, a Summary, an Executive Summary*, page 53, which gives information on the following:
>
> - **The different types of content in a *Summary* or *Abstract***: descriptive, informative and descriptive/informative.
> - **The short type of *Summary* or *Abstract*** that is part of a larger document. It is generally from 200 words to half a page but will be longer in a thesis or large document.
> - **An *Abstract* for a conference paper** (usually about two pages).
> - **An Executive Summary**.

Keywords

These are needed only in a journal paper. See *Keywords*, Chapter 6: *A Journal Paper, page* 87.

Acknowledgements

Purpose

To thank staff and other people who have helped by:

- Sending you material (experimental or literature)
- Giving you technical help in your laboratory work
- Discussing your work with you
- Putting you in touch with other people
- Giving you emotional support, particularly members of your family

How to write it

- State very simply that you would like to thank the following people and state also the type of help they gave you.
  Example:

  I would like to thank the following people:
- If you feel particularly grateful to someone, start by saying ***I am particularly grateful to***… *for*… *I would also like to thank*…, *and* then list their names and state what they did.
- Make sure that you include the following:
  - Not only the surname of a person you are thanking but also the first name or the initials.
  - The person's correct title (Dr, Associate Professor, Ms, Mr and so on). If you don't know it, make a point of finding it out, if necessary by telephoning their institution.
  - Their department/institution/organisation.

Common mistakes

- Using flippant wording. It is possible to sound patronising or silly.
- Not including people's first names or initials and their department and institution. Wrong*: I would particularly like to thank Dr Stevens for giving me samples of*… Corrected: ***I would particularly like to thank Dr A. J. Stevens, Department of Evolutionary Biology, University of Middletown, for giving me samples of***…

Table of Contents (*or* Contents Page)

Purpose

To give a listing of the headings and subheadings, together with their corresponding page numbers.

Difficulties

- Deciding on an appropriate layout.
- Formatting it correctly so that the indentations are consistent.
- Making sure that the page numbers in the text correspond with those on the Table of Contents.

All of these problems can be eliminated by using the facility on your word processor that automatically constructs and formats your *Table of Contents*. See ***The Outline Mode of Microsoft Word®: Organising a Document***, Chapter 1: *Structuring a Document: Using the Headings Skeleton*, page 11.

How to write it

If you are not using the word processor's facility, use the following guidelines:

- Decide the lowest level of heading to display on the *Table of Contents* (e.g. whether you want to go down to the subheading level or to the sub-subheading level).
- List all of the sections and all of their subheadings down to your chosen level down the left-hand side of the page.
  - Number the sections and their subheadings by the accepted conventions, using the decimal point numbering system (see *Numbering of Illustrations, Sections, Pages, Appendices, Equations*, Chapter 16: *Conventions*, page 192).
  - If you are indenting for subheadings, make sure that the indentations are consistent for each level of heading.
- Place the corresponding page numbers at the right-hand side of the page.
  - Use the accepted conventions for the page numbering system (see *Numbering of Illustrations, Sections, Pages, Appendices, Equations*, Chapter 16: *Conventions*, page 192).
- Don't list individual figures on the *Table of Contents*. If you have a lot of illustrations (e.g. as in a thesis), you need a section called List of Illustrations, which immediately follows the *Table of Contents* (*see* List of Illustrations, *this chapter*).
- Conventionally, the *Abstract* or *Summary* is not listed on the *Table of Contents.* However, it may help the reader to do so, even though it is placed immediately after the *Title page* and is therefore easily found. This has been done in the example below.

Common mistakes

1. Mismatches between the text and *Table of Contents* in the wording and numbering of the various headings, together with their corresponding page numbers.
2. Inconsistent formatting and indenting of the various levels of headings.

Example: Table of Contents

Checklist for the Table of Contents

To use while checking these features: see *Numbering of Illustrations, Sections, Pages, Appendices, Equations*, Chapter 16: *Conventions*, *page* 192.

☐ Does it list the preliminary pages and give their page numbers in Roman numerals system?
☐ Does it list the following:
   - Chapter headings
   - Section and subsection headings
   - The List of References section
   - Each appendix?
☐ Does it give the correct section number of the sections, subsections, the *List of References* section and each appendix?
☐ Does each appendix have a title?
☐ Do the page numbers match up with those in the text?
☐ Is it consistently formatted? Are the indentations of the sections and subsections consistent?
   Note: You can avoid the last two problems by using the automatic Table of Contents function in your word-processing software.

List of Illustrations

Purpose

To list – separate from the *Table of Contents* – the numbers, titles and corresponding page numbers of all your tables and figures.

How to write it

- The term *illustrations* includes tables and figures (graphs, line drawings, photographs, maps and so on). Use the title *List of Illustrations* if your document contains both tables and figures. If it contains only tables, call it *List of Tables*; if only figures, use *List of Figures*.
- If you are using *List of Illustrations*, list all of the figures first, followed by a list of all of the tables.
- List the number, title and page of each illustration.
- Place the *List of Illustrations* immediately after the *Table of Contents*. If both of them are brief, put them on the same page with the *Table of Contents* first.

Common mistakes

Mismatches often occur between the features of the text figures and tables and the way they are listed in the *List of Illustrations*. Use the automatic Table of Contents function in your word-processing software to avoid this.

