Verb forms in composition instruction for students studying English as a second language

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Verb forms in composition instruction for students studying English as a second language

by

Sandra Ann Hugg

A Thesis Submitted to the Graduate Faculty in Partial Fulfillment of The Requirements for the Degree of MASTER OF ARTS

Major: English

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I. INTRODUCTION

This is a text for a course designed for nonnative English learners who are advanced in their study of the English language. Primarily, this material is for those students who are in the sciences, engineering, or agriculture and who must learn how to write about processes. The text examines three types of processes—reoccurring processes, nonreoccurring processes, and sets of directions—for their use of person, voice, and tense. Then, it presents rhetorical "rules" for their use. These "rules" are not formal, absolute, or complete; they are intended to be guidelines which help the students write about processes correctly.

The idea for this text resulted from a questionnaire sent to all members of the English Department at Iowa State University. (The results of the questionnaire are stated in Appendix A.) The questionnaire asked these members to consider the foreign students they had had in their classes and to indicate the students' competency in four areas of composition: material, organization, expression, and mechanics. The results of this questionnaire showed that most of the teachers considered "mechanics" to be the weakest area for most of the foreign students. More specifically, the teachers reported that verb forms gave the students the most problems. Therefore, it was decided
that this thesis should deal with verb forms in compositions. Furthermore, since most foreign students at Iowa State University come to the United States to study some field of science, engineering, or agriculture, it was decided to concentrate on verb forms in the types of compositions that these students would have to write in their fields, i.e. process descriptions.

The book consists of three major units: reoccurring processes, nonreoccurring processes, and sets of directions. Each part contains a sample composition whose verbs are analyzed for person, voice, and tense. For the most part, the analysis is presented inductively. The student is asked to consider the verbs in the context of the composition. Then, he is given questions, the answers for which become a basis for deriving a rule for the selection of person, voice, or tense. This approach is used to help the student learn to analyze his writing. In the author's experience with foreign students, she has discovered that, in many countries, students are taught to memorize rather than to analyze. The approach this book takes will help the student learn to analyze his writing and recognize when to apply the rules. After each analysis of the sample composition, there are sets of exercises which allow the student to practice the rules he has just learned. These exercises follow a controlled writing approach; they attempt to guide the student's writing
from the point where he merely changes a verb form of an already-written composition to the point where he composes an entire composition by himself. In this way, the teacher can control the verb forms the student practices. Also, the already-written compositions provide the student with models for the compositions he must compose by himself.

The sources of both the sample compositions analyzed in each unit and the model compositions in the exercises are various technical and scientific writings from encyclopedias, scientific journals, scientific anthologies, and publications of the Government Printing Office. The exact source for each composition is indicated in the notes.

While writing the text, the author tried to use language appropriate for the nonnative English learner who is advanced in his study of the English language. Furthermore, she assumed that the student has a knowledge of traditional grammar terminology.

It should be noted that each unit in the text contains its own set of rules. Although some of the rules in a unit are the same as those in another unit, the rules are stated separately in each unit. Furthermore, the exercises in each unit pertain to that unit only. Consequently, a teacher, according to the needs of individual classes or individual students, can use each unit of this text independent of the others.
II. PROCESSES

A process is a group of actions that are related and which occur in a special order. For instance, building a chair or painting a house are processes. There is usually a result of the process. A new chair is the result of building a chair while a newly-painted house is the result of painting a house.

There are two types of processes: 1) reoccurring and 2) nonreoccurring. A reoccurring process is one that has occurred in the past and is likely to occur again in the future. The life cycle of flies is such a process. A nonreoccurring process is one which will not happen again; it occurred only once at a specific time and at a specific place in the past. An example of a nonreoccurring process is the life cycle of one fly. Thus, reoccurring processes are more general than nonreoccurring ones; the steps in a reoccurring process occur to all the members of a group, such as a group of flies. However, nonreoccurring processes are specific; the steps in a nonreoccurring process happen to one member of a group, such as one fly. Another example of a reoccurring process is a description of how to build chairs, while an example of a nonreoccurring process is a description of how Jim Smith built a particular chair for his living room during one week in 1976.
When writing about a process, a person usually can describe the steps in chronological order, the order in which the steps happen. W. P. Jones suggests that the following outline be followed for writing about both reoccurring and nonreoccurring processes.

I. Introduction
   A. Definition of the process
   B. General information: where, when, by whom performed
   C. Preparation for the process
      1. Materials and apparatus
   D. Precautions to insure safety, quality, etc.
   E. List of the steps
II. Description of the steps
   A. Description of Step 1
      1. Definition
      2. General statements about the step as a unit
      3. Materials, apparatus, etc. needed
      4. List of divisions of Step 1
         a. Description of first division
         b, c, etc. Description of other divisions of Step 1 in order
   B, C, etc. Descriptions of Steps 2, 3, etc.
III. Synthesis: summary of the steps as a whole
     (if necessary)
   A. Appropriate concluding statements if needed

Although the same outline can be followed to describe both reoccurring and nonreoccurring processes, identical verb forms cannot be used. Writers who are describing processes must make decisions about what is called "verbal point of view." They must choose the appropriate forms for verb voice (active or passive), tense (present, past, future), aspect (progressive, perfect), person (first, second, third), and for modal auxiliary verbs ("may," "should," "can," "must,"
"might," etc.). The discussion which follows will give suggestions and rules for making choices about verbs for writing descriptions about reoccurring processes.
III. REOCCURRING PROCESSES

The introduction on processes says a reoccurring process is one that has occurred in the past and is likely to occur again in the future. Also, it is one which happens to all the members of a group. The following is an example of a reoccurring process. Notice that it follows Jones's outline for processes.

