TRANSFERABLE ACADEMIC SKILLS KIT

TASK

module 9

University Foundation Study

Scientific Writing

Course Book

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Skills Map

Unit 1

Structure and schedule

Find out how to structure and timetable your report in a logical way.

Unit 2

The *Materials and Methods* section

Learn how to include appropriate content and write in a suitable style.

Unit 3

The *Results* section

Learn how to write a Results section, including how to present and describe tables and figures.

Unit 4

Writing numbers and abbreviations

Familiarise yourself with conventions for writing numbers and abbreviations in scientific reports.

Unit 5

The *Discussion, Introduction, Bibliography* and *Title* sections

Find out how to write the other sections of a report effectively.

Unit 6

Editing and revising your report

Practise editing and revising your report using an editing check list.

Destination: Scientific Writing

1 Structure and schedule

At the end of this unit you will be able to:
- **structure your report and include appropriate scientific report sections;**
- **organise your time appropriately.**

Task 1 Organising a scientific report

When you do laboratory or field work, you will be asked to write a scientific report of your experiment or investigation. Scientific papers and reports are typically divided into five sections.

1.1 **Discuss the following questions in small groups. Use your answers to complete the table below.**

a) What are the sections in a report?

b) What order do the sections come in?

c) What questions should be answered in each section?

Sections	Questions
1	
2	
3	
4	
5	

1.2 **Feedback as a class. Discuss the reasons for your choices.**

Task 2 Organising your time

When you write your report, you will not only need to write each section, but also allow time for additional research, revision and possibly discussion with your peers. You will probably have to do all this by a set deadline.

2.1 **To meet deadlines, it is important to manage your time. Imagine you and your partner have to submit your reports in seven days' time. Working individually, read through the steps below and put them into a logical order. When you have finished, compare your work with your partner's.**

a) Revise first draft

b) Write first draft of the *Introduction*

c) Hand in revised draft

d) Revise first draft

e) Hand in revised draft

f) Write first draft of the *Discussion*

g) Write first draft of the *Material and Methods*

h) Research background information

i) Meet with another student to discuss peer review (have a writing conference)

j) Start *Bibliography*

k) Give first draft to another student to review, using list of 'Points to check'

l) Complete practical laboratory work

m) Write first draft of the *Results* (do calculations, draw up tables, graphs, charts)

2.2 **Now that you have decided on a logical order of steps, think about how to time each step. Write your answers in the *Activity* column of the table below and give a reason for your timing, wherever possible, in the *Reason* column. Work individually.**

Time Frame	Activity	Reason
Day 0	Complete practical laboratory work	
Day 1		
Day 2		
Day 3		
Day 4		
Day 5		
Day 6		
Day 7		

Remember, you can adjust the time frame according to your own deadlines.

2.3 Discuss your tables in small groups. You may have your own reasons for doing things in a different way from others in the group. Give reasons for your choice.

Reflect

Think about reports you have written or read. Did they include the five sections discussed in this unit, or were the sections slightly different? How does the way a report is divided into sections help the reader?

Try to remember the different activities you included in the timetable in Task 2.2. Think about why each activity is important and how it contributes to the final report.

Student notes for Unit 1

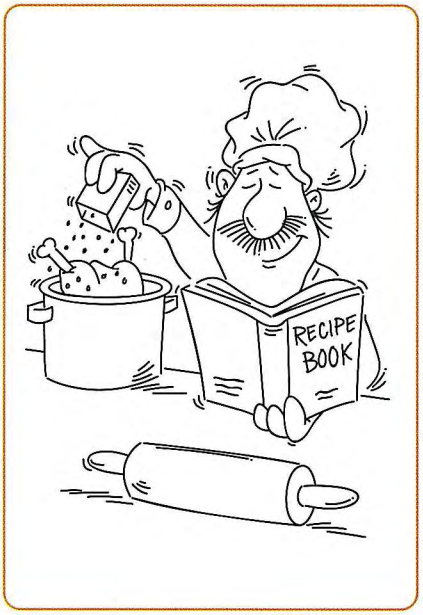
Unit 2 The Materials and Methods section

At the end of this unit you will know:
- **what to include in the *Materials and Methods* section of your report;**
- **how and why to write in the passive voice.**

Task 1 What do I include?

The first section of your report is *Materials and Methods*. In this section you answer the questions: What did I do? Where? When? How?

You should describe how you did the experiment, writing in sufficient detail for another scientist to repeat your experiment.



1.1 In groups, brainstorm the following points. Choose a group secretary to write down the ideas you discuss.

a) Examples of information that should be included in a good *Materials and Methods* section, e.g., temperature, volume.

b) Examples of information that does not need to be included in a *Materials and Methods* section. (Think about your reader: what does everyone in your subject area know about the everyday equipment and techniques that you use?)

Include	Do not include

1.2 Report back to the whole class.

1.3 Which two of the following statements do you agree with?

a) Even if well-known procedures or equipment have been used, it is necessary to describe it in detail.

b) All equipment used should be listed.

c) It is important to include clear references to published protocols and methods.

d) The method should be explained using numbered points, as in a set of instructions.

Task 2 How do I write a good *Materials and Methods* section?

You should include all appropriate information in your report. It is also important to use the most appropriate style.

```
Weigh 10g air dried 2mm sieved soil into a 50ml centrifuge tube. Using an automatic
dispenser add 25ml ultra pure water. Cap the tube and place on the shaker for 15 minutes
```

pH determination

Ten g of soil was placed in a 50ml centrifuge tube. Twenty-five ml of ultra pure water was added and the tube placed on a shaker for 1 hour. The pH was then measured using a calibrated pH meter.

2.1 Complete the paragraph below, using an appropriate word from the list which follows. There are more words than gaps, so you will not need to use them all.

paragraphs sentences passive active
imperative past present future

Laboratory schedules are usually written in the _____ as a list of instructions. However, when you write your report, you must summarise what you did in full _____ and well-developed _____. You will usually write in the _____ tense and use the _____ voice.

2.2 Discuss these questions about the advice in 2.1 as a class.

a) Why is there a difference in grammar between laboratory schedules and reports?

b) Why is information divided up into paragraphs in a report?

c) Why is the passive voice so common in the *Materials and Methods* section of a report?