Checklist for the list of Illustrations

To use while checking these features: see *Numbering of Illustrations, Sections, Pages, Appendices, Equations*, Chapter 16: *Conventions*, *page* 192.

☐ Are all of the figures listed first and then the tables?
☐ Are the number, title and page of each illustration given?
☐ Do the page numbers match up with those in the text?
☐ Conversely: **In the main text**, do the illustration numbers in the text match those in the *List of Illustrations*?

Glossary of Terms and Abbreviations (or List of Symbols, when dealing with only mathematical symbols)

Purpose

To define the specialist terms, symbols and abbreviations (including acronyms) that you use in the main text of the document.

How to write it

- Decide terms that need definitions. Remember that a term self-evident to you may not be as generally known as you think. Even when you are writing a specialist document that will be read only by experts – such as a thesis – your referees will appreciate a list of clearly defined terms.
  Make sure, though, that you don't include terms that are generally very well known; to define them would look silly.
- Terms that need to be dealt with include the following:
  - Specific technical terms.
  - Greek or other symbols.
  - Abbreviations (usually called acronyms). These are often in the form of the initial letters in capitals of a series of words, e.g. **PCR: polymerase chain reaction; PLC: programmable logic controller.**
    List the terms in alphabetical order of the abbreviations, followed by the definition of each one, e.g.:

    PCR   polymerase chain reaction
    PLC   programmable logic controller

- Before you list the terms and abbreviations, it may be appropriate to state the following:

  S.I. (Système International d'Unités) abbreviations for units and standard notations for chemical elements, formulae and chemical abbreviations are used in this work. Other abbreviations are listed below.

Where to put it

The *Glossary of Terms* can be placed either at the beginning of the document immediately after the *Table of Contents* or the *List of Illustrations* (this is the optimal position for the reader), or at the end, immediately before the Appendices.

If the glossary is large, and you feel that it needs to be at the end of the document, readers would appreciate a note placed immediately before the *Introduction*, referring the readers to the page number of the glossary. Suggested wording:

Explanations of terms and abbreviations used in this document are given in the *Glossary of Terms and Abbreviations*, page 27.

Introduction

> **For material specific to a journal paper *Introduction*, see Chapter 6: *A Journal Paper*, *page* 91.**

Purpose

1. To allow readers to understand the background of the study without needing to consult the literature themselves. You should keep your reader adequately informed but not write an overly long *Introduction*.
2. To point out the relationships between the various authors' works – the correlations and contradictions.
3. To show gaps in the knowledge, correlations, contradictions and ambiguities.
4. Having pointed out the gaps in the knowledge, to state the main objective of the work described in your paper (often unclear or missing).
5. To provide a context for the later discussion of the results.
6. To define specialist terms used in the paper.
7. In a longer document: to describe the structure of the document.

Note: For guidelines for writing a self-standing literature review, see Chapter 4: *A Literature Review*, page 63. This is often required as a chapter in a thesis or as a separate assignment.

Difficulties

The *Introduction* can sometimes be a difficult section to write due to the following most common problems:

- **Writing too much**. It can happen you waste time including too much material in to an *Introduction* that then needs to be cut down.
- **Deciding how much background detail to include.** This is especially difficult when your readers are made up of both specialists and non-specialists.
  For specialists: a thorough introduction to the topic may sound patronising.
  For the less knowledgeable: too little information may leave them unclear about what you are trying to achieve. Graduate students trying to gain familiarity with the subject often find *Introductions* too short and uninformative.

- **Deciding how many references to include.**
- **Writing a good first sentence.** The first sentence shouldn't be a banal statement of general knowledge. It needs to provide an overall introduction, but be specific to your particular problem. It can be difficult to think up, and people sometimes resort to a trite statement of the obvious. For example:

  Toxic waste is a very serious problem in the world today.

  Even pompously dressing it up can't disguise the banality:

  The quantity of toxic waste currently generated in the world is a problem of the utmost seriousness.

- **Long documents: final paragraphs:** After stating your purpose and approach, in a fresh set of paragraphs, briefly describe the structure of the document.
  Section 4 gives the historical background…Section 5 reviews the current techniques… and so on.
- **For a document that contains both an *Introduction* and a *Literature Review*:** The *Introduction* in this case will be made up of a description of the general background to the study, with only a few references, together with a description of the structure of the document.

Tense of the verb in the Introduction

See *The Correct Form of the Verb*, page 224, Chapter 18, *Problems of Style*, for guidelines on using tense in technical documents, together with examples of the various forms of the tenses of the verb.

The *Introduction* needs a mixture of present and past tenses.

Example:
It has been previously shown (*past*) that plants flower (*present, because it's established knowledge*) under environmental conditions that maximise seed set and development… Much work has been done (*past*) towards understanding the environmental, physiological and genetic regulation of flowering in the species under study… *Author name* (20xx) showed that the mutants flowered (*past*) later than wild-type plants; GI was therefore proposed (*past*) to be a floral promotion gene. This work describes (*present*) research undertaken to verify the isolation of…

Common mistakes

- Too long, rambling, unspecific, unstructured, with irrelevant material.
- Specialist terms not defined.

