Contrast Contrast properties with the properties of others to reveal their significance.

Structure

Format Clarify the text with

(a) *Heads* Identify topics with clear, nested section headings.
(b) Lists Itemize related features with indenting and marks.
(c) *Figures* Integrate figures and text with labels and references.

Verbal cues Guide the reader through the instructions with

(a) *Parallelism* Use parallel words and phrases for parallel ideas.
(b) *Proleptics* Use verbal links (*also*, *but*, *however*, etc.) to signal how the description fits together.

Checklist

As you reread and revise your instructions, watch out for problems such as the following:

- Make sure you provide real instructions—explanations of how to build, operate, or repair something.
- Write a good introduction—in it, indicate the exact procedure to be explained and provide an overview of contents.
- Make sure that you use the various types of lists wherever appropriate. In particular, use numbered vertical lists for sequential steps.
- Use headings to mark off all the main sections and subheadings for subsections. (Remember that no heading 'Introduction' is needed between the title and the first paragraph. Remember not to use first-level headings in this assignment; start with the second level.)
- Use special notices as appropriate.
- Make sure you use proper format for all headings, lists, special notices, and graphics.
- Use graphics to illustrate any key actions or objects.
- Provide additional supplementary explanation of the steps as necessary.
- Remember to create a section listing equipment and supplies, if necessary.
- Include strong sections of definition, description, or both, as necessary, using the guidelines provided on content, organization, and format.
- Share the draft with the people of similar aptitude and knowledge for whom the instructions are made

Writing Technical Descriptions

The main steps involved in writing technical descriptions include naming, definition (assigning meaning to objects), description (highlighting certain aspects of the object), and illustration (description using graphic elements rather than words). These four activities are explained as follows:

Naming

This most basic activity, naming, is how we understand the world around us. Without names, we would have to refer to objects, people, or places with sounds and gestures: 'uhh, that big thing over there' or 'you know, what's his name, the little fat guy with the blue hair'. This might be acceptable to some extent in a face-to-face communication, but it is impossible in written communication. We describe the world around us by naming what we see. Hence, start with naming the objects and processes that are being described.

Definition

A technical description begins with a definition (formal or extended) of the object or process to be described and a general breakdown of the components that will be detailed. The introductory paragraphs (or pages, in some cases) provide the reader with general information of the content that follows. Usually, the definition is followed by a list of the components and a brief note on the detailed description of each. In the case of the digestive system, for example:

First, the definition

> The digestive system is essentially a tube passing through the body from the mouth to the anus. It is responsible for the ingestion and processing of food into useable energy, which is taken up by the body's cells, and non-useable waste products, which are eliminated.

Then, the list of components

> The digestive system consists of the mouth, oesophagus, stomach, small and large intestines, the colon, and the anus.

Finally, an outline of the detailed description that follows

> Each of these components is described in terms of its function and cellular makeup in the subsections that follow.

A *definition* fixes an object, concept, or process within some system of knowing. Definitions appear in one of three forms: *formal*, *informal*, and *extended* definition. A formal definition will contain a *term* (that which is to be defined), a *category* to which the term belongs, and a set of *differentia* (a set of words that separate the term from those elements within the category in which the term is located). An informal definition appears in brackets in a sentence to help clarify a concept (for example, one was used in the definition of *term* above). An extended definition is a form of technical description itself and may run to tens, hundreds, or even thousands of pages in length. The formal definition is the most common form and is the one given in dictionaries. As a rule, a definition cannot use the term itself in the category or the differentia. For example, we cannot say that a Calico cat is a cat that is calico in colouration—this is referred to as a circular definition.

If you have ever played 'twenty questions' (the game in which the players try to guess the identity of an object in the mind of another player by asking questions to which the answer can only be yes or no), you will have a good grasp of categories. To start a game like this one, a player will ask a question such as 'Is the object manufactured' or 'Is the object natural'. It would be useless to ask 'Is it a comb' right away since you only have twenty questions that you can ask. The strategy to playing successfully is to narrow the category to which the object belongs sufficiently so that naming specific objects becomes a possibility.

Asking whether an object is big or small provides no useful information because the terms big and small are relative—one quickly learns to relate the size to something specific—like a Volkswagen or a Canadian dime. For example, a float-plane is an object that is larger than a Volkswagen, but you would still have a difficult time determining the name of the object from that category.

Functional categories are also useful in this case; such as 'What does it do?'. Questions such as 'Is it a form of transportation?' or 'Is it a tool?' might help. To guess that the object is a form of transportation gets us somewhere closer to a correct guess, in the case of the float-plane, but so are cars, trains, and ships. As it is obvious, narrowing the category is critical to winning this game—guess air transport, guess fixed-wing air transport, guess fixed-wing air transport that is able to take off or land on water and you have a working definition of a float-plane.