2.3 **As indicated above, the *Materials and Methods* section of your report, is usually written in the passive voice. The passive is used because the procedure is more important than the person who carried it out. Look at the following sentence.**

I removed the skins from the onions and homogenised them in the blender.

In a scientific report this should be written:

The onions were skinned and homogenised.

In the second sentence there is no mention of the blender. Which of the following is the most likely reason?

a) It has been mentioned in a previous part of the text.

b) Only non-standard equipment should be mentioned.

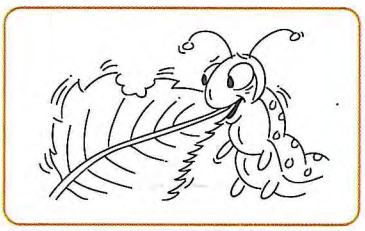
c) The next sentence will state: This was carried out in a blender.

Task 3 Using the passive

The following two sentences describe the same event.

Active:

*John conducted **the analysis.*** (***the analysis*** is the object)



Passive:

*The analysis was conducted by **John.*** (*the analysis* is the subject)

The analysis (or the methods, materials and procedures) is more important information for the reader than who conducted the analysis (John). The analysis is therefore usually made the grammatical subject of the sentence.

3.1 **Complete the following rule.**

The object in the active sentence, *the analysis*, becomes the _____ in the passive sentence. The subject in the active sentence, *John*, changes position in the passive sentence as it comes _____ the main verb and is introduced with _____.

3.2 **Some verbs, such as *give*, have two objects.**

Active:

*We gave the caterpillars **one dose** every three hours.*

We can therefore choose which object we want to make the subject. We choose the one we think is most important.

Passive:

a) *The caterpillars were given one dose every three hours.*

or

b) *One dose was given to the caterpillars every three hours.*

In the active sentence above, the two objects are _____ and _____. One or the other can become the subject in the _____ sentence.

Other common verbs that can have two objects are: *bring, send, offer, ask, pay, lend, sell*. However, you are less likely to use these in scientific reports.

3.3 Read the explanation about the use of tenses. Then complete the following sentences in the past simple.

You write the *Materials and Methods* section of a scientific report in the **past** tense. This can be the *past simple*, the *past perfect* or the *past continuous*. Each tense works the same way in the passive. It is only the verb *to be* which changes, according to the tense chosen.

Past simple

The plant was taken.	The plants _____ taken.
A pot _____ made.	The pots were made.
The image was shown.	The images _____ _____.

Past perfect

The solution had been shaken.	The solutions had been _____.
The animal _____ been fed.	The animals _____ been fed.
The mixture had been kept.	The mixtures _____ _____ _____.

Past continuous

A record was being made.	Records were _____ _____.
An attachment was being fitted.	Attachments _____ being fitted.
The result was being analysed.	The results _____ _____ _____.

Note: In all passive sentences, *to be* is singular if the subject is singular, and plural if the subject is plural.

The box **was** being built.	The boxes **were** being built.

3.4 **Look at the following draft of a student's *Materials and Methods* section and the tutor's comments on it. In small groups, discuss what changes the student should make in response to the tutor's comments. Make a note of the points you discuss in your group.**

I started my field work recordings on 12 February, 2007, and ended them on 12 March, 2007. My partner used digital camera to record the animals found on the beach and I marked the animals with quick-drying non-toxic paint. We were making recordings of environmental conditions, including the temperature, the salinity and the substrate, at the same time. I began the laboratory experiments at the same time as the field work. Each day I collected 10 animals from beach and placed them in the controlled conditions in the laboratory until experiments began.

We set up the apparatus as shown in Figure 1 and I placed 1 crab in each specimen tube. By the time an experiment started, we had acclimatised the crabs for at least 2 days. I had fed crabs daily. I had prepared their food in advance. My partner used a digital camera at the end of each experiment to record the appearance of the animals. We had printed the photographs taken at the beach for comparison. We were analysing results continuously. We analysed our results using statistical tests.

Overall, a clear description of your methods. You could improve your writing by:
- focusing the reader's attention on the method, rather than who used the methods
- paragraphing more accurately
- checking your articles (the, a, an)

3.5 **Write the final version of the section, using the tutor's comments and the notes you made to help you.**

Reflect

Look back over the unit and think about the conventions for writing scientific reports that you feel are the most important. Reflect on the reasons for your choice. For example, do you think it is important to use the passive voice, and if so, why?

Think about the sort of mistakes and omissions you might have made in the past or you feel are still likely to make. Reflect on how these mistakes might affect the way that other people regard your work.

Student notes for Unit 2

Unit 3 The Results section

At the end of this unit you will know:

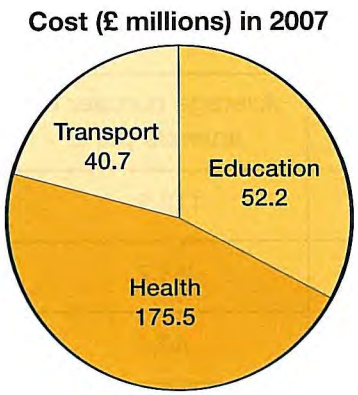
- **what to include in the *Results* section;**
- **how to present and describe tables and figures;**
- **how to write about your results.**

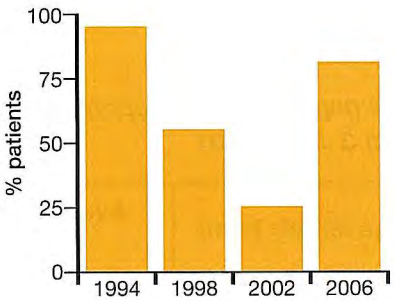
Task 1 What to include

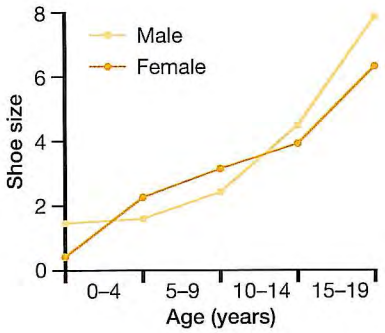
The *Results* section of your report enables you to present your data (findings or results) to show what you found and whether it matched your expectations.