Introduction: checklist

Checklist for the Introduction

For a checklist for a journal paper *Introduction*, see Chapter 6: *A Journal Paper*, page 93.

Does the Introduction do the following:

☐ Adequately reviews other people's work?
☐ Identifies the gaps in the knowledge and inconsistencies in this area of research?
☐ Gives a historical account of the area's development? (if appropriate)
☐ Puts your study into the context of other people's work?
☐ *Clearly* states the purpose of your study in the final paragraphs?
☐ Follows the purpose statement by briefly summarising your approach?
☐ Briefly describes the structure of the document? (*in a long document*)

Background

If you are writing a report, you may prefer to call your section *Background* instead of *Introduction*. If so, all of the guidelines given previously for an *Introduction* apply also to a *Background* section.

Some organisations, in particular consulting engineers, may require both an *Introduction* and a *Background*. In this case, the differences are the following:

• The *Introduction* usually includes a restatement of the brief and a description of the structure of the report.
• The *Background* gives the history of the subject matter and the objectives of the study. Alternatively, the objectives can be stated in a separate *Objectives* section.

Theory

If a description is needed of the theoretical background of your work, it should be written for a busy professional in your discipline who has a good, broad understanding of the area but no detailed knowledge. This means that the description of the theory should not start at an elementary level and should include the material that you think such a person would need and be no longer than needed.

Objectives

Purpose

To describe the aims of your study.

How to write it

- This section should be very brief and concisely stated.
- The objectives can be listed:

> The objectives of this study were:
> 1. To (*establish the…*)
> 2. To (*determine the…*)

- In a longer document such as a thesis or a research proposal, it is effective to first state the broad purpose and then follow with the specific objectives:

Aims of this study

The purpose of this study was to investigate the development and structure of bacterial biofilms grown on different specific substrata in a subsurface-flow wetland.

The specific objectives of the research were to:
- **develop methods for investigating biofilms grown on different substrata in a constructed wastewater treatment wetland**
- **investigate the initial adsorption of bacteria to different wetland substrata, namely…**
- **study the early development of biofilms and their population structures.**

Purpose Statement, Scoping Statement (or Scope), Procedure Statement, Problem Statement

Some documents, particularly consulting or management documents, require one or more of these four sections. They present material that in other reports is covered in sections such as the Introduction, Background, or Procedure/Methods. They answer the following questions:

Question	*Section that Answers the Question*
What is the purpose (objective) of this report?	Purpose statement
What is the problem? What is its significance?	Problem statement
Who or what caused the writer to write about the problem?	
What are the specific topics and their limits that the report covers?	Scope statement
What procedures were used to investigate the problem?	Procedure statement

Purpose statement

Purpose

To state the purpose of the document (the equivalent of the *Objectives* section).

How to Write It

1. State the purpose clearly. 'The purpose of this report is…' (to solve whatever problem made the report necessary or to make whatever recommendation).
2. Name the alternatives if necessary.

Problem statement

Purpose

To describe the problem and its significance

How to write it

Probably in this order:

- Describe the problem, giving the basic facts about it.
- Explain what has gone wrong.
- Specify the causes or the origin of the problem.
- Describe the significance of the problem (short term and long term).
- Give the appropriate data and state their sources.
- Specify who is involved and in what capacity.
- Discuss who initiated the action on the problem or what caused you to write the report.

Scope statement

Purpose

To describe the topics covered in a report.

How to write it

- **For a feasibility study or recommendation report:** name the criteria you used to formulate the requirements.
- **For other types of reports:** identify the main sections or topics of the report.
- Specify the boundaries or limits of your investigation.

Procedure statement

Purpose

To describe the processes you followed in investigating the topic of the report. This statement establishes your credibility by showing that you took all the proper steps. In a standard experimental report, this material is covered in the *Procedure/Materials and Methods/Methodology* section.

How to write it

Explain all of the actions you took, including the people you interviewed, research performed and so on.

Literature Review

Purpose

- To review the literature in your field of work.
- To show that you have a good understanding of the history and current state of your topic.

    See Chapter 4: *A Literature Review*, page 63.

A Section Covering Your Planning of Tasks

Suggested headings for this section are **Schedule of Tasks** *or* **Time Management.**

Purpose

To describe how you propose to schedule the various tasks that you will have to do.

How to write it

This involves intelligent and informed guesswork. The most convenient way of showing a time schedule is to use a Gantt chart. This subdivides your proposal into tasks together with the dates when you propose to begin and end each one. It is a version of a bar chart (see Figure 2.1).

Points to remember when compiling a Gantt chart:

1. You need to assess:
   - The number of tasks
   - How long each task is going to take
   - How you can fit each task with another
2. **Most tasks will overlap with each other**. For instance, if your first task is to get a preliminary understanding of the literature, this is likely to overlap with the first stage of your experimental process.

Allocation of Responsibilities

This section may be needed in a report from a project team.

- In a preliminary report, describe the person(s) who will be responsible for each task and the roles of the subsidiary individuals.
- In a final report, you may need to give a more detailed account of the various roles that each person has played in the progress of the work and the writing of the report. In addition, you may be asked for a peer review of each person. This calls for an objective assessment of the effectiveness with which each person fulfilled his or her roles.

