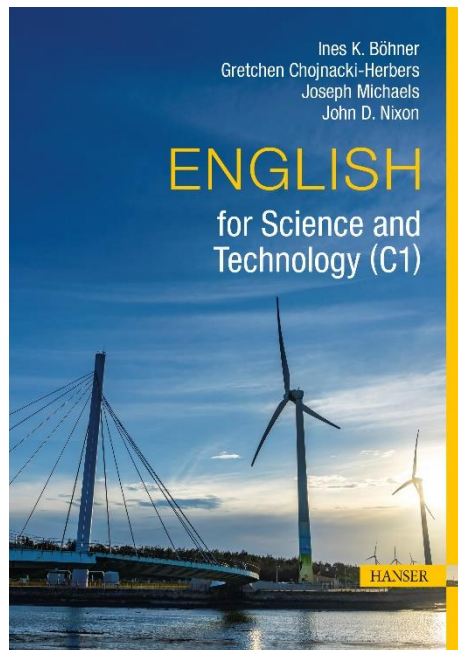


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English for Science and Technology (C1)

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Joseph Michaels und John D. Nixon

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Preface

This book draws on the collective experience and expertise of four English instructors from the University of Stuttgart's Language Center, who have each taught various courses in the areas of English for Specific Purposes (ESP) and academic English for well over a decade. Each instructor has specialized over the years in a particular area of technical English, such as English for Civil Engineering, English for Chemistry or English for Space Engineering. The idea behind the book was to bring together the ample material that we have developed over the length of our careers to create an ESP textbook for technical English courses at a solid C1 level, given that much of the published material already on the market fell short of this advanced level or was not particularly relevant to or appropriate for university students.

The texts contained in this book have either been drawn from authentic material in the respective scientific or engineering fields or been written using scientific and technical information from reputable sources. The goal was to bring together textual material from a variety of fields that was both challenging and accessible to non-experts.

While this book is intended as a textbook to accompany technical English courses at post-secondary institutions across the German-speaking world, if one disregards the occasional contrastive language exercises (English vs. German), it could easily be used for ESP classes anywhere. Students are not expected to have in-depth knowledge of each topic, and it is unlikely that all of the chapters in the book could be covered in one technical English course. Therefore, this book can easily be implemented in different English-language programs requiring technical English by selecting the relevant chapters or individual academic English exercises from throughout the book. Furthermore, this textbook can be used by engineers and scientists who have already begun their careers as part of a structured course or as a means of self-study.

Users of this book should have a firm grasp of general English. The book is geared towards a C1 level of English as outlined by the Common European Framework of Reference for Languages or UNICert Level III. Not only are technical English topics

covered, but also elements of academic writing, such as discourse markers and register, are explored throughout. In this way, the book goes beyond simply providing technical jargon by pointing out vocabulary and expressions typical of academic English. As is often the case in ESP classes, the line between technical and academic English cannot be clearly delineated.

The referencing standard in academic writing can vary from field to field and even within one field. For this book, the Chicago and IEEE citation styles were chosen as they can be found in a number of scientific and engineering publications. They are also similar to several other citation styles found in technical texts. Both the author-date system and bracketed number referencing system are used to expose students to these two common practices.

As the material has been taken from a number of sources in its original context or written by instructors of diverse backgrounds, the variety of English differs from chapter to chapter. Consequently, British English spelling co-exists alongside American and Canadian spelling. This should not be viewed as inconsistent, but rather as representative of the global varieties of English that students will encounter in their studies and careers.

This book is a combination of reader and workbook. Space has generally been provided so that students can enter their answers into the book as they work through the exercises under the guidance of an instructor or on their own.

Although there is emphasis on reading comprehension, vocabulary and writing skills, there are exercises throughout the textbook that provide practice for listening comprehension, speaking and mediation. A few task-oriented exercises have also been provided to allow the students to employ all of their English-language resources in authentic, real-life situations.

We would like to thank all of the individuals who provided help and advice along the way and in particular the companies and governmental organizations that granted us permission to use their material as a basis for our exercises. We are also indebted to our students, whose enthusiasm for English and thirst for knowledge have spurred us to research new fields over the years and to compile some of our material in this book. Finally, we would like to express our gratitude to Hanser Publishing for supporting us on this project and publishing this manuscript.