This section needs to include a short paragraph or two describing and analysing trends and results, as well as any relevant tables or figures that support your findings. It may be the shortest section of your report, but it is also the most important.

1.1 Match each of the diagrams below to the correct name in the box.







Study group	N	Mean age (years)	Mean height (m)
A	17	43.2	1.77
B	24	44.9	1.69
C	22	56.2	1.64

table histogram pie chart line graph

1.2 Discuss the following questions with another student.

a) What is the difference between a table and a figure in a scientific report?

b) Should the *Results* section always include tables or figures, or can the results be expressed by text alone?

c) Should the title of the figure or table be above or below it?

d) What do you think make tables and figures easier to interpret?

Task 2 Preparing tables and graphs

If you have a large quantity of data to present, or are comparing several different things, a table can show it more clearly than a graph. Graphs and other figures, on the other hand, are a good way of illustrating and emphasising trends, particularly if they are dramatic.

2.1 **Tables 1 and 2 below present the same information but in different formats. Discuss with another student:**

a) the differences between Tables 1 and 2;

b) which of the tables is better organised, easier to read and makes it easier to compare results;

c) whether it is appropriate to show this information in a graph.

2.2 **Work in groups and decide what features make a good table.**

Think about how to:

a) show your data to make it easy to compare significant information;

b) give units, arrange numbers, use abbreviations;

c) give table and figure numbers, and titles.

Table 1. Characteristics of three populations of Daphnia species collected at Rye Meads Pond on 3 June, 1981

Species	Average length (mm)	Average number of eggs	Average number of animals per L
Daphnia magna	5.01	15.3	112.5
D. obtusa	2.33	8.2	68.7
D. longispina	2.77	6.8	40.4

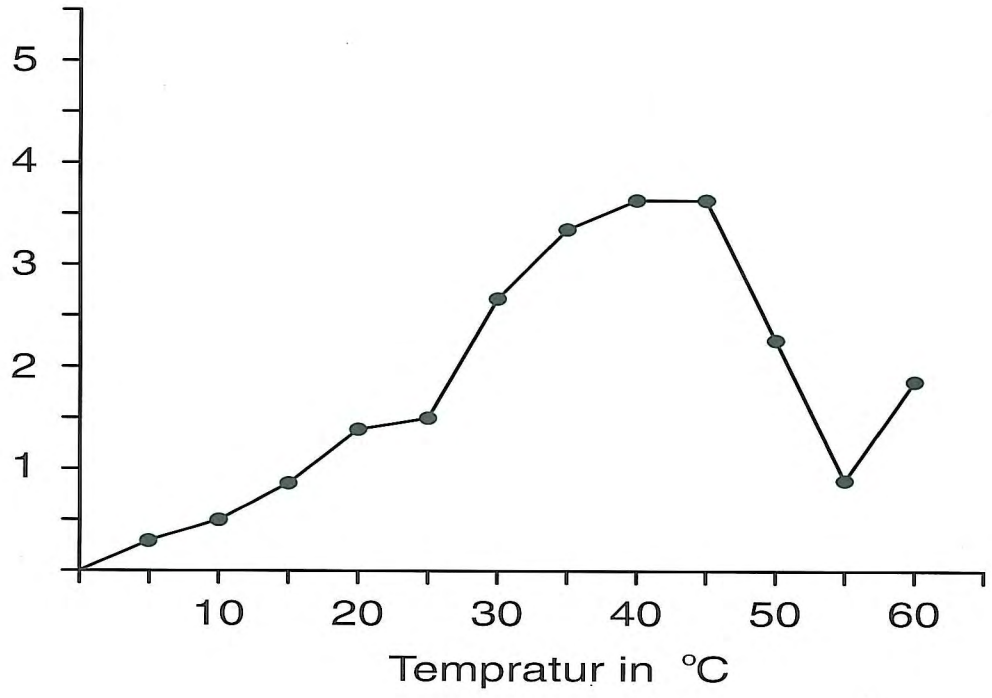
Table 2. Characteristics of three populations of Daphnia species collected at Rye Meads Pond

Species	Daphnia magna	D. obtusa	D. longispina
Av. length	5.01	2.33	2.77
Aver. no. of eggs	15.3	8.2	6.8
Av. no. of animals	112.5	68.7	40.4

2.3 **The results below are taken from a student's laboratory notebook and are followed by a graph that the student made based on the data to include in a written report.**

Discuss the strengths and weaknesses of the graph.

Temperature °C	Rate of reaction, mg. products per hr
0	0
5	0.3
10	0.5
15	0.9
20	1.4
25	2.0
30	2.7
35	3.3
40	3.6
45	3.6
50	2.3
55	0.9
60	0



2.4 Draw an improved version of the graph on the graph paper below.

As you prepare your graph, you should consider the following questions.

a) Which is the independent variable (the one the investigator can control or manipulate)?

b) Which is the dependent variable (the one that changes in response to the independent variable)?

c) Are the axes organised correctly? (Note: The convention is that the independent variable is usually plotted on the vertical or x- axis, and the dependent variable is plotted on the horizontal or y – axis.)

d) Are the scales appropriate?