PLANNING SCHEDULE – 20xx

Research Project: **Modification of a pulsatile pump for an isolated heart**

No.	Activity	Feb	Mar	Apr	May	June	Estimated no. of hours
1.	Literature search	▓	▓				20
2	Test and assess the current pumping system	▓					40
3	Design the modifications to the current system	▓	▓				20
4	Build components		▓				40
5	Assemble, test and evaluate the rig		▓	▓	▓		60
6	Modify and retest the rig if necessary				▓		50
7	Evaluation of the final results			▓	▓	▓	40
8	Write the final report				▓	▓	60
					Total Time (hours)		330

Figure 2.1 Example of a Gantt chart for time scheduling.

Ownership/Confidentiality

Purpose

An agreement between you and the commercial organisation funding you that gives you some right of publication of your results, while assuring the organisation that you will not divulge commercially sensitive information.

When needed

This section may be needed in a research proposal.

For academic projects, it is essential that the rights to publish scientific papers and theses are retained. On the other hand, many commercial organisations will want to own the rights to the outcomes of your research so that they can commercialise them. Moreover, all commercial organisations will expect you to maintain in confidence any commercially sensitive information that they provide to help the research or that results from the project.

How to write it

The wording of the proposal should be tailored to the specific circumstances. Terms for ownership should be agreed to before any work starts, but at the proposal stage, it may be sufficient to state that these are to be negotiated.

Requirements

Purpose

To describe what you expect to need from your funding organisation during your research.

How to write it

Possible wording:

To complete this work, we will need the following from (*name of the organisation*):

Then give a list of your requirements. The types of things that you may have to request are:

- Guaranteed access to the field site, the organisation's laboratories, test hall and so on.
- Access to specified items of the organisation's equipment.
- Assistance with the preparation and/or installation of specified items of equipment.
- A laboratory base with access to power, water and bench space.

Costs

Purpose

To describe your expected costs during the course of your research that you are asking the funding organisation to cover.

How to write it

It needs to an itemised list of the various costs. You may need to include such things as the following:

- Student stipend
- Supervisory costs
- Materials and equipment
- Travel costs
- Overheads

State the total final cost (the so-called *bottom line*).

Materials and Methods (can also be called Methods or Procedure)

> See also *Materials and Methods*, Chapter 6: *A Journal Paper*, page 93, for detailed material on how to write it, tense of the verb, common mistakes and a checklist. This material is also useful for any document that describes experimental work.

Purpose

- To describe your experimental procedures.
- To give enough detail for a competent worker to repeat your work.
- To describe your experimental design.
- To enable readers to judge the validity of your results in the context of the methods you used.

Difficulties

Not many. This section is often the easiest part of a document to write. Describing experimental methods is usually very straightforward.

Therefore it is often the best place to start writing. Writing a document is often difficult, and there is absolutely no need to write it in sequence from beginning to end. Start with the section that will give you the fewest problems.

See also *Starting to Write a Journal Paper*, Chapter 6: *A Journal Paper*, page 84.

Results

> See also *Results*, Chapter 6: *A Journal Paper*, page 96, for detailed material on how to write it, tense of the verb, common mistakes and a checklist. This material is also useful for any document that describes experimental work.

Purpose

- To present your results, but not to discuss them.
- To give readers enough data to draw their own conclusions about the meaning of your work.

Difficulties

Deciding how much detail to include.

General comments

- Your results need to be clearly and simply stated. This is the new knowledge that you are presenting to the world; it is the core section of the document.
- **It needs to be presented as a logical story.** If it is interrupted by material that is too detailed or is not directly relevant, your readers are going to become disorientated and lose the thread.
- It is often the first place that readers familiar with the topic will look (after the *Title* and the *Abstract*). Many readers, after first reading the *Abstract*, then look at the illustrations. (This highlights the need for illustrations to be as self-explanatory as possible, by means of informative titles and captions.)

Structuring of Corresponding Headings for *Materials and Methods* and *Results* Sections

If your work has a number of separate experimental elements to it, group the procedures and the results for each element together. Don't describe all of the procedures in sequence, and then follow with all the results in sequence. This will result in a poorly structured document that is difficult for your assessor to read.

If appropriate, you can include a short *Discussion* section for each separate part and follow up with an overall main *Discussion*.

Schematic

Efficient Structure	*Poor Structure*

First experiment
  Procedure
  Results
  Discussion
	Procedures
	  Description for first experiment
	  Description for second experiment
	  Description for third experiment
	  Description for fourth experiment

Second experiment
  Procedure
  Results
  Discussion
	Results
	  Results for first experiment
	  Results for second experiment
	  Results for third experiment
	  Results for fourth experiment

etc. • • • **Overall Discussion**	**Discussion**

Results and Discussion

If it is possible to write a *Results and Discussion* section, then do so; it is often easier to write and better for the reader than separate *Results* and *Discussion* sections.

Formula for a *results and discussion* section

Efficient Structure
First set of results Discussion of them
Second set of results Discussion of them
etc. • • • **Overall *Discussion* incorporating the conclusions**

Discussion

See also *Discussion*, Chapter 6: *A Journal Paper*, page 98 for detailed material on how to write it, tense of the verb, common mistakes and a checklist. This material is also useful for any document that describes experimental work.

