

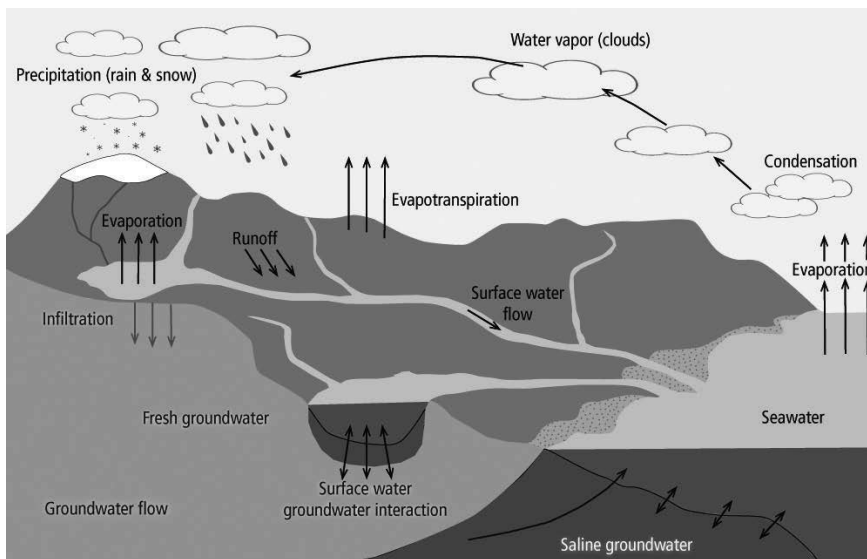
# 1

# 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?

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

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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?

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## ■ 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 <sup>1</sup>	After that, ...
	Finally, ...
	The final step is ...

<sup>1)</sup> 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.

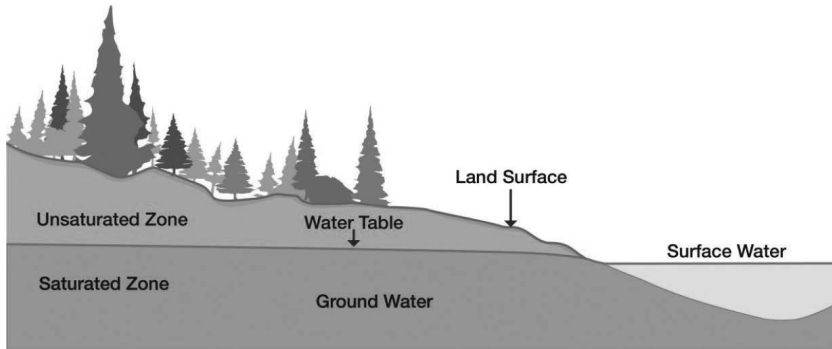
Passive voice:

**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.

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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).



## 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 agglomerations<sup>2</sup>

**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.

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<sup>2)</sup> 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.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		
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