Development of a Colony of Social Wasps

Section | Introduction
---|---
Social wasps are stinging insects related to the bees and the ants. These wasps live together in communities and cooperate with one another. Furthermore, they have a caste system which consists of: a) queens--fertile females that lay eggs, b) males, and c) workers--sterile females. Except for the queens, the social wasps live only from spring until winter. Thus, a new colony of wasps is produced each year.
The development of the colony occurs in three stages: 1) the mating of the males and the queens, 2) the development of the workers, and 3) the enlargement of the nest.

Mating of the Males and the Queens
The first step in the development of a colony of social wasps occurs in the fall. At this time, the queens and the males leave their nests and mate. The males die shortly after mating, but the queens hibernate in the cracks of rocks, under the bark of trees, in buildings, or in the ground.

Development of the Workers
The second step happens in the spring. Then, the queen comes out of hibernation and starts building a nest. She collects wood or vegetable fiber from trees and woody plants, chews it into a paperlike substance, and constructs a comb that consists of a few shallow cells. She lays

List of the Steps

Definition of the Process and General Information About It
Section

An egg in each cell.
In two or three days, the eggs hatch into larvae. The queen cares for these larvae by killing fresh insects to feed them. In twelve to eighteen days, the larvae complete their development; then they spin silken cocoon caps over the cells and change into pupae. After twelve days, the pupae become adults and emerge from the cells. These adults are all workers.

Enlargement of the Nest
In the third stage, the adult workers take complete charge of nest life. The queen does nothing except to lay eggs. The workers care for the larvae and enlarge the nest by building additional cells. Most of the new larvae develop into more workers. However, in late summer, the queen lays eggs which become males and young queens. It should be noted that, if the queen dies before the summer ends, the workers, if they have been well fed, produce the eggs.

Conclusion
The development of the colony is completed with the production of males and young queens. In the fall, the males and queens mate, the males die, and the queens hibernate. Thus, the process repeats itself.

A. Tense, Person, and Voice Used With Reoccurring Processes

When writing about a reoccurring process, one must follow certain rules for using tense, person, and voice. First of all, let's consider the rule for the use of person. If you examine the above example of a reoccurring process, you will discover that one person is used throughout the paper. What person is it? First? Second? Third? Notice that third person is used. This is not unusual. According to W. P. Jones, third person is generally used for describing
reoccurring processes. Sometimes, first person is used, but first person occurs only when 1) the author is the performer of the process and 2) it is important to know that the author is the performer of the process. However, these conditions are seldom met, so first person is rarely used. Third person is usually employed for describing scientific processes. Thus, Rule 1 for writing about a reoccurring process is:

**Rule 1 for Reoccurring Processes**

When describing a reoccurring process, use the third person. Use the first person only if the following two conditions are met: 1) the author is the performer of the process and 2) it is important to know that the author is the performer of the process.

Now, let's examine the wasp colony example for the use of tense. To begin, let's consider Section I.

**Introduction**

(1) Social wasps are stinging insects related to the bees and the ants. (2) These wasps live together in communities and cooperate with one another. (3) Furthermore, they have a caste system which consists of: a) queens—fertile females that lay eggs, b) males, and c) workers—sterile females. (4) Except for the queens, the social wasps live only from spring until winter. (5) Thus, a new colony of wasps is produced each year. (6) The development of the colony occurs in three stages: 1) the mating of the males and the queens, 2) the development of the workers, and 3) the enlargement of the nest.

Notice that all six sentences employ the same tense. What tense is this? All six sentences use the present tense. However, the sentences do not employ the present tense for the same reason. For instance, consider sentence 1. It uses
the present tense because it states a definition. Thus, it follows Rule 2 for writing about reoccurring processes.

Rule 2 for Reoccurring Processes
When defining, use the present tense.

Now, look at sentences 2 through 6. They make statements which have been true in the past about social wasps and which should be true about these wasps in the future. Thus, sentences 2 through 6 state general facts about social wasps. A general fact about a process describes what happened when the process took place and what will occur when the process is performed in the future. Therefore, we can now state Rule 3 for writing about reoccurring processes.

Rule 3 for Reoccurring Processes
When stating general facts about a process, use the present tense.

At this time, reread Sections II and III of "Development of a Colony of Social Wasps," and note that one tense is used consistently throughout these sections. What tense is it? Why is it used? Notice that the sentences in these sections state general facts about the development of a colony of social wasps. Therefore, these sentences follow Rule 3 and employ the present tense.

It should be noted that the definition of a general fact and the definition of a reoccurring process are similar. Let's review these definitions.

Definition of a reoccurring process: a process that has occurred in the past and is likely
to occur again in the future.

**Definition of a general fact about a process:** a fact that describes what happened when the process took place and what should occur when the process is performed in the future.

These definitions show that the description of a reoccurring process consists mainly of general facts. Therefore, the majority of a description of a reoccurring process is written in the present tense.

Let's continue to examine the tenses in "Development of a Colony of Social Wasps." First, let's study Section IV.

**Enlargement of the Nest**

1. In the third stage, the adult workers take complete charge of nest life.
2. The queen does nothing except to lay eggs.
3. The workers care for the larvae and enlarge the nest by building additional cells.
4. Most of the new larvae develop into more workers.
5. However, in late summer, the queen lays eggs which become males and young queens.
6. It should be noted that, if the queen dies before the summer ends, the workers, if they have been well fed, produce the eggs.