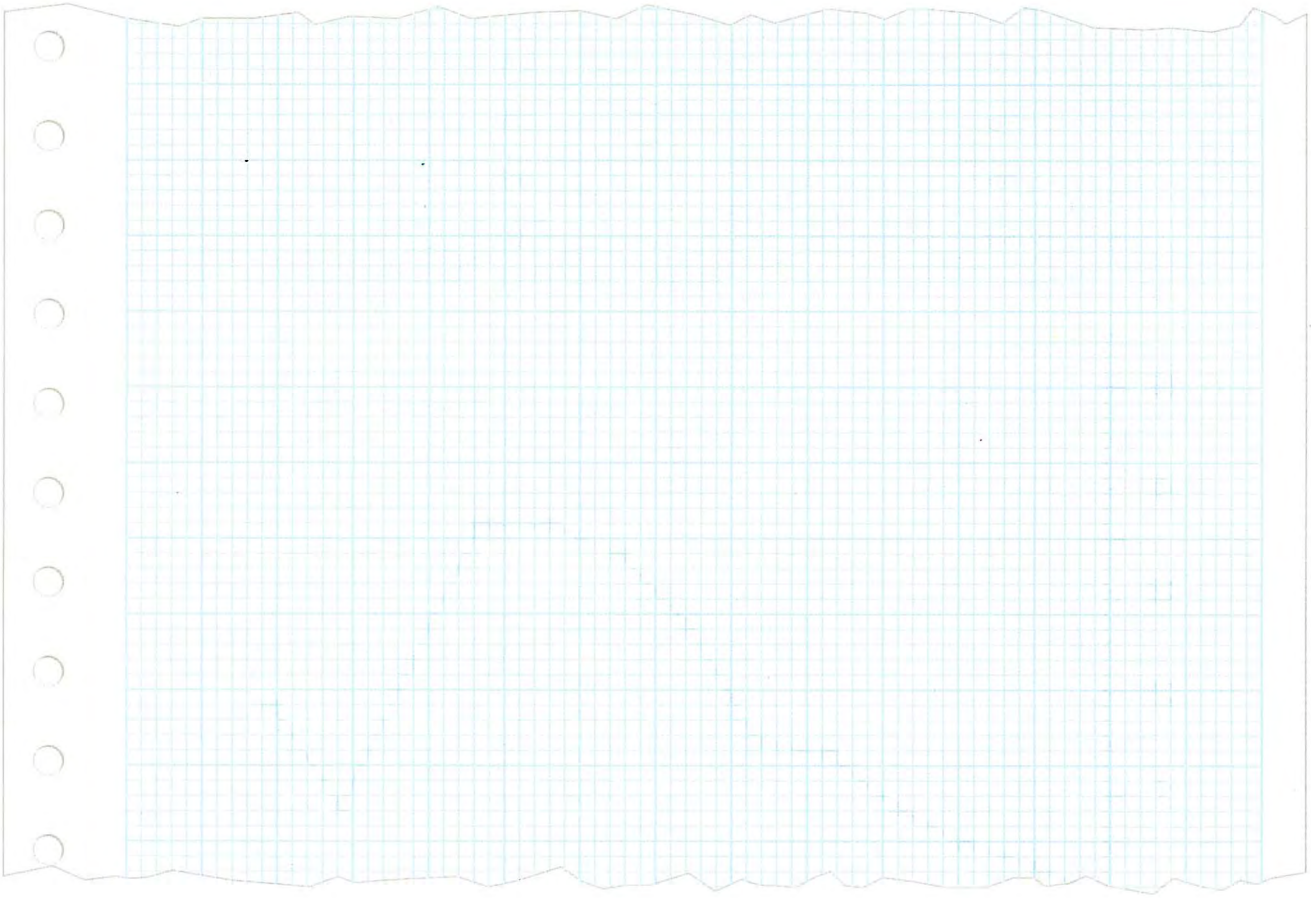
e) Are the axes labeled correctly, with units?

f) Are the data plotted accurately?

g) Are the abbreviations correct?

h) Does the graph have a figure number and a title that enables the reader to understand what the graph represents?

Note: You will usually produce graphs using a computer package (See TASK Module 7: Introduction to IT Skills).



Task 3 Writing the text of the *Results* section

After you have presented your results graphically, you must describe your findings in the rest of your *Results* section. As you are now describing what the results were, rather than what you did, you will usually use the past tense in the active voice.

Start with a sentence that states each important finding and which refers to the table or figure that supports this finding. Next, write about the specific details of the data shown in the figure.

The following example is a paragraph taken from a *Results* section of a report.

> Oxygen production varied depending on the pH of the solution (Figure 1). At pH 2, oxygen production was 3ml, whereas at pH 7 it increased to a maximum of 6ml. At pH values above 7, oxygen production decreased and was at a minimum of 1ml at pH 10.

3.1 Discuss with another student what points you would include in a description of the results presented in the graph you drew in Task 2. Then work individually and write a paragraph to describe the data.

3.2 When you and your partner have completed your paragraphs, evaluate each other's work.

a) Work in a group of 3–5. Discuss what you feel are the main features of a good description of results.

b) Write a check list giving advice for writing the *Results* section.

The Results section

Reflect

Reflect on what you have learnt in this unit about using tables, figures and text in the *Results* section. What do you think are the key things to remember?

Think about an experiment you have conducted or are going to conduct. Did you use tables, graphs, pie charts or simply text to present your results? If you wrote your results again, could you present them differently? Would the use of different types of figures or tables be more or less effective?

Student notes for Unit 3

Unit 4 Writing numbers and abbreviations

At the end of this unit you will be more familiar with:

- **when to use numerals and when to spell numbers in scientific reports;**
- **how to use very large and very small numbers;**
- **the conventions for using abbreviations.**

It is essential to use numbers correctly when writing a scientific report to ensure the reader is provided with an accurate account of what happened. Even if the numbers shown in a report are correct, it is easy for the reader to be confused or overwhelmed if they are not used in a clear and conventional way.

Task 1 Writing numbers

The guidelines on page 20 for writing numbers are according to the *Modern Scientific Number* Style recommended by the Council of Science editors (updated 2000).

1.1 Read the guidelines on page 20 and find an example of the following.

a numeral _____

an ordinal _____

a fraction _____

a decimal form _____

1.2 Match the five words from the guidelines with their meaning.

a) adjacent	**i)** exact
b) non-quantitive	**ii)** worthy of attention
c) fraction	**iii)** next to each other
d) precise	**iv)** not a whole number
e) significant	**iv)** not describing a specific amount

a) Numerals are used to express quantities and mathematical relationships. This makes them stand out in the text.

For example:

2 theories	7 mm
22 amino acids	0.5 nm
3 replicates	400 x magnification
378 specimens	100-fold

b) Situations in which numbers should be spelled out include the following.

When a number is at the beginning of a sentence.

For example: Fifteen g of peas were placed in the tube.

When two numbers are adjacent, use a numeral for the one that goes with a unit of measurement, spell out the other number.