Stuttgart, December 2023

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1

Water Purification

■ 1.1 Drinking Clean Water

1.1.1 Introduction

The natural water cycle includes processes that help to filter the natural water to make it potable (Figure 1.1). Nevertheless, not all water that has gone through the natural process is fit to be drunk by humans.

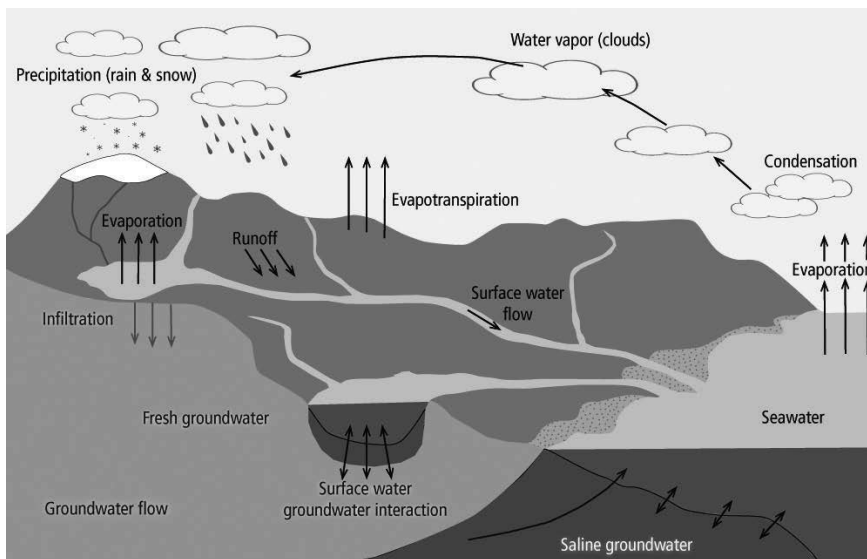


Figure 1.1 The water cycle (source: Cabibbo 2022)

1.1.2 Exercise

1. What technical challenges must be overcome to ensure that all people have access to clean water?

2. What types of systems are in place to maintain the water supply?

Later in this chapter, you will find a process description of a water treatment plant (Section 1.3.2), but first we will discuss the importance of giving clear instructions.

■ 1.2 Giving Instructions

1.2.1 Introduction

Giving clear, concise and appropriate instructions is a necessary skill when working in a lab or in a team. When thinking about what information is required, one must keep the audience and purpose in mind.

Audience: Who is being addressed? Do you know the audience? What previous information (if any) does the audience have about the topic? What type of experience does the audience have regarding the topic? Knowing whom you are addressing will help you when considering what information needs to be included and in what register the information should be written. Register refers to the level of formality in language. A formal register is directed to a professional contact, a person in a high position or a person of authority, such as a judge. An informal register is directed to someone with whom one is familiar, a friend or friendly acquaintance or a person of a lower position.

Purpose: Why are you writing? Are you imparting information? Are you telling someone what to do? Are you expressing your opinion? Are you trying to convince

someone of your point of view? The audience you are addressing as well as the purpose will influence the language you use (vocabulary, grammar, detail), as well as the level of formality.

1.2.2 Exercise

Think about a situation when you were responsible for telling someone what to do. What were some factors that you needed to consider?

■ 1.3 Process Description

1.3.1 Introduction

A process description is a useful way of describing an experiment, explaining how a machine works, or telling a colleague how a task is completed (Focus 2017). There is a simple structure which should be utilized so that the reader is able to follow the description of the task without much difficulty.

Introductory Statement

As in most essay-style texts, it is useful to include an introductory statement, which explains what the process is. This gives the reader an overview of what is happening, why the process is useful and what the outcome should be. The introduction should also incorporate limitations of the process. Information about the number of steps in the process may also be included in this statement.

Useful phrases for an introductory statement:

- This process describes ...
- The process of ... is useful for ...
- An (experiment) is done in order to ...
- A (machine) is used to ...
- The diagram illustrates ...