Let's consider sentences 1 through 5. What tense do they employ? Like the sentences in Section II and III, sentences 1 through 5 employ the present tense because they state general facts about the development of a colony of social wasps. Sentence 6 is more complicated than sentences 1 through 5. Note that sentence 6 contains five verbs and that these verbs do not all use the same tense. Let's examine these tenses individually. First, let's look at the opening clause of sentence 6.

It should be noted that . . .
Notice that this clause uses the passive voice. Who or what is the agent of this clause? The agent is the person who is reading the process. Therefore, this clause does not make a statement about the wasp nest process; instead, it makes a statement about the person reading the process. Furthermore, note that the verb consists of the modal should plus the passive be noted. The modal should is used because the clause expresses an advisory obligation—that is, the clause advises the reader about something he ought to do if he wants to understand the process fully. The author could have used the modal ought to, instead of should, in this clause because the modal ought to also expresses an advisory obligation. Therefore, we can now state Rule 4 for describing reoccurring processes.

**Rule 4 for Reoccurring Processes**

When stating an advisory obligation, use the modal should or the modal ought to.

Now, let's examine some other clauses in sentence 6.

... if the queen dies before the summer ends, the workers ... produce the eggs.

We should look at these three clauses together because they state a condition and its result.

**Condition:** if the queen dies before the summer ends

**Result:** the workers ... produce the eggs

Consider the tenses in both clauses. Are they the same or different? They are the same; all the clauses use the present
tense. They employ the present tense because the condition and its result state general facts—that is, the condition and its result have occurred in the past and are likely to occur again in the future. Thus, we can now state Rule 5 for reoccurring processes.

Rule 5 for Reoccurring Processes

When a condition and its result are general facts, use the present tense for the clause that states the condition and for the clause that states the result.

Now, let's examine the clause

... if they [workers] have been well fed, ...

Note that this clause also states a condition; it expresses a condition that must be fulfilled before the workers are able to produce eggs. Notice that this clause does not employ the present tense. What tense does it use? This clause uses the present perfect. Why? The present perfect is used to express an action that has been carried out a little while before the present or immediately before the present. Sometimes this action even continues into the present. Therefore, since the action of being "well fed" occurs before the action of producing the eggs, and the action of producing the eggs is stated in the present tense, the action of being well fed must be stated in the present perfect. Perhaps the following diagrams will help to explain this fact more clearly.
Actually, it is possible to state this condition in the present tense, so sentence 6 could be written:

It should be noted that, if the queen dies before the summer ends, the workers, if they are well fed, produce the eggs.

It is possible to use the present tense here because the condition is stating a general fact about the process. However, it is probably better to use the present perfect for stating this condition because the action stated in the condition has been fulfilled before the action in the result occurs.

Perhaps you are wondering why the first clause (if the queen dies) of the condition if the queen dies before the summer ends was not stated in the present perfect because the queen must die before the workers are able to produce eggs. Actually, it is correct to express this condition in the present perfect. Thus, sentence 6 could be written:

It should be noted that, if the queen has died before the summer ends, the workers, if they have been well fed, produce eggs.
However, it is better to employ the present tense (if the queen dies) with this condition. One reason for this is that the present tense here follows Rule 5. Another reason is that the present tense emphasizes the immediacy of the action; at the point that the queen dies, the workers begin to produce the eggs. This condition of dying immediately precedes the result, and it is the main condition which causes the result to happen. The following diagram demonstrates this.

```
queen dies workers produce eggs
```

Figure 3.2. Time relationship of condition to result

The actions in the condition and the beginning of the result occur at approximately the same time. Therefore, the same tense is used to express these actions.

To understand this concept better, consider the other condition, if they have been well fed. Note that this condition does not immediately precede the result; in other words, it is not the main condition which causes the egg laying result. If the queen does not die, the workers do not produce eggs, even if the workers have been well fed. Thus, if they have been well fed expresses a preliminary condition which must occur sometime before the egg laying result but which does not have to occur immediately before the result. Because this "well fed" condition starts earlier,
it is better stated in the present perfect. The following
diagram illustrates the time relationship between these two
conditions and the result.

(preliminary
condition) (immediate
condition) (result)

workers have
been well fed queen dies workers produce
eggs

Figure 3.3. Relationship of two conditions to
a result

Thus, we are now ready to state Rule 6 for reoccurring
processes.

Rule 6 for
Reoccurring
Processes

6A: When a result and its conditions
state general facts, all of the
clauses that state them can
employ the present tense.

6B: Because some immediate and
preliminary clauses must start
well before the result, these
can be expressed in conditional
clauses that use the present
perfect.

6C: The best way to express a result
and its conditions which are
general facts is to use the
present tense for stating the
result and those conditions
which directly cause the result--
i.e., those which occur immediately
before the result--and to use the
present perfect for preliminary
conditions--i.e., those which start
before the result, but not imme-
diately before it.

At this time, let's examine Section V, the conclusion
of the wasp colony process description. Notice that the sentences in this section employ the same tense. What is the tense? Why do they employ it? Since the sentences in this section state general facts about the development of a colony of social wasps, they follow Rule 3 and employ the present tense.

We are now ready to study the "Development of a Colony of Social Wasps" for its use of voice. Reread this sample process description to see what voice is used in the majority of the article. Is the voice there mainly active or passive? Notice that the majority of the article employs the active voice. In fact, only three sentences in the entire article use the passive.

Sentence A (from Section I): Thus, a new colony of wasps is produced each year.
Sentence B (from Section IV): It should be noted that, if the queen dies before the summer ends, the workers, if they have been well fed, produce the eggs.
Sentence C (from Section V): The development of the colony is completed with the production of males and young queens.