For example: three 25 ml samples

When a number has a non-quantitative meaning.

For example: one of the specimens
was one of the most significant
the zero value

When writing ordinal numbers (numbers that convey order or rank) less than 10.

For example: the seventh sample
a second time

When a fraction is part of the running text.

For example: a third of the plants

Note: When a precise value is required, the decimal form is used.

For example: 0.5 ml

1.3 Complete these sentences by choosing and underlining the correct option from each pair or group of words in italics.

Example:

a) Experiments lasting *one / **1*** day indicated that temperature was ***one*** */ 1* of the most important factors, whereas *seven / **7*** -day toxicity tests suggested that salinity was crucial.

b) 5 / five gammarus were placed in *fifty / 50* ml of *0% / zero per cent*, *50% / fifty per cent* and *100% / one hundred per cent* sea water solutions.

c) The animals were collected at Swansea Bay and *one half / ½ / 0.5* were divided between *3 / three 50 / fifty* ml pots.

d) After washing *2 times / twice* in buffer, the tissue was immersed in *2% / two per cent* osmium tetroxide in *0.25 / .25* M phosphate buffer, for *one / 1 hr*.

Task 2 Common scientific abbreviations

Abbreviations are frequently used in scientific reports. Some abbreviations are used for technical or scientific words that occur three or more times in the text. In this case, you should define the abbreviation when you use it for the first time and put it in parentheses, e.g., Ampicillin resistant (AmpR). Other standard abbreviations can also be used, e.g., ml., min., and do not need to be defined.

2.1 Write the full form of the standard abbreviations below.

a) s _____

b) min _____

c) h / hr _____

d) g _____

e) mg _____

f) µm _____

g) O _____

h) MW _____

i) U _____

j) bp _____

k) DNA _____

l) UV _____

Task 3 Using numbers and abbreviations in the *Results* section

3.1 Look at the table, then read the extract from the *Results* section below. Discuss the following questions with another student.

a) Are there any mistakes in the use or layout of numbers in the table?

b) How effective are the abbreviations?

c) Could anything else be added or changed to make the results clearer?

Ratios of M.L.D.s at a ratio of synergist; active ingredient of 10:1

	Flies		Bugs	
	pyrethrins	allethrin	allethrin	pyrethrins
Pip. butoxide	4.00	3.25	2.75	1.75
IN 930	1¾	2	.75	1.5

Table 3 shows the ratios of the Median Lethal Doses at a 10.1 ratio of synergist; active ingredient. Piperonyl butoxide is shown to be more effective as a synergist with pyrethrins against houseflies, but more effective with allethrin against bedbugs. IN 930 is almost equally effective with both active ingredients against both insects.

Reflect

Look through a variety of experiments in journals and try to notice the way numerals, conventions and abbreviations are dealt with. The more you notice, the easier it will become.

Student notes for Unit 4

Unit 5 The Discussion, Introduction, Bibliography and Title sections

At the end of this unit you will know:

- **what to include in the *Discussion* section of your report;**
- **how to cite references and write a *Bibliography*;**
- **how to write an appropriate *Title* and *Introduction*.**

The *Discussion* section is an important part of the report that follows on from the explanation of your methods and presentation of your results. After you have written the *Discussion* it will be easier to organise your *Bibliography*, *Introduction* and *Title*.

Task 1 What to include in the *Discussion*

You now have an opportunity to interpret your results and explain their significance in the *Discussion* section.

1.1 Look at the figure below. It is a table of results for an experiment that compared the distribution of beetles in two different woodlands. Think of some questions that you might ask about the results of the experiment.

Example:
Were there any significant differences between the two habitats?

Table 1: Mean number of beetles per quadrat for two woodlands

		Mean number per quadrat	
Scientific name	Common name	Pound Wood	West Wood
Aphodius nemoralis	A dung beetle	9.1	11.3
Curculio glandium	Acorn weevil	8.4	6.9
Coccinella septempunctata	7-spot ladybird	7.8	6.7
Adalia bipunctata	2-spot ladybird	6.3	5.9
Agonum assimilie	A ground beetle	5.1	4.9
Rhopalomesites tardyi	Holly weevil	3.9	4.2
Ampedus sanguinolentus	A click beetle	2.4	3.1
Byrrhus fasciatus	Banded pill beetle	3.1	2.5
Pogonocherus hispidulus	A longhorn beetle	2.6	1.3
Clytus arietus	Wasp beetle	3.0	3.0
Ampedus rufipennis*	A click beetle	0.8	0
Carabus intricatus*	A ground beetle	3.5	0
Dryphthorus corticalis*	A weevil	2.7	0
Gnorimus nobilis*	The noble chafer	1.7	0
Lucanus cervus*	Greater stag beetle	1.8	0

*Species of conservation importance

1.2 The paragraph below summarises what to include in the *Discussion*. Complete the gaps with words from the box.

hypothesis	suggestions	implications	conclusions	deviations

The *Discussion* section of the report will generally move from the specific (the results of your experiment) to the general (how your results fit in with other scientific findings). Normally, the discussion should do the following.

- Explain whether your results support your original _____ .
- Consider any surprising data or _____ from what you expected.
- Relate your findings to previous results in the same area and derive _____ about the process you are studying.
- Look at the practical and theoretical _____ of your findings.
- Make _____ for extensions of your study.

1.3 Look at the discussion of the results in Table 1.1. on page 23.

a) Identify which different elements from Task 1.2 have been included.

b) Identify which of the following language structures and forms are used in the *Discussion*.

- the passive voice
- the past tense
- comparative structures
- modal verbs
- the imperative
- relative clauses

Discussion

The results show that populations of common beetle species were similar in both woodlands and were comparable to numbers found in previous studies. These common beetles are found in most woodland habitats and can be described as generalists. As expected, it was also found that the diversity of beetle species was higher in Pound Wood than in West Wood. Pound Wood was found to contain a surprisingly high number of beetle species which are rare in the UK and which can be described as specialists.