Description

Description is the process of making an object, idea, or process known to someone who is unfamiliar with it (it is very much like a definition in that respect). A description will use words and illustrations to outline the shape, the material, the purpose or function, and the relationship of one object, idea, or process to other objects, ideas, and/or processes. A description attempts to make the unknown familiar; therefore, it occasionally uses the light of the familiar to illuminate the darkness of the unfamiliar. In this quest, it is common for descriptions to use analogies, metaphors, or similes to get an idea across (for example, the metaphors of light and darkness in the preceding sentence were used to carry the meaning of the process of gaining knowledge). Description also relies upon strategies of organization such as division and classification, comparison and contrast.

Division and classification is the process of breaking down complex systems into more manageable components and then grouping the components together based on some over-riding determinant such as spatial relationship, functional or genetic similarity, chronological relationship, or a host of other bases upon which a classification can take place. The result is usually informative or analytical in nature rather than comparative. When the programming takes place for solving an algorithm, the programme is made of subprogrammes which are called within the main programme to get the final output of the algorithm.

Comparison and contrast is familiar to most people who have ever shopped for something that is made by many suppliers, or that comes in a variety of models—like a car or a computer. The compare and contrast method depends on a fixed set of criteria (such as cost, practicality, efficiency, or options available) in order to analyse the choices presented to the user. The criteria are applied to each of the cars or computers, for example, and a comparison of the results usually points to a better car or computer. Compare and contrast analysis is result oriented, and sometimes persuasive, rather than being strictly informative.

Illustrations

It has been said that a picture is worth a thousand words; however, in technical writing, it must be understood that a picture does not *replace* words; rather it *enhances the meaning* of the words. A prudent technical writer uses graphics to his/her advantage to show an overall view of the object or process and to illustrate each of the sub-divisions into which the object or process is divided.

Graphics are very useful as aids to transmit meaning, especially when language is a barrier to understanding, but they are limited to describing something abstract. Consider the following: How would you describe the beautiful maple leaf to someone who has never seen one? Or a hockey stick?

Graphics are ideal for representing things that are complex. However, they do not define themselves; we have to label and describe each part of the graphic based on what we want to convey. Consider this example: Is the definition of a hockey stick different for someone who has never seen one compared to someone who uses one professionally? The answer is yes. The hockey player defines the stick in a much different way because he/she has a different need—the player defines the stick in terms that are more refined: blade width, amount of curve allowed, shaft flexibility, and a host of other regulations imposed by the governing body of whichever league he/she plays in. The person who has never seen a hockey stick will most likely want to know what it looks like and how it is used.

Process Description

Once the components of the object, idea, or process have been described—and illustrated—there is one more form of description that allows the reader to visualize the complete function: the cycle of operation. This is a functional or relational description and shows how all the parts described work together to produce the desired result. This section takes the form of a narrative and gives the reader an overall view of the object, idea, or process. Process descriptions are written as if the process is taking place right now—and so in present tense. They usually begin and end at the same point; for example, press the start button/stop button, or feed in raw material/extract the finished product. Hence, ensure that a technical description follows this basic three-step form:

- A definition, followed by a list of the major components to be discussed, and an illustration.
- A section for each of the major components listed, which defines the components in terms of their function and then describes the components in terms of their material, dimensions, texture, relationship to other components, the method of attachment (and any other descriptors necessary), and lists all sub-components (which will also follow the basic 'define, describe, and illustrate' format)
- A description of one complete cycle of operation (a process description).

The following examples of object and process descriptions will help you understand how the guidelines given in this chapter can be used to write good technical descriptions.

Object Description: Dual-option Burner System

The dual option burner system can be operated either with or without a flow spoiler for optimum operation under different analytical conditions. Some versions of the dual option burner system also allow use of a removable impact bead. Consult the Spectrometer instruction manual for details on the burner system provided. A diagram of the dual-option burner system is shown in Figure 16.1.

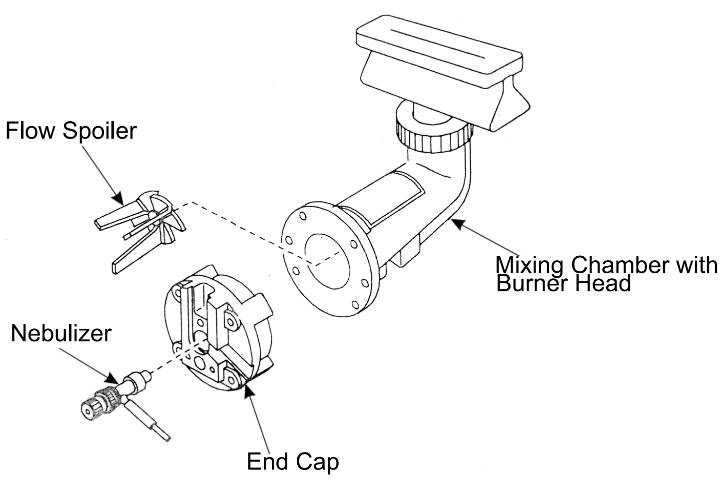

FIGURE 16.1 Diagram of dual-option burner system

The premix burner chamber is molded from plastic and treated to insure proper drainage. The burner system can be operated either with or without a flow spoiler. The flow spoiler is molded of polypropylene and is held in position by three support arms which press-fit to the walls of the mixing chamber.