Let's examine these sentences to see why they use the passive.

First, let's look at sentences A and C. They are similar because they have the same agent. Who or what is the agent in these sentences? The agent is obvious—it is those wasps which build the colony, i.e. the queen and the workers. Furthermore, these sentences are alike in that both
emphasize the verb's target by making it the grammatical subject of the sentence. Thus, in sentence A, the product, a new colony of wasps, is emphasized while in sentence C the development of the colony is stressed. Now, let's look at the clause if they have been well fed in sentence B. What is the agent of this clause? The agent is unknown. We do not know who has done the feeding; perhaps other wasps in the colony fed the workers, or maybe the workers fed themselves. We can only guess because we do not know. Furthermore, notice that this clause emphasizes the verb's target, they [the workers], by making it the grammatical subject of the clause. Therefore, we can conclude that the passive voice is used in sentences A and C and the clause if they have been well fed in sentence B because the author 1) wants to emphasize the target of the verb and 2) either cannot mention the agent because it is unknown or does not need to mention the agent because it is obvious. So, we can state Rule 7 for reoccurring processes.

**Rule 7 for Reoccurring Processes**

The passive voice is used when it is important to emphasize the target of the verb or when the agent is obvious, unimportant, or unknown.

Now, let's consider the first clause in sentence B, It should be noted. This clause is similar to sentences A and C in that it does not mention the agent because the agent is obvious. However, the agent in this clause is not the same as the agents in sentences A and C. In this clause,
the agent is the reader of the article about the wasp colony. This clause also differs from sentences A and C in that the target of the verb is not the grammatical subject of the clause. The target of the verb note is the that-clause (that if the queen dies before the summer ends, . . . ) which follows the verb. The subject of the clause is a "dummy" it, an it which does not refer to anything. Although it would be grammatically correct to make a that-clause the subject of a sentence, in English this usually is not done because readers of English do not like "front-heavy sentences." Therefore, verbs whose targets are that-clauses and whose agents are obvious, unimportant, or unknown often use the following construction: It + passive verb + that-clause. Some verbs that are commonly used with this construction are: forget, remember, deny, admit, think, suspect, believe, know, note, observe, determine, deduce, advise, recommend, suggest, urge, demand, prefer, say, prove, show, see, notice, demonstrate.

It + passive verb + that-clause.
It is forgotten that . . .
It is remembered that . . .
It is denied that . . .
It is admitted that . . .
It is recommended that . . .
etc.

We can now state Rule 8 for reoccurring processes.

Rule 8 for Reoccurring Processes
When a verb has a target which is a that-clause and an agent which is obvious, unimportant, or unknown, use the following construction:
It + passive voice + that-clause.
It should be noted that there are other forms of the "dummy"-it-plus-that-clause construction. There are certain verbs which never employ the passive with this construction. These verbs are: appear, follow, seem, happen, occur, turn out. These verbs use the following construction: It + active verb + that-clause.

\[
\text{It + active verb + that-clause.}
\text{It appears that . . .}
\text{It follows that . . .}
\text{It seems that . . .}
\text{It happens that . . .}
\text{It occurs that . . .}
\text{It turns out that . . .}
\]

We can now state Rule 9.

**Rule 9 for Reoccurring Processes**

For sentences which employ a that-clause, a "dummy" it as the grammatical subject, and the verbs appear, follow, seem, happen, occur, and turn out as the main verbs of the sentences, use the following construction: It + active verb + that-clause.

Still another construction which employs a "dummy" it and a that-clause occurs when an adjective modifies the that-clause. This construction is: It + be + adjective + that-clause. Some adjectives commonly used with this construction are: false, true, likely, unlikely, possible, unfortunate, important, necessary, impossible, fortunate, urgent, vital, essential.

\[
\text{It + be + adjective + that-clause.}
\text{It is false that . . .}
\text{It is likely that . . .}
\text{It is possible that . . .}
\text{It is necessary that . . .}
\text{etc.}
\]
Thus, we can now state Rule 10.

Rule 10 for Reoccurring Processes

When a sentence employs "dummy" it as the grammatical subject and contains a that-clause, use the following construction when an adjective modifies the that-clause: It + be + adjective + that-clause.

It should be noted that when certain verbs and adjectives are used with "dummy" it, the verb in the that-clause employs a special form, the simple base form. For instance, look at the following sentences.

Set A
- It is suggested that the experimenter place the acid in a glass container.
- It is advised that the lids be on top of the containers.
- It is preferred that nitrogen be used instead of sulfur.
- It is necessary that the experimenter place the burner at a 45° angle.
- It is important that the water contain no impurities.

Set B
- It is observed that the experimenter places the acid in a glass container.
- It is noted that the lids are on top of the containers.
- It is admitted that nitrogen was used instead of sulfur.
- It is true that the experimenter places the burner at a 45° angle.
- It is unlikely that the water contains no impurities.

Let's compare the sentences in Set A with those in Set B. In Set A, look at the verbs in the that-clauses. What form do they employ? They employ the simple base form of the verb. Now, look at the verbs in the that-clauses of Set B. What form do they employ? They use the indicative form and agree with the subject in person and number. Why do the verbs in
the that-clauses of Set A employ the simple base form while the verbs in the that-clauses of Set B agree with their subjects in person and number? The reason is found in the types of verbs and adjectives which precede the that-clauses. Look at the verbs and adjectives which precede the that-clauses in Set A. Notice that the Set A verbs state suggestions, preferences, and advice while the adjectives in Set A express necessity and importance. However, in Set B, the verbs which precede the that-clauses express none of these. Thus, in English, the verb in a that-clause uses the simple base form when the verb that precedes it states a suggestion, a preference, or some advice or when the adjective which precedes it expresses necessity or importance. Some common adjectives which cause the verbs in the that-clauses that follow them to use the simple base form are: essential, important, necessary, impossible, possible, vital, and urgent. Some common verbs which cause the verbs in the that-clauses that follow them to use the simple base form are: ask, advise, command, order, recommend, suggest, urge, beg, demand, and prefer. We can now state Rule 11 for reoccurring processes.