The results show that for beetles, Pound Wood is of more conservation interest than West Wood. It is a suitable habitat for some beetle species that are rare in Britain and are the subject of species recovery plans that aim to increase their numbers in UK habitats. Pound Wood, therefore, should take priority in management and investment for beetle conservation purposes over West Wood. However, this data says nothing of the overall biodiversity of either of the woodlands. There may be other species of conservation importance present in West Wood that have not been recorded in this study. Therefore, further work should be carried out to assess the overall biodiversity of both of these woodlands before any decisions regarding management or investment are made for either.

Task 2 Citing references and writing a bibliography

In the *Discussion* section you may compare your results with other studies. This will require you to cite references to other reports and published material.

You will also need to list all the references that you have referred to in your report in a bibliography at the end of your report. (See TASK Module 10, *Research and Referencing,* for more detailed information on citing sources and writing bibliographies). It is important to use a standard layout for this, such as the APA System.

2.1 Read the citation below and make a note of the order in which the author, publisher, date and place of publication are written.

Southwood, T.R.E. (1984). *Ecological Methods with Particular Reference to the Study of Insect Populations, 2nd ed.* New York: Chapman and Hall.

2.2 In scientific writing, many bibliography references will be to articles in scientific journals. Look at the two citations below and answer the following questions.

a) What do the numbers 13,2025-2036 in the second citation refer to?

b) What abbreviations are used in the second citation?

c) What is the main difference between the two citations?

Wallace, M.J., Newton, P.M., Oyasu, M., McMahon, T., Chou, W.H., Connolly, J., and Messing, R.O. (2006). *Acute Functional Tolerance to Ethanol Mediated by Protein Kinase C Varepsilon.* Neuropsychopharmacology, Published online.

Yamada, K., Fukaya, M., Shimizu, H., Sakimura, K., and Watanabe, M. (2001). *NMDA receptor subunits Glurepsilon 1, GluRepsilon 3 and GluRzeta 1 are encircled at the mossy fibre-granule cell synapse in the adult mouse cerebellum.* Eur. J. Neurosci. *13, 2025-2036*.

2.3 Compare your answers with another student and discuss the bibliography conventions.

It is advisable to start your bibliography with full details and in the correct format as soon as you start reading references. Then you can add references to your list as you go along. In this way you will find that you avoid omissions and errors, and will save yourself time.

To help you do this, always keep a detailed record of your references; for example, make notes when reading in the library without a computer.

When you have finished the report, give your Bibliography a final check, making sure it is complete and presented in the correct format.

Task 3 What to include in the *Introduction*

Now that you have written the *Materials and Methods, Results* and *Discussion* sections, you are in a position to write an *Introduction* to your report.

3.1 Look at the questions and decide which ones might be addressed in the *Introduction*. Discuss your ideas in groups.

a) When did you do your experiment?

b) What was the background of your experiment?

c) What was the aim of your experiment?

d) Were there any unexpected results?

3.2 Look at the following example of an *Introduction* and put the sentences in the correct order.

Beetles in Woodland Habitats

Introduction

a) Many of these species are the subject of species recovery plans designed to manage suitable habitat and increase their numbers. Organisations with responsibilities for areas of woodlands are often lacking in sufficient resources to protect the entire woodland habitat under their jurisdiction.

b) Woodland habitats have been in decline throughout Britain for centuries. This decline has been most notable since the Industrial Revolution and the mechanization of farming practices.

c) Therefore, they have to prioritise woodlands that are in need of immediate protection.

d) The organisms under most threat are the plants and the insects. These organisms tend to have low dispersal rates and are slow to colonise new habitats. Many species of plants and invertebrates are now threatened with extinction in Britain due to a loss of habitat.

e) With the decline in woodland, many organisms are under threat from a loss of habitat.

f) This study assesses the importance of two woodland habitats to beetle conservation.

Task 4 What makes a good *Title*?

The *Title* gives the reader a concise and informative description of the focus of your report. It summarises the information contained in the *Introduction* and *Results* sections. You may use a 'working title' during the writing stages, but you should revise it when your report is complete.

The title should give the reader a complete description of the study and include important keywords and phrases.

4.1 Look at the following titles. Work in groups and decide which one is better and why.

Title 1: *Determination of metabolic rate*

Title 2: *The effect of temperature on oxygen consumption in mice*

4.2 Discuss your findings as a class.

4.3 Work with another student and compare the following two pairs of titles. Think about the different information each pair gives the reader. Come to a clear conclusion about the importance of an appropriate title.

Title 1: *Species composition of summer phytoplankton in Lake Windermere, Great Britain*

Title 2: *Sampling plankton in a lake*

Title 1: *Effects of pollutants on Daphnia*

Title 2: *Morphological and ultrastructural effects of sublethal cadmium poisoning on Daphnia species*

Reflect

You have now done work on all aspects of a piece of scientific writing. Think about what you have learnt in Units 1 to 5 and how the information in each unit ties in with the others.

Student notes for Unit 5

6 Editing and revising your report

At the end of this unit you will:

- **be more aware of how to check your work for grammatical and vocabulary mistakes;**
- **be more aware of how to edit your work to ensure that you use full sentences which are clear and concise.**

Task 1 What do I check for?

After you have written your report, it is important to check for mistakes and errors. You will get into the habit of editing more efficiently if you are aware of the key areas in which you tend to make mistakes.

'The high temperature Sp. effected the results.'

1:1 Working in groups, look at the questions below and discuss which problem areas you feel are the most important.

- Is the use of vocabulary appropriate?
- Is the general vocabulary correctly spelt?
- How about the specialist vocabulary? Do you need to look any of it up?
- Does the numbering follow the correct conventions?
- Does your punctuation help the reader?
- Is writing clear and concise?
- Can you spot any errors in grammar?

1.2 Compile a check list of problem areas you should check to revise and edit a report.

1
2
3
4
5
6
7
8

Task 2 Use of tenses

In this module, you have looked at the academic conventions for use of different tenses and aspects in scientific reports. It is important to remember to use these correctly and consistently in your work.

2.1 The table below shows sections and topics that might be included in a scientific report. For each one, choose whether the past or present tense should be used in the example sentence.