- The diagram indicates ...
- The picture shows ...
- The chart depicts how ...

Example:

Ground water is often found in aquifers or underground rock layers containing water. The water found in aquifers has undergone a natural filtration process. This process is a part of the water cycle. Water contained in aquifers may still require further filtration and cleaning in order to be suitable for human consumption. This text will describe the natural filtration process. **Natural filtration begins when precipitation hits the ground.**

Ordinal Numbers and Sequential Words

Since a process description is describing a step-by-step process, it is useful to include **ordinal numbers** and **sequential words** to show the reader the order in which the steps should be completed. Remember that after a sequential word, one cannot use an ordinal number again.

Correct: First, take out the supplies. **Second**, add the solvent to the solute. **Next**, mix the solution using a magnetic stirrer. **Finally**, cool the solution using an ice bath.

Incorrect: First, take out the supplies. **After that**, add the solvent to the solute. **Third (= incorrect)**, mix the solution using a magnetic stirrer. **Finally**, cool the solution using an ice bath.

Ordinal numbers	Sequential words
First, ...	Next, ...
Second, ...	To begin with, ...
Third, ...	Subsequently, ...
Fourth, ...	Following this/that, ...
Fifth, ...	The next step is ...
Sixteenth, ...	When ...
Once ¹	After that, ...
	Finally, ...
	The final step is ...

¹⁾ to show two actions in one sentence

Example using ordinal numbers:

The **first step** in the natural water filtration cycle is precipitation. **Second**, the water infiltrates the soil and reaches a sand and gravel layer. **Third**, the water is filtered as it passes through the sand and gravel layer.

Example using sequential words:

After the rain hits the ground, the water infiltrates the soil. **Next**, the water flows through the soil and reaches a sand and gravel layer. **Following this**, the water is filtered as it flows through the sand and gravel layer.

Example using both ordinal numbers and sequential words:

The **first step** in the natural water filtration cycle is rain. **In the second step**, the water infiltrates the soil and reaches a sand and gravel layer. **Next**, the water is filtered as it flows through the sand and gravel layer.

Grammatical Features

Since a process description illustrates a situation which is always the case, the simple present is used. In addition, the person completing the action is of little to no importance, or as in the case above, there is no actor. That is why the passive voice is a common feature of process descriptions.

Active voice:

Subject + verb + object + additional information (manner, place, time)

The sand and gravel layer filters the water as it flows through.

Passive voice:

Object + to be + past participle + additional information + (by/preposition) subject

The water is filtered as it flows through the sand and gravel layer.

1.3.2 Exercises

When it rains, water goes into the soil. First, the water goes into the unsaturated zone. Next, it flows down to the water table and enters the saturated zone. In Figure 1.2, the saturated zone is blue. Third, the dirt and sand in the soil clean the water. After that, it collects in underground cracks and basins. Finally, people can collect the water and drink it. That's how an aquifer forms.

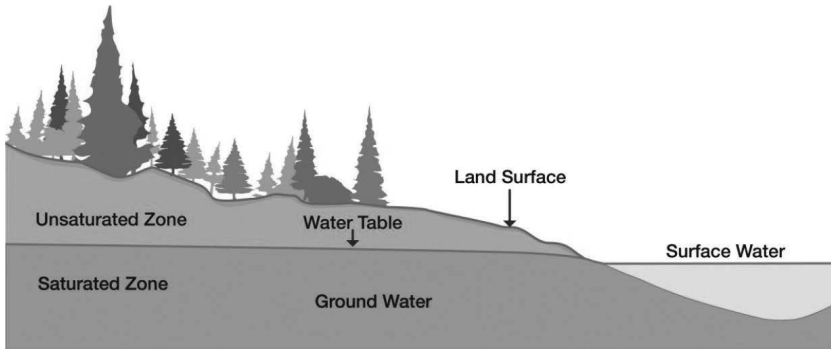


Figure 1.2 Ground and surface water sources (source: Centers for Disease Control and Prevention, Water Sources 2022)