**Rule 11 for Reoccurring Processes**

When a verb which precedes a that-clause states a suggestion, command, preference, or some advice, or when an adjective which precedes the clause expresses necessity, importance, or possibility, the verb in the that-clause employs the simple base form.
Notice how Rule 11 is applied in these two examples:

It is important that the seed remain uncontaminated.
He advised that the seed remain uncontaminated.

You might be wondering why the active voice is used so much in "Development of a Colony of Social Wasps." To answer this, let's examine the first three sentences of Section IV.

(1) In the third stage, the adult workers take complete charge of nest life. (2) The queen does nothing except to lay eggs. (3) The workers care for the larvae and enlarge the nest by building additional cells.

All three sentences are in the active voice. Why? To answer this, consider the following questions. Who or what is the agent in each sentence? Is it important to identify the agent--i.e., would the agent be obvious if it were not stated in the sentence? Is it necessary to emphasize the agent by making it the grammatical subject of the sentence? Note that it is important to identify the agent in each sentence because the agent would not be obvious otherwise. For example, if the agent, adult workers, were not identified in sentence 1, the reader might think the agent was the queen or the adult workers plus the queen. The same mistake could be made for sentences 2 and 3. Thus, because it is necessary for the reader to identify the agents in these sentences, the author has emphasized the agents by using the active voice in order to make the agents the grammatical subjects of the
sentences. We can now state Rule 12 for reoccurring processes.

**Rule 12 for Reoccurring Processes**

When it is important to emphasize the agent, use the active voice.

Do not think that the passive is used very little in reoccurring processes. The use of the passive or the active depends upon the process. For instance, examine the process description below. Notice that the passive is employed more often in this passage than in "Development of a Colony of Social Wasps." Study the active and passive sentences and decide why the author chose the voice he did for each sentence. The passive verbs are underlined so that you can identify them easily.

**Simple Distillation**

**Introduction**

Distillation is a method to purify a liquid, such as water. This process operates on the principle that a liquid changes to a gas as it is heated and back to a liquid as it is cooled. This process employs heat and a still; the still consists of three parts: a boiler, a condenser, and a receiver. The process itself consists of two steps: vaporization and condensation.

**Vaporization**

Vaporization is the step in which the liquid is changed into a gas. In this step, the liquid is put into the boiler. Once it is in the boiler, the liquid is heated to its boiling point. This liquid continues to boil until it changes into a gas. The gas then passes into the condenser.

**Condensation**

The second step occurs in the condenser. In the condenser, the gas is cooled until it changes into a
liquid again. When this happens, the liquid passes into the receiver where it is collected. This completes the process.

Conclusion

The distilled liquid is purer than the original because the process leaves behind the substances in the liquid which do not evaporate at the liquid's boiling point. Thus, in two simple steps--vaporation and condensation--distillation purifies a liquid.

Now, reread the above passage and note the tenses used. What are they? Notice that only one tense--the present tense--is employed throughout the passage. Except for the second sentence in the paragraph headed "Introduction," you should be able to state the rules which allow the sentences in this passage to use the present tense. Let's examine the second sentence in the "Introduction" in order to discover why it employs the present tense.

This process operates on the principle that a liquid changes to a gas as it is heated and back to a liquid as it is cooled.

We are concerned only about discovering why the present tense is used in the that-clause (that a liquid changes to a gas as it is heated and back to a liquid as it is cooled) because we already know the reason for the use of the present tense in the opening clause of this sentence. The opening clause states a general fact about distillation; therefore, it follows Rule 3 and employs the present tense. Thus, let's look at the that-clause. Notice that this clause states two conditions and two results.
Condition 1: as it [a liquid] is heated
Result 1: a liquid changes to a gas

Condition 2: as it [a gas] is cooled
Result 2: [a gas changes] back into a liquid

Note that both conditions and both results state general facts about distillation. Because they do, you might be wondering why Rule 6 does not apply to these conditions and their results. If you review Rule 6, you will see that it applies to conditions which have been completed before the result begins. If you look at the above conditions and results, you will note that the conditions begin immediately before the results and these conditions continue until the results are completed. The following diagrams will help to demonstrate this fact.

Because these conditions and results begin at approximately the same time and occur simultaneously, they must employ the same tense. Since the conditions and results state general
facts, the tense they must use is the present. Rule 6 does not apply to these conditions and results because Rule 6 allows conditions which are general facts to employ either the present tense or the present perfect tense. The conditions in Figure 3.4 cannot employ the present perfect. Therefore, we need a new rule for these conditions. We can now state Rule 13 for reoccurring processes.

**Rule 13 for Reoccurring Processes**

When a condition starts immediately before a result and continues to occur at the same time as the result, the condition and the result must employ the same tense. If the condition and the result are general facts, the tense they employ is the present.

Now, you should be able to state why the present tense is used in each sentence of "Simple Distillation." Test your understanding of tense use with reoccurring processes by examining each verb in the passage and stating the rule which allows it to use the present tense.