Section of report	Example sentence
a) *The Materials and Methods* section	The apparatus ***is /was*** set up as shown.
b) Referring to a table or graph	Table 1 ***presents / presented*** the results from sites 3 and 4.
c) Stating (quoting) the findings of published work	Cadmium ***is / was*** a highly toxic metal to freshwater fish (Ball, 1999).
d) The *Results* section	Oxygen production ***varies / varied*** depending on the pH of the solution.
e) Referring to someone else's work	Smith (2002) ***finds / found*** that ...
f) To make a general statement	Respiration ***is / was*** a complex series of chemical reactions that ***results / resulted*** in the release of energy from food.

2.2 Identify any sentence(s) which use the passive voice. Then discuss why you think it should be used.

Task 3 Common mistakes with vocabulary

The following exercise identifies some words that are commonly confused with each other in scientific writing.

3.1 Look at the following pairs of sentences. Choose the correct word to complete each one.

a) affect / effect

1) Temperature strongly _____ the rate of reaction.

2) The study investigated the _____ of temperature on rate of reaction.

b) continual / continuous

1) The tank was provided with a _____ supply of nitrogen.

2) Impurities can be eliminated by _____ heating, cooling and reheating.

c) site / cite

1) Smith's study _____ several previous incidents.

2) The _____ chosen for the experiment was a nearby pond.

d) their / there

1) _____ is more than one way to do this.

2) The crabs were fed daily and _____ food supply was adjusted gradually.

3.2 **Now write sentences of your own for each of the pairs of words below. Use a standard dictionary to check the meaning and spelling of terms.**

a) fewer / less

b) breath / breathe

c) rise / raise

d) consecutive / concurrent

3.3 **Compare your ideas with another student.**

Task 4 Plurals

Scientific words often have irregular plurals, particularly if they come from Greek or Latin terms. You will need to notice and remember common patterns, such as those on the next page.

You should also check that you are consistent in your use of plural nouns and that plural subjects agree with the verb that follows them.

4.1 **Complete the following table of singulars and plurals of common scientific terms.**

Singular	Plural
analysis	
	bacteria
	criteria
datum	
formula	
hypothesis	
medium	
ratio	
	phenomena

4.2 Complete the following sentences.

a) Greek- or Latin-based singular nouns that end in *–um* generally form the plural by changing _____.

b) Greek- or Latin-based singular nouns that end in *–is* generally form the plural by _____.

4.3 Decide whether the subjects and verbs agree in the sentences below. Correct them if necessary. (Note: Two sentences are correct and two need to be changed.)

a) This data is supported by evidence from other studies.

b) 10 drops of hydrochloric acid were added to each sample.

c) The period of immersion for crabs at different times of the tidal cycle are presented in Table 1.

d) One source of error in these experiments are the inaccuracy in recording light intensities.

Task 5 Be clear and concise

When writing reports, it is important to consider your audience. Unless you take great care to write clearly, it is easy to confuse the reader, particularly if you are describing a complex experiment or set of results.

One way to ensure clarity is to make sure that you do not use more words than necessary.

5.1 Work with another student or in small groups. Discuss how you would revise the following sentences to eliminate unnecessary words.

Example:
In the experiment, the test animals were subject to analysis for investigation of their gut contents.

The gut contents of the test animals were analysed.

a) One of the environmental conditions to which the zooplankton were shown to be affected by was pH.

b) The experiments alone are insufficient to tell what the optimum conditions are.

c) Ten test tubes were labeled with the following concentrations of sodium chloride and 50 ml of those solutions were then prepared and placed in the test tubes: 0%. 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%.

Task 6 Write in complete sentences

Another reason why reports are sometimes difficult to read is that they are not written using complete, well-formed sentences.

6.1 With another student, revise a, b and c to make complete well-formed sentences. When you have written your paragraphs, compare them with other pairs in the group.

Example:

In accordance with the Law of Limiting Factors, rate of photosynthesis is affected by light intensity, temperature and carbon dioxide concentration. Resulting in maximum rates in optimum conditions.

In accordance with the Law of Limiting Factors, rate of photosynthesis is affected by light intensity, temperature and carbon dioxide concentration and maximum rates occur in optimum conditions.

a) In the third set of experiments, citric acid concentration was doubled and at each temperature three sets of readings.

b) Enzymes are denatured at high temperatures. Because molecular conformation is altered.

c) The reaction occurred at its maximum; copper was absent.

Reflect

Collect samples of reports that have been submitted by fellow students. Practise noticing where things could be improved.

As you carry this out, develop your own check list and procedure for editing.

Student notes for Unit 6

Module 9

Web work

Website 1 — **Using the passive voice**

http://www.geocities.com/CollegePark/Classroom/8012/quizzes/Grammar_Goblins/GGvpassive.html

Review
This site provides 45 exercises in using the passive voice. You can check your answers and get instant feedback.

Task
Complete exercises listed on the site.

Website 2 — **Interpreting graphs**

http://www.oup.com/pdf/elt/catalogue/0-19-431517-7-b.pdf

Review
This site presents five exercises in "Interpreting Graphs". You can test your knowledge of the use of verbs and prepositions in describing line graphs. The final exercise tests your skill in interpreting and describing information in a pie chart.

Task
Complete the exercises on the site.

Extension activities

Activity 1

Before writing your first report, it is helpful to study a few short papers in a major scientific journal, such as *Ecology, Developmental Biology*, or *Genetics*. Choose papers in journals from your own field. You don't need to read for content, but look at the way in which the paper is crafted.

Answer the following questions.

a) What is included in the *Introduction*?

.....

b) How much detail is given in the *Materials and Methods* section?

.....

c) How are the results presented in the *Results* section? If graphs are presented, how are axes labeled?

.....

d) How are titles written for tables and figures?

.....

e) What is included in the *Discussion*?

.....

f) How are references cited?

.....

Activity 2

When you have written the first draft of a scientific report, use the following check list to edit and revise your report.