This section is almost always required in a journal paper and is often appropriate to other types of documents.

In a *Discussion* section, show the relationships among your observations and place them into the context of other documentation and other people's observations and work.

Purpose

1. To show the significance of your results and how your results lead to your conclusions.
2. To explain how your results support the answer.
3. To show the relationships among your observations.
4. To put the results into context.
5. To state clear conclusions, unless there is a *Conclusions* section in your document.

Difficulties

Not knowing where to start, what or how much to put in it and how to create a logical flow.

Conclusions

> See also *Conclusions/Conclusion*, Chapter 6: *A Journal Paper*, page 101 for detailed material on how to write it, tense of the verb, common mistakes and a checklist. This material is also useful for any document that describes experimental work.

Purpose

To present the conclusions that arise from the material in the document.

How to write it

*   *Important*: There should be no new material in this section. Each conclusion must be drawn directly from material that has already been presented in the main body of the report, and it must be well substantiated.
*   Each conclusion should be related to specific material.
*   Each conclusion should be brief (because the full explanation is given elsewhere in the document).
*   A numbered or bulleted list can be used if appropriate. Start with the main conclusion and then present the conclusion points in descending order.
*   If there are a large number of conclusions, they can be grouped under headings as shown in the box. In this case, ensure that the numbers run sequentially through the whole list to make them more readily identifiable.

Example: *Conclusions* section

Public health issues
1. The waters of the basin continue to present a significant risk to human health owing to sewage pollution.
2. Sewer overflows are a major source of pollution; they contribute over 98% of the faecal coliform pollution load to the basin and half of the nitrogen load.
3. etc.

Water quality
4. The water in the basin is very highly loaded with nutrients, mainly from sewage overflows.
5. Storm water is also a major source of pollution.
6. etc.

Siltation
7. Sedimentation plates indicate that the level of siltation in the basin has increased from 3 to 6.5 mm per year over the past 20 years.
8. Sediment quality is fair and is not considered to present an abnormal health risk.
9. etc.

Recommendations

Purpose

To propose a series of recommendations for action, resulting from the conclusions drawn from your work (e.g. a design improvement, management strategies and so on).

Position in the document

In a formal technical document, the section *Recommendations* is usually placed either.

- At the start of the document, immediately after the Summary
- At the end of the document, often usefully combined with the *Conclusions* into a section called *Conclusions and Recommendations.*

How to write it

1. Recommendations are your subjective opinions about the required course of action, but this doesn't mean you should go into wild flights of fancy.
2. **Recommendations can be of various types.** Their character will depend on the purpose of your report, e.g.:
   - To choose a new procedure or technique and show why it is preferable
   - To identify a need and suggest a way to fill it

- To explore a new concept and show how it should be applied to existing problems
- To propose a new project and show why and how it should be carried out
- To analyse a problem, find a solution and propose a remedy

3. Recommendations are usually best given as a numbered list. Each item should be brief.
4. Make the main solution to the problem your first recommendation. This usually fulfils the purpose of the report.
5. Then list your other recommendations in a logical way.
6. No recommendation should be unsupported. The supporting information should exist elsewhere in the document.

Tense of the verb

See Appendix 2 for guidelines for using tense in technical documents, along with definitions and examples of the various tenses of the verb.

The conditional, subjunctive or present form of the verb should be used. It can also be worded as a series of instructions (the imperative form of the verb).

Examples:

It is recommended that:
  The test equipment should be modified as shown in Figure 4.3 (*conditional*).
  The test equipment be modified as shown in Figure 4.3 (*subjunctive*).
  The test equipment is modified as shown in Figure 4.3 (*present*).

or:
The recommendations are:
  Modify the test equipment as shown in Figure 4.3 (*imperative*).

Checklist for the *recommendations*

☐ Is the first recommendation in your list the most important one?
☐ Are the other recommendations presented in descending order of importance?
☐ Is each recommendation brief, clearly stated and unambiguous?
☐ Is each recommendation feasible?
☐ Is each one related logically to material presented elsewhere in the report?

Suggestions for Future Research

Purpose

To propose directions for further development of your work.

Research usually opens up more questions than you have time to answer. Many people are unwilling to draw a line under their research and start writing up because it always seems that just a bit more work will tie it up better.

This can be professionally acknowledged by including this section. It may be called *Suggestions for Future Development* or *Suggestions for Further Study*. Check

with your supervisor; for reasons of competitiveness, some may be unwilling to indicate future directions.

How to write it

Outline the following:

- Suggestions for the immediate development of the work, i.e. the areas you may not have been able to tie up to your satisfaction. If your project is to be developed by a subsequent student, this will be very useful to both student and supervisor.
- The possible long-term development of the work, if any.

List of References *or* References

See Chapter 15: Referencing, page 176.

List of Personal Communications

See Chapter 15: *Referencing, page* 175.

Bibliography

See Chapter 15: *Referencing*, page 186.

Appendices

Note the singular and plural of the word, which is sometimes a source of confusion: one *Appendix*; two or more *Appendices*.

Purpose

The appendices are for complex material that would interrupt the flow of your document if it were to be inserted into the main body, e.g. raw data, detailed illustrations of equipment, software coding, specifications, product descriptions, charts and so on.