**B. Exercises for Reoccurring Processes**

A. For each sentence below, fill in the blank with the correct tense of the verb in parentheses. Then give a brief explanation of why the tense is correct. For some blanks, more than one tense is correct.

1. When the metal *(to cool)*, it is removed from the pan.

2. If the students *(to complete)* the experiment, they are ready to begin another one if the instructor *(to prepare)* it.

3. If the superintendent *(to give)* the students permission and if the bus driver *(to fill)* the bus with gas, the teachers allow the students
to load.

4. When the paper (to catch) on fire, the burner is turned off.

5. If the student (to test) the metal thoroughly, he has no problem stating its identity if the teacher (to ask) him to do so.

6. When the vapor (to burn) in air, the temperature rises.

7. As the music (to play), the children dance if they (to awake) from their naps.

8. When iron (to cool), it contracts.

B. For each sentence below, fill in the blank with the correct voice of the verb in parentheses. Some verbs employ the construction It + passive voice + that-clause while other verbs use the construction It + active voice + that-clause. Use the present tense for all the verbs.

1. It (to follow) that angles ABC and DEF are equal.
2. It (to note) that the water evaporates.
3. It (to observe) that the nitrogen crosses the bed quickly.
4. It (to deduce) that the acid reacts with the base.
5. It (to happen) that the bones break at this point.
6. It (to appear) that the rocket travels at a much higher speed.
7. It (to turn out) that the results are not conclusive.
8. It (to believe) that the gases are inert.

C. For each sentence below, fill in the blank with the correct form of the verb in parentheses. When the verb takes the indicative form, use the present tense. Review pages 21-23 before you do this exercise.

1. It is essential that the acid (to be) poured into the container first.
2. It is recommended that the experimenter (to lower) the temperature.
3. It is true that the earth (to be) not flat.
4. It is impossible that the car (to travel) at a speed of 1,000 kph.
5. It is admitted that money sometimes (to bring) happiness.
6. It is observed that the temperature (to be) lower
at night.
7. It is thought that the birds (to be) in the nest at night.
8. It is important that the experimenter (to increase) the amount of air used in this part of the experiment.
9. It follows that the magnesium (to decrease) in weight when it is burnt.
10. It is sometimes said that the moon (to be) made of cheese.

D. Read the following description of a reoccurring process. For each sentence underlined, decide if it is important to emphasize the target of the verb. If so, change the sentence to the passive voice. If not, leave the sentence in the active voice. You might want to review Rules 7, 8, 9, and 12 before you do this exercise.

Digestion

Introduction

Digestion is the process which breaks down food into smaller particles for use in the human body. This process changes starches and complex sugars into simple sugars, fats into fatty acids and glycerin, and protein into amino acids. The simple sugars, fatty acids, glycerin, and amino acids then pass into the blood stream for utilization by the body. Digestion takes place in almost all parts of the alimentary canal and consists of the following steps: 1) the grinding of the food, 2) the churning of the food in the stomach, and 3) the breakdown of the food in the small intestine.

The Grinding of the Food

Digestion begins in the mouth. Here a person chews the food into fine particles. As he chews the food, it mixes with saliva which contains the enzyme ptyalin. The ptyalin changes some of the starches into sugar.

The Churning of the Food in the Stomach

Now a person swallows the food, and it passes through the esophagus into the stomach. Once the food is in the stomach, the vigorous churning motion of the stomach mixes the food with gastric juice. The gastric juice partially digests the protein in the food, but it does nothing to the starches, sugars, and fats. Depending upon the food, it
remains in the stomach for two to five hours. It then passes into the small intestine.

The Breakdown of the Food in the Small Intestine

In the small intestine, pancreatic juice, intestinal juice, and bile complete the digestion of the food. The pancreatic juice contains the enzymes trypsin, amylase, and lipase. Trypsin splits proteins into amino acids, amylase changes starch into simple sugars, and lipase breaks down fats into fatty acids and glycerin. The intestinal juice which the walls of the small intestine produce breaks down the same foods as the pancreatic juice does. The bile helps the body to absorb fats.

Conclusion

Once the body completes the digestion of the food, the tiny blood and lymph vessels in the walls of the small intestine absorb the food. The blood and lymph then carry the food to various parts of the body where the body utilizes it for nourishment.

E. Write a well-developed description of the reoccurring process of mitosis of the animal cell. To do so, follow Jones's outline for processes. Also, use the following information and illustrations. Before writing this description, review Rules 1 through 13. Use the outline which follows for your essay.

Mitosis of Animal Cells

Introduction

Definition of mitosis: process by which most cells reproduce

General information:
Process utilized by one-celled plants and animals, many-celled plants and animals, and most cells of the human body
Place of most of the process: nucleus of the cell
Stages of the process: 1) prophase, 2) metaphase, 3) anaphase, 4) telophase
Preparation of the animal cell for mitosis
Gathering of the chromatin—the substance containing the cell's hereditary material—into several chromosomes (threadlike structures)
Duplication of each chromosome to produce pairs (sister chromosomes) joined near the middle or end
Duplication of centrioles—two bundles of rods just outside the nucleus

Prophase
Simultaneous movement apart of each pair of centrioles
Condition: movement apart of each pair of centrioles
Result: centrioles sending out long fibers in all directions to form a spindle

(Rule 13)
Movement of centrioles to opposite sides of the cell to form poles
Breaking apart of the nuclear membrane

Figure E3.3. Cell in the prophase stage

**Metaphase**
Movement of the sister chromosomes to the equator (middle of the spindle)
Attachment of each sister chromosome to a spindle fiber