To facilitate removal, the end cap is held in place by four large knurled-head screws. A large O-ring, held captive by a groove in the end cap, is used to seal the end cap to the mixing chamber. For extended operation with organic solvents, a Corkprene O-ring is also available.

For routine operation it is recommended that the burner system be operated with a flow spoiler. The flow spoiler helps to remove large droplets from the nebulizer aerosol and thus minimizes chemical interferences. Removing the flow spoiler provides somewhat improved sensitivity with generally little or no degradation in precision. However, it is recommended that operation without a flow spoiler be restricted to the analysis of relatively "clean" samples, where the risk of chemical interferences is low.

Burner heads

There are four burner heads available for use with the dual-option burner system. They are all made of solid titanium which is corrosion resistant and free of most of the elements commonly determined by atomic absorption.

The 10-cm burner head is designed to be used with the air-acetylene flame. Because of its long burner path length, it provides the best sensitivity for air-acetylene elements.

The 5-cm nitrous oxide burner head is required for nitrous oxide-acetylene operation. On many spectrometer models, it can also be used with air-acetylene or air-hydrogen. It can be rotated 90° to provide reduced sensitivity.

The three-slot burner head is designed to be used when analyzing samples with high concentrations of dissolved solids. The three-slot burner head is not compatible with all gas control systems. Refer to your spectrometer operating manual or hardware guide for information about possible use of the three-slot burner head.

A 5-cm air-acetylene burner head is available for applications in which reduced sensitivity is required. On many spectrometer models, it can be rotated 90° to provide reduced sensitivity, and it has a wide slot to prevent clogging. This burner head can be used only for air-acetylene operation.

Nebulizers

To meet varying analytical requirements, several different types of adjustable nebulizers are available. Some types are constructed from inert plastic to provide maximum chemical resistance when highly acidic or corrosive solutions are being analyzed. The standard nebulizer, which provides best performance with respect to minimizing chemical interferences, is recommended for general-purpose applications. A High-Sensitivity Nebulizer is available for applications that require maximum sensitivity and the lowest flame detection limits. The High-Sensitivity Nebulizer utilizes an integral ceramic impact bead to enhance atomization efficiency.

All Perkin-Elmer nebulizers can be easily disassembled for cleaning, and individual parts are available if replacement is necessary.

The Standard Conditions section of this manual provides typical characteristic concentration values for the standard nebulizer.

Process Description: Natural Waters

Scope

This method describes the determination of calcium, copper, lithium, magnesium, manganese, potassium, sodium, strontium, and zinc in natural waters, and may be applicable to other elements.

Reagents

Lanthanum solution, 5% (w/v). Prepare as described under the Standard Conditions for La.

Hydrochloric acid, HCl, concentrated.

Standard solutions

Prepare all standard solutions except calcium and magnesium by suitable dilutions of the stock solutions described under the Standard Conditions for each element. For calcium and magnesium, dilute the stock solutions with the 5% (w/v) La solution and HCl to give dilute standards which contain 0.25% (w/v) La and 5% (v/v) HCl.

Sample preparation and analysis

Filter each sample through a 0.45 micron micropore membrane filter, if necessary, to avoid clogging of the burner capillary. Aspirate each sample directly, except for calcium and magnesium. For calcium and magnesium, dilute with 5% (w/v) La solution and HCl to give a final solution concentration of 0.25% (w/v) La and 5% (v/v) HCl. Determine the concentration of the element of interest by using the Routine Procedure as described in the General Information section. Calcium and magnesium results should be corrected by using a reagent blank.

Calculations

Read the concentration of the element of interest directly against the appropriate standards. Where a dilution is required, the concentration of the element of interest is calculated as follows:

Element (ug/mL) = (ug/mL in diluted solution)(volume of diluted solution in mL)

(volume of aliquot taken for dilution in mL)

Please refer to the companion CD for more samples of object and process descriptions.

SUMMARY

Research papers may be classified under the advanced forms of technical writing, generally taken up by academicians and researchers. This formal form of writing possess certain specific characteristics and include some essential components in its structure. It is also necessary to follow certain steps in writing them. Knowledge of all these features will enable one to write this important document with effectiveness in order to disseminate research-related information to their readers. The importance of technical descriptions is also growing fast with the development of technologically advanced products. A technical description is required to understand the details of an object or a process, and to be able to identify the problem if something goes wrong in the functioning. Hence, one needs to keep in mind organization, content, structure, classification, and level of detailing in order to provide a clear and effortless description that is easy for the reader to grasp.