How to assemble the Appendices

1. Appendices are placed at the end of the document.
2. Material included in an appendix should be there for a specific purpose. It is all too easy to use the Appendices as a sort of rubbish bin into which you tip all the bits you've collected and don't know what else to do with. To avoid an irrelevant, jumbled mess, be selective.

3. Appendices should contain well-structured information, not a formless mass.
4. Related material should be grouped into separate Appendices.
5. Give each Appendix a number or a letter (e.g. Appendix 1, Appendix 2,… *or* Appendix A, Appendix B,…). See *Numbering of Appendices*, Chapter 16: *Conventions*, page 194.
6. Give each appendix a title following the appendix number.
   Example – **Appendix 3: Input File Formats.**
7. The number and title of each appendix should be listed in the *Table of Contents* (*see Table of Contents*, this chapter, page 23).
8. Every item that is included in an appendix should be referred to at an appropriate place in the text.

For Twintex TPP specifications, see Appendix 3: *Technical Data and Specifications***, page 13–21.**

Common mistakes

1. Too much unrelated and unnecessary material in the appendices.
2. Lack of organisation of the material.
3. Lack of numbering and titling of each appendix.
4. Some or all of the *Appendices* not referred to in the text.

Checklist for the *Appendices*

To use while checking these features, see *Numbering of Illustrations, Sections, Pages, Appendices, Equations*, Chapter 16: *Conventions*, *page* 194.

☐ Is the body of the document unnecessarily cluttered? Could some of the material be more appropriately placed in the *Appendices*?
☐ Is there material in the *Appendices* that might be better placed in the main text of the thesis? Does it weaken the argument to have it in the *Appendices*?
☐ Do the *Appendices* look like a rag-bag of assorted bits gathered together because you didn't know what else to do with them?
  • If so, can you order the material more logically?
  • Does it all really need to be included?
☐ Are complex sets of data in the *Appendices* summarised at the appropriate points in the main body text?
☐ Is each *Appendix* titled?
☐ Does the title of each *Appendix* appear in the *Table of Contents*?
☐ Is each *Appendix* referred to in the text?
☐ Is the first reference to it in the text at the first appropriate point, or should it be earlier?
☐ Should you refer to it again later in the text?
☐ Have you given enough details for your examiner to be able to interpret the appendix?
☐ Are the *Appendices* numbered or lettered consecutively?
☐ Does the title of each *Appendix* correspond with that listed in the *Table of Contents*?

☐ Does each illustration in the *Appendices* have the following:
  · An appropriate number (e.g. Figure 1: Appendix B)
  · An informative title
  · Enough information to be interpreted
☐ Is each page in the *Appendix* numbered?

Index

Purpose

At the end of long documents, a list in alphabetical order provides topics mentioned in the book and the pages where they occur. An index makes your material more readily accessible to your readers.

How to compile an index: guidelines

· A helpful index is compiled with the readers' needs in mind.
· Think about how you would look for this item in an index, i.e. how you would classify it, what subsections you would look under and to which other entries you might cross-refer.
· There are features available in word-processing software that allow you to mark the items that should be included in an index. However, a manually assembled index that takes into account the search terms a reader might use is often much more intelligent.
· Include every important subject, topic, subtopic and proper name.
· Entries are usually not capitalised.
· Most indexes consist of two levels of entries: main headings and subheadings, if necessary. Occasionally, a third-level heading may be needed.
· Use cross-references at appropriate places to guide the reader to other related entries in the index. A cross-reference is usually placed either after the main heading or at the end of the list of subheadings, with *see also* in italics before the cross-reference.

Example of a three-level index entry with a cross reference to another entry:

hovering, 218–234 *see also* **flight**
  actuator disc theory, 218–226
  blade element theory, 226–230
    applied to animals, 230–232
  hummingbirds, 224–235
  mandarin fish, 232–233
  wasps, 233–234

Illustrations

This section gives general guidelines about the subject of illustrations in general. It does not aim to tell you how to produce effective graphics. Here your best guide is the expertise of other students. There is also a wealth of information online that can be helpful.

Definition of terms

Caption/legend

Each illustration has a figure number, a title and an explanation. This explanation is supplied by the *caption* and the *legend*. These two terms are sometimes distinguished from each other, but they are more often confused or considered synonymous (*A Manual of Style*, University of Chicago Press, 1969). To avoid confusion, this book uses only the term *caption* to describe the explanatory material that follows the title of an illustration.

For the conventions for numbering illustrations, see *Numbering of Illustrations*, Chapter 16: *Conventions, page* 192.

Each illustration must have a clear purpose. Ask yourself what your readers will need to help understand the text. For instance, they may not need a diagram of a standard piece of equipment, but they may appreciate a diagrammatic representation of how you modified it. Figures therefore need to be as self-explanatory as possible.

Make each illustration as self-contained as possible. Remember, to make a preliminary assessment of the work, readers often skim through a document looking first at the figures before they read the text. Each graph, table or diagram should not need the reader to refer to the text to make its overall meaning clear.