Figure E3.4. Cell in the metaphase stage

**Anaphase**
Separation of sister chromosomes

<table>
<thead>
<tr>
<th>Condition: separation of sister chromosomes</th>
<th>Result: movement of sister chromosomes to opposite poles</th>
</tr>
</thead>
</table>

(Rule 6)
Figure E3.5. Cell in the anaphase stage

Telophase
- Splitting of the cell at the equator
- Production of two new cells
- Dissolution of chromosomes into the strands and particles of chromatin

Conclusion
Result of mitosis: two new cells, each with a full set of chromosomes containing the same hereditary information as the original cell
Information which the reader should note: mitosis in plant cells different from mitosis in animal cells because cells in multicellular plants contain no centrioles

F. Write a paper describing a reoccurring process. The process should be one with which you are familiar. Follow the examples given in this chapter. Also, use Rules 1 through 13 when writing the paper.
IV. NONREOCCURRING PROCESSES

A nonreoccurring process, as stated previously in the introduction on processes, is one which occurs only once at a specific time and at a specific place. It occurs in the past and is completed there. Descriptions of scientific experiments are examples of such processes because they describe what an experimenter did with specific materials at a specific time at a specific place. The following is an example of such an experiment. Note that it follows Jones's outline for descriptions of processes.

Interactions of Stack Gas Sulfur and Nitrogen Oxides on Dry Sorbents

Section Introduction

During recent experimental testing, the Combustion Research Section (CRS) of EPA's Control Systems Laboratory observed that sampling and analytical procedures previously utilized for measuring NO\textsubscript{x} emissions from natural gas and light oil combustion were not satisfactory for measuring nitrogen oxides (NO\textsubscript{x}) in sulfur oxide (SO\textsubscript{2}) laden gases. For example, sulfur dioxide (SO\textsubscript{2}) levels of 1600 ppm (equivalent of 2.5 percent sulfur fuel) resulted in measured NO\textsubscript{x} concentrations of less than half the actual level. The problem was finally isolated to the dry sorbent system used to remove water from the gas sample prior to the analytical instrumentation.

It is well known (e.g. Sundaresan et al.) that certain drying materials such as commercial zeolites and silica gel have the ability to selectively adsorb NO\textsubscript{x} from nitric acid tail gases where the NO\textsubscript{x} concentration is in excess of 2000 ppm. Previous CRS work had shown that NO adsorption and/or reaction had not occurred with the molecular sieve and Drierite drying
Section III

Drying agents utilized in the standard CRS analytical train; however, all prior work had been done with essentially sulfur free flue gases. The purpose of the work reported herein was to briefly investigate the observed SO_2/NO_x/ drying agent interactions and to define what further work, if any, should be done in the area.

A three part approach was utilized. First, controlled mixtures of ambient air, nitric oxide (NO), and SO_2 were prepared, passed through various types of drying systems, and then sampled to determine the expected interferences and/or interactions. Next, the tests were repeated using actual flue gas from a propane flame with and without SO_2 present. Finally, the work was extended to full scale testing on a package boiler burning residual oil with 0.9 percent sulfur.

Isothermal Testing With Known Gas Concentrations

Under combustion conditions it is not possible to measure the amount of NO in a given flue gas stream without first removing the water of combustion. (Failure to do so will result in water vapor condensation in the sample cell and/or instrument interference.) Therefore, in the first test series ambient air (with appropriate NO and SO_2 added) was utilized instead of actual flue gas so that the sample could be run directly to the appropriate analyzer. The purpose of this series was to define which elements, if any, of the standard drying system needed further investigation.

Figure 1 shows the experimental facility used for this test series. Basically, it was designed to allow sampling a gas flow of ambient air with and without NO and/or SO_2. Both the NO and SO_2 came from laboratory cylinders through precalibrated rotameters into the sampling duct ahead of the mixing section. Sampling was accomplished via a standard quartz combustion probe. From the probe the sample went either directly to the analyzer (baseline tests) or to the system component being checked (e.g., the ice bath) then to the analyzer. All NO analysis in this series was done with a chemiluminescent analyzer.

The results of these tests are shown in Table 1. In tests A-1 through A-5, the stream being sampled contained only ambient air and
Section approximately 200 ppm NO. As the data indicate, none of the common drying schemes had any significant effect on the measurement. In tests A-6 through A-10, sufficient SO$_2$ was added to the air stream to give about 1600 ppm in the mixture. As the data indicate, both the Drierite and the molecular sieve led to radical reductions in the measured NO level initially; however, with time both appeared to "saturate" and the NO asymptotically approached the correct value. These data suggest that some type of NO/\textit{SO}_2 interaction was occurring; however, unfortunately during this series it was not possible to measure \textit{SO}_2 to determine its fate. It was also noted that, if the bulk of the flow (the ambient air) was replaced by pure nitrogen, no NO/\textit{SO}_2 interaction was observed. This fact suggests that \textit{O}_2 and/or water vapor was also involved.