Editing check list

- Is the *Title* descriptive and concise?
- Does the *Introduction* include background information, supported by references from the literature?
- Does the *Introduction* include the aim of the study?
- Is the *Materials and Methods* section written in the past tense?
- Is the *Materials and Methods* section written in the passive voice where appropriate?
- Does the *Materials and Methods* section contain all the information required to repeat the experiment?
- Does the *Results* section contain tables and figures, with titles that inform and can be understood without reference to the text?
- Does the *Results* section contain text describing results with reference to each table and figure?
- Does the *Discussion* explain what the results mean?
- Does the *Discussion* compare results with those from other studies and cite references?
- Does the *Discussion* assess errors and unexpected results and suggest extensions?
- Is the *Bibliography* presented correctly?
- Are *References* cited in the text?
- Is writing clear and concise?
- Are numbers, abbreviations, punctuation and spelling correct?

Module 9

Glossary

Analyse (v) To break an issue down into parts in order to study, identify and discuss their meaning and/or relevance.

Bibliography (n) A list of references to sources cited in the text of a piece of academic writing or a book. A bibliography should consist of an alphabetical list of books, papers, journal articles and websites and is usually found at the end of the work. It may also include texts suggested by the author for further reading.

Check list (n) A list of tasks to do or aspects to consider when planning and preparing for an event such as an academic assignment, journey or party.

Cite (v) To acknowledge sources of ideas in your work. This may be done through an in-text reference to an author, a reference in a bibliography or footnote or a verbal reference in a talk or lecture.

Conclusion (n) In academic terms, the final part of an essay or presentation, usually involving a summary of your results or argument, and a judgment.

Concise (adj) Used to describe something that is expressed clearly in a few well-chosen words.

Criteria (n) Qualities, rules or standards on which decisions or judgments are based.

Deadline (n) The date or time by which something needs to be completed. In academic situations, deadlines are normally given for handing in essays and assignments.

Decimal (n) (adj) 1 A fraction expressed using numbers to the right of a decimal point. For example, one-quarter expressed as a decimal is 0.25. 2 Used to describe any numbering based on tens.

Dependent variable (n) In an experiment or study, a variable that changes in response to the independent variable or control. For example, if the response of insects to a particular chemical is being measured, the independent variable is the amount of chemical that is administered and the dependent variable is the degree to which the insects respond.

Deviation (n) A variation or movement away from a standard or expected result.

Discussion section (n) The section of a scientific paper that analyses the findings or results of an experiment.

Draft (n) (v) 1 (n) An early version of a piece of academic writing that is used as the starting point for further work. 2 (v) To create an early version of an essay, knowing that you will go back afterwards to develop and edit your language and ideas.

Edit (v) To select, rearrange and improve material to make it more suitable for its final purpose. Editing material involves reorganising it, correcting errors, improving the wording or content and changing its length by adding sections or taking them out.

Evaluate (v) To assess information in terms of quality, relevance, objectivity and accuracy.

Experiment (n) A test under controlled conditions to examine whether or not a hypothesis is true.

Field work (n) Research or information collected away from the classroom, office or laboratory where you usually do your work.

Figure (n) A diagram, graph or picture that illustrates information in a text.

Formula (n) An equation, fact or rule expressed in symbols and sometimes numbers, for example, $\pi r2$ (pi r squared) is the formula for the area of a circle.

Fraction (n) The expression of a number as part of a whole. It is shown as a quotient, where one number (the numerator) is divided by another (the denominator), such as ¼, ½ and ⅜.

Histogram (n) A form of graph that uses horizontal or vertical bars. The width (when horizontal) or height (when vertical) of the bars are in proportion to the values of the data items they represent.

Hypothesis (n) An idea about, or explanation of an observation, phenomenon or scientific problem. Hypotheses are tested by experimentation or analysis.

Implication (n) Something that can be interpreted or inferred but is not directly stated.

Independent variable (n) The variable in an experiment or study that the investigator can control or manipulate. For example, if the response of insects to a particular chemical is being measured, the independent variable is the amount of chemical that is administered and the dependent variable is the degree to which the insects respond.

Interpret (v) Give the meaning or explain the significance of something as you understand it.

Keyword (n) An important word in a text. Keywords are often used as a reference point to search for other words or information

Laboratory schedule (n) A list of procedures or instructions for conducting an experiment or operation in the laboratory.

Layout (n) The way that things are positioned within a space; for example, the way text, pictures and diagrams are arranged on a page or computer screen.

Line graph (n) A graph that highlights trends by showing connecting lines between data points.

Materials and Methods section (n) The section of a scientific report that gives an account of the procedure that was followed in an experiment. It also details the materials and equipment that were used.

Numeral (n) A symbol used to represent a number: 1, 2, 3, 4, etc., are numerals.

Ordinal (n) Symbols that show the position of a numbered items in a series. For example, 1st, 2nd, 3rd and 4th.

Plot (v) To mark points on a graph or chart.

Peer review (n) The process of getting colleagues or other students to check one's work. The idea is that peers can identify each other's errors quickly and effectively.

Pie chart (n) A graphic representation of amounts or percentages which are shown as segments of a circle (like a pie that has been divided up). It can be used instead of a table in the Results section of a scientific writing report.

Protocol (n) Standard procedures and principles that are followed, for example when writing a report or conducting an experiment.

Quotation (n) A part of a text written or spoken by one author and reproduced in a text, piece or academic writing or talk by another author. When you quote someone's words or ideas, you do not change the wording at all and should put them in inverted commas to signal that it is a quotation.

Ratio (n) The relation between two quantities expressed as the quotient of one divided by the other. For example, the ratio of 9 to 4 is 9:4 or 9/4.

Reference (n) (v) 1 (n) Acknowledgment of the sources of ideas and information that you use in written work and oral presentations. 2 (v) To acknowledge or mention sources of information.

Research (v) (n) 1 (v) To gather information from a variety of sources and analyse and compare it. 2 (n) Information collected from a variety of sources about a specific topic.

Scale (n) A sequence of marks at fixed intervals used to show measurements on, for example, a ruler, graph or map.

Source (n) Something (usually a book, article or other text) that supplies you with information. In an academic context, sources used in essays and reports must be acknowledged.

Theoretical background (n) Academic ideas and information that must be studied and understood before conducting an experiment, and that should be considered and referred to in the discussion stage of a scientific report.

Trend (n) The general direction in which something moves, or a sudden change in direction.

Further notes

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