Guidelines for illustrations:

1. Make sure each illustration has the following:
   - A**n informative title** (*for the principles of devising titles, see page* 19, *The Title, this chapter*).
   - A **clear, explanatory caption** following the title.
2. **Use as few abbreviations as possible in an illustration**. **If you must use abbreviations, include a key in the illustration itself.** For instance, if you have been sampling at sites that you have, for convenience, called AO3, BV4 and so on, try not to use these as headings in a table. Instead, do one of the following:
   - Think up short labels that give a better description of the characteristics of each site.
   - Include a key to the labels in the illustration.
3. **Make your illustrations look professional.** Find out from other students the best software packages to use.
4. **Emphasise the data, not the axes.** The axes should be thinner than the curve or plot lines. Most graphing programs will do this.
5. **Make sure that the axes on each graph are fully labelled.** Each axis must be labelled with what is being plotted and the units. (***Common mistake:*** leaving out the units.)
6. **Don't extend the axes too far.** The X and Y axes should extend only to the next tick mark after the maximum value for the data. Graphing programs usually do this.
7. **Make sure that there are not too many lines on your graphs**. It is better to create two graphs than to have one that is overcrowded. Graphs with more than four lines are likely to be difficult to read, especially if the lines overlap.

8. **Make each line on a graph easily distinguishable from the others**. Some software packages do not create symbols that adequately distinguish one line from another.

9. **Include in an appendix the raw data on which important graphs are based.** Refer to the appendix at the appropriate point in the text. This enables the reader to assess the exact values of the data.

10. **Make sure that your illustrations will be big enough.** It is very easy to compress an illustration until it is almost unreadable. Take particular care that any labelling is large enough, particularly subscripts and superscripts.

11. **Keys:** Usually the key is given in the illustration itself, but sometimes it can be included in the title.

12. **Numbering of illustrations:** To use while checking these features, see *Numbering of Illustrations, Sections, Pages, Appendices, Equations*, Chapter 16: *Conventions*, *page* 192.

    With all the reformatting that a large document may need, it is all too easy to get the figures out of sequence or to refer in the text to a figure that doesn't exist. It is worthwhile to use the feature of a word-processing package that automatically correlates text references to a figure with its figure number.

13. **If your document has a lot of illustrations:** You need to include a *List of Illustrations*: for the conventions; see *List of Illustrations*, page 26, this chapter.

14. **Using other people's illustrations and data:** Cite the source at the end of the caption to the illustration, and include the source in your *List of References*. See *Copying and Adapting Illustrations*, Chapter 15: *Referencing*, page 175.

Checklist for *Figures*

To use while checking these features, see *Numbering of Illustrations, Sections, Pages, Appendices, Equations*, Chapter 16: *Conventions*, page 192.

☐ Is the figure needed?
☐ Could it be simplified?
☐ If it is a graph, are there too many lines? Would it be better to consider having more than one graph to illustrate the point?
☐ Is the material better presented as an illustration in the text or as an illustration in the *Appendices*?
☐ Is each figure numbered consecutively, logically and consistently?
☐ Is there enough detail in the figure's title, caption (legend) and keys for an overall interpretation of the figure without reference to the text?
☐ Does the title correspond with that given in the *List of Figures*?
☐ If you have used or modified someone else's figure, or used someone else's data to construct your own figure, have you done the following:
 • Cited the source in the caption (legend) to your figure?
 • Used the wording required by referencing conventions?
 • Cited the source in your *List of References*?
☐ *For any document other than a journal paper*: Is the figure close to but following the place where it is first mentioned in the text?

Checklist for *graphs*

☐ Are the *x* and *y* axes labelled?
☐ Are the units of measurement stated on the axes?
☐ Are the lines clearly distinguishable from each other?
☐ Are the symbols marking the points clearly distinguishable from each other?
☐ Are all the components of the figure clearly labelled?
☐ Are abbreviations explained? If not, are they well known? Are you sure?
☐ Does the arrangement of the figure proceed from left to right?
☐ Does the figure look cluttered and illogical?
☐ Is the figure correctly positioned on the page?
☐ Is the raw data of important graphs presented in the *Appendices*?

Designing Tables

- For more information about *Tables* for posters, see *Tables* in Chapter 14: *A Conference Poster*, page 161.

Good design of tables can help the reader find the information efficiently. Disorganised, poorly designed or cluttered tables are visually hurtful and can easily put a reader off.

When to use a table

- When you do not need to show trends pictorially (such as a graph).
- When you need to present accurate data and specific facts (e.g. graphs with data that have to be interpolated and are therefore only approximate).
- To demonstrate the relationships between numerical and/or descriptive data.

Do not use unnecessary tables. Your data might be better presented as a graph or given more concisely in the text.

Guidelines for designing tables

The Parts of a Table

- **Boxhead:** The horizontal region across the top of the table containing column headings.
- **Stubhead:** The vertical column to the far left of the table in which you list the various line headings that identify the horizontal rows of data in the body of the table.
- **Spanner head:** A region that spans the head of two or more columns. Used for related parameters and to reduce repetition in the column heads.
- **Body spanner:** A region that spans across two or more columns in the body of the table.
- **Column heads:** Must all have headings as described here:
  - The headings should include units of measure, where appropriate, and any scaling factors used.
  - Headings should be short. A maximum of two lines is a general rule. If absolutely necessary, use abbreviations and define them in footnotes. But avoid abbreviations if at all possible (Figure 2.2).