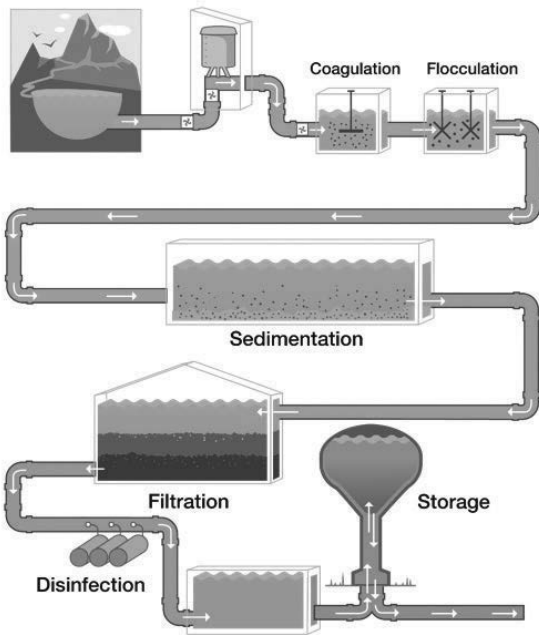
1. The previous process description of natural water filtration based on Figure 1.2 contains a number of errors according to the rules above. With a partner, list all of the errors you can find.

- a) _____
- b) _____
- c) _____
- d) _____
- e) _____
- f) _____
- g) _____

2. Re-write the process description. You may use some of the example sentences presented here.

3. Write a process description for filtering water at a water filtration plant. You can find a diagram (Figure 1.3) as well as important vocabulary below (courtesy of Centers for Disease Control and Prevention, Water Treatment 2022).

Water Treatment Steps



cdc.gov/drinkingwater

Figure 1.3 Steps in water treatment (source: Centers for Disease Control and Prevention, Water Treatment 2022)

Vocabulary

Adsorption: the adhesion of particles (ions, atoms, molecules) from a fluid or dissolved solid to a surface

Clarification: the separation of formed precipitates using either settlement or flotation techniques

Coagulation: the process whereby positively charged metal salts are added to the water and rapidly mixed to neutralize negatively charged particulates, colloidal and dissolved contaminants, resulting in the formation of floc particle agglomerations²

Filtration: the physical process that occurs when liquids, gases, dissolved or suspended matter adhere to the surface of, or in the pores of, an absorbent medium

Flocculation: the gentle mixing of water to form larger, heavier particles called flocs. Often, water treatment plants will add additional chemicals during this step to help the flocs form.

Ground water: water found under the surface, absorbed either in the soil or between crevices in rocks

Mechanisms: a system of parts working together in a machine

Reverse osmosis: the flow of fluids, gases or dissolved fluids that moves from an area of high concentration to one of lower concentration, which is the reverse of the natural flow

Sedimentation: the process whereby heavier particles settle to the bottom

Straining: the flowing of a fluid through a porous material to separate out solid particles

Surface water: water that collects on the surface of the earth in streams, rivers, ponds, lakes and oceans

■ 1.4 Writing a Lab Report

1.4.1 Introduction

A lab report is a written overview of what was completed in the lab during an experiment. It is a necessary aspect of lab work and follows a very specific format. This ensures that all readers are able to follow what was done easily.

²⁾ accumulations

Purpose: to express what was completed in an experiment, including an overview of the steps performed as well as the results of the experiment and background on why the experiment was conducted, or why this experiment is useful

Audience: lab instructor, classmates, people who would like to complete the experiment (usually all people who have knowledge of the experiment performed)

1.4.2 Exercises

There are a number of considerations when writing a lab report. Use the chart below to guide you in thinking about what needs to be included, and how each section should be written. Work with a partner to complete the chart. Use the lab report in Appendix 3 for help. Alternatively, you can find examples of lab reports in the following links:

- https://www.reed.edu/writing/paper_help/labreport_good.html
- <https://www.hamilton.edu/documents/Sample%20Bio%20Lab%20Report.pdf>
- <https://physics.unc.edu/undergraduate/courses-credits-placement/sample-report>

Sections of a Lab Report		
Section	Content	Guidelines

Sections of a Lab Report		
Section	Content	Guidelines

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