Stub head	Column head	Column head	Spanner head	
			Column head	Column head
	Body spanner			
	Column entry			
	Body spanner			
	Column entry			

Box Head

Figure 2.2 The parts of a table.

Direction of reading information

- Information always reads *down* from the boxhead.
- Information reads *down* from the stubhead.
- Information described by the stubhead reads *across*.

Guidelines for designing tables

- The independent variable (e.g. time) usually reads across the table.
- The dependent variable (e.g. test number) reads vertically.
- Every column or spanner head needs a unit of measurement (or some explanation if the values are arbitrary rather than measurements).
- It is more clear to put the unit in the head rather than in the entries, e.g.:

This is better…	…than this
Temperature (°C) 40 60 100	*Temperature* 40°C 60°C 100°C

- **Spanner heads** help to combine data and avoid repetition. Instead of repeating the unit of measurement after two or more column heads, a spanner head can be used:

Average daytime temperatures °C	
1999	2000

- **Body spanners** are effective ways to divide data sets, e.g. data from men, data from women.
- **Important:** Columns are easier to compare than rows because we are more used to running our eyes down a column to compare data than running our eyes across. In Table 2.1,

Table 2.1 Maximum Tensile and Compressive Stresses of the Bones of the Wing of
Pteranodon ingens

Bone	Tensile Stress σ_t (MPa)	Compressive Stress σ_c (MPa)
Metacarpal	68	73
First phalanx	70	75
Second phalanx	113	123
Third phalanx	215	230
Fourth phalanx	146	174

From M. Johnston (1997) An aeroelastic model for the analysis of membrane wings and its application to yacht sails and *Pteranodon ingens*

Table 2.2 Maximum Tensile and Compressive Stresses of the Bones of the Wing of
Pteranodon ingens

Bone	Metacarpal	First Phalanx	Second Phalanx	Third Phalanx	Fourth Phalanx
Tensile stress σ_t (MPa)	68	70	113	215	146
Compressive stress σ_c (MPa)	73	75	123	230	174

Note: This is the same data as in Table 2.1, but the rows and columns are reversed.

it is very easy to see by running down the columns that the third phalanx of *Pteranodon ingens* has higher tensile and compressive stresses than the other bones. This is not obvious from Table 2.2, where the data in the rows and columns have been transposed.

- Plan your table so that there is adequate spacing of columns and to avoid splitting the table across two pages.
- Any table too wide to fit upright on a page should be presented in landscape mode so that it is read from the right-hand side of the page.
- **The table number and title are placed *above* a table; the title of a figure is placed *below* it.** This is just one of those strange conventions that you have to stick to.
- **Make the table as self-contained as possible.** Readers will often look at tables and figures first to assess the key points of the results without first reading the text. To make sure that it contains the key information needed, do the following:
  - Give it an **informative title**. The readers should be able to understand the table without looking for the relevant part of the text. The title should typically include these items:
    - The independent variable(s)
    - The dependent variable(s)
    - The concept or the species studies
- A **comprehensive but concise caption (legend)** that includes definitions of the symbols.
- **Footnotes** can be used for the following:
  - To define abbreviations
  - To explain a missing entry

- To explain an entry that seems anomalous
- To explain where an entry had different conditions from those in the rest of the table
- To expand a shortened entry
  But don't let footnotes take over the table. If there are too many, you need to reassess the method of presentation of the data. A table may not be appropriate.
- **If any table is taken from another source**, the reference should be cited in the legend to the table. See *Copying and Adapting Illustrations*, Chapter 15: *Referencing*, page 175.

Checklist for *Tables*

To use while checking these features, see *Numbering of Illustrations, Sections, Pages, Appendices, Equations*, Chapter 16: *Conventions*, page 192.

☐ Is the table needed?
☐ Could the data be better presented as a figure?
☐ Is the material better presented as a table in the text or as a table in the *Appendices*?
☐ Does each table deal with a specific question?
☐ Does the table have a clear, uncluttered layout? Could it be simplified?
☐ Does each table show what the text says it shows?
☐ Are all the tables numbered consecutively?
☐ Is your numbering system consistent throughout the document?
☐ Does the title correspond with that given in the *List of Tables* or *List of Illustrations*?
☐ Does the page number where the table appears correspond to that given in the *List of Tables* or *List of Illustrations*?
☐ Are all of the tables of a similar format?
☐ Does each table have an informative, explanatory title?
☐ Is the wording of the stubhead and the boxhead(s) also contained in the title of the table?
☐ Is there enough detail in the table's title, caption (legend) and keys to interpret the table?
☐ Is the table as self-explanatory as possible, without the reader having to refer to the text to understand it?
☐ Are symbols and abbreviations explained? If not, are they well known? Are you sure?
☐ Are you using too many decimal points?
☐ Are there missing or extra numbers?
☐ Are units of measurement stated?
☐ Is there too much detail?
☐ Are column entries aligned?
☐ Are column headings short (no longer than two lines)?
☐ Is the table positioned correctly on the page?
☐ *For a document other than a journal paper*: Is the table close to but following the place where it is first mentioned in the text?
☐ *For a journal paper*: Does it match the journal style (as set out in the *Instructions to Authors*) in *all* of its features?