![Figure 1. Isothermal test facility](image-url)
Section

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Test gas composition</th>
<th>Sample conditions</th>
<th>Chemiluminescent measured NO, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Ambient air + 400 ppm NO</td>
<td>Direct to analyzer</td>
<td>194</td>
</tr>
<tr>
<td>A-2</td>
<td>&quot;</td>
<td>Drierite, 15 g</td>
<td>204</td>
</tr>
<tr>
<td>A-3</td>
<td>&quot;</td>
<td>Molecular sieve, 100 g</td>
<td>189</td>
</tr>
<tr>
<td>A-4</td>
<td>&quot;</td>
<td>CaCl$_2$, $2\text{H}_2\text{O}$</td>
<td>195</td>
</tr>
<tr>
<td>A-5</td>
<td>&quot;</td>
<td>Ice bath</td>
<td>193</td>
</tr>
<tr>
<td>A-6</td>
<td>Ambient air + 400 ppm NO + 71600 ppm SO$_2$</td>
<td>Direct to analyzer</td>
<td>184</td>
</tr>
<tr>
<td>A-7</td>
<td>&quot;</td>
<td>Drierite, 15 g</td>
<td>(2 min.) 141, (10 min.) 176</td>
</tr>
<tr>
<td>A-8</td>
<td>&quot;</td>
<td>Molecular sieve, 100 g</td>
<td>(2 min.) 67, (10 min.) 130</td>
</tr>
<tr>
<td>A-9</td>
<td>&quot;</td>
<td>CaCl$_2$, $2\text{H}_2\text{O}$</td>
<td>185</td>
</tr>
<tr>
<td>A-10</td>
<td>&quot;</td>
<td>Ice bath</td>
<td>183</td>
</tr>
<tr>
<td>A-11</td>
<td>Ambient air + 71600 ppm SO$_2$</td>
<td>Direct to analyzer</td>
<td>0.98</td>
</tr>
<tr>
<td>A-12</td>
<td>&quot;</td>
<td>Drierite, 15 g</td>
<td>0.60</td>
</tr>
<tr>
<td>A-13</td>
<td>&quot;</td>
<td>Molecular sieve, 100 g</td>
<td>0.29</td>
</tr>
<tr>
<td>A-14</td>
<td>&quot;</td>
<td>CaCl$_2$, $2\text{H}_2\text{O}$</td>
<td>0.78</td>
</tr>
<tr>
<td>A-15</td>
<td>&quot;</td>
<td>Ice bath</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Table 1. Series 1 results

aTotal sample flow was 71 liters/hr (2.5 scfh). The flue gas sample flowed through a particulate filter to prevent clogging instrument sampling lines. (There was no evidence that this filter adversely affected measured NO$_x$ readings.) A dry layer air filter pack #99/97 Microsorban made by Delbag Co. was used to remove particulates.

bFresh drying agent materials were weighed on a triple-beam balance for each sample requiring an agent.

Hot-Flow Testing--Propane Doped With SO$_2$

In the second test series, flue gas from propane combustion was artificially doped with SO$_2$ on a controlled basis. The purpose of this series was to investigate the NO$_x$/SO$_x$ interaction on as nearly a practical system as possible and to still be able to control the SO$_2$ concentration in the flue gas stream being...
Section VIII

The results of this test series are presented in Table 2. In tests B-1 through B-4, the only major pollutant in the flue gas being sampled was NO (since propane contains no sulfur and this combustor does not produce significant carbon monoxide, unburned hydrocarbons, or NO₂). As in the first test series, all of the drying methods gave essentially the same NO concentration level; there was no evidence of any unusual interactions. (The sample could not be run directly to the analyzer without the ice bath due to water condensation in the analyzer cell.)

Table 2. Series 2 results

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Test gas composition</th>
<th>Sample conditions</th>
<th>Chemiluminescent measured NO, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>Combustion gas</td>
<td>Ice bath</td>
<td>94</td>
</tr>
<tr>
<td>B-2</td>
<td>&quot;</td>
<td>Drierite, 15 g + ice bath</td>
<td>96.5</td>
</tr>
<tr>
<td>B-3</td>
<td>&quot;</td>
<td>Molecular sieve, &quot;</td>
<td>96.5</td>
</tr>
<tr>
<td>B-4</td>
<td>&quot;</td>
<td>CaCl₂·2H₂O, &quot;</td>
<td>94</td>
</tr>
<tr>
<td>B-5</td>
<td>Combustion gas +21600 ppm SO₂</td>
<td>Ice bath</td>
<td>94</td>
</tr>
<tr>
<td>B-6</td>
<td>&quot;</td>
<td>Drierite, 15 g + ice bath (2 min.)</td>
<td>41,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(30 min.)</td>
</tr>
<tr>
<td>B-7</td>
<td>&quot;</td>
<td>Molecular sieve, &quot;</td>
<td>(2 min.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(30 min.)</td>
</tr>
<tr>
<td>B-8</td>
<td>&quot;</td>
<td>CaCl₂·2H₂O, &quot;</td>
<td>94</td>
</tr>
</tbody>
</table>

Hot-Flow Testing—Residual-Oil-Fired Package Boiler

The final test series was conducted in a 60-hp residual-oil-fired package boiler. The purpose of this series was to confirm the previous results with flue gas from a typical commercial system and to quantify the actual effects.

The results of tests C-1 through C-5 are shown in Table 3. In test C-1, no drying agent (other than the refrigeration cooler) was used to remove water vapor prior to the emission analysis. The 232 ppm NO is considered to be the baseline emission for this unit. In the next four tests, new and regenerated molecular
Section sieve and Drierite samples were used for final sample drying. (New implies the material had just been received from the manufacturer; regenerated implies the material had been used on several prior occasions for water removal and then "regenerated" by heating to drive off absorbed water.) The data indicate that:

1. With both molecular sieve and Drierite some reduction in NO does occur across the drying material, confirming the Series A and B results.
2. The process involves simultaneous reaction of both NO and SO₂.
3. Regenerated molecular sieve gave the largest reductions in both NO and SO₂.

It should be noted, however, that eventually the measured emissions approached the baseline level as the drying material "saturated." To quantify this phenomenon, three tests were run where flue gas was drawn through 65 grams of regenerated molecular sieve and the emissions were monitored in turn for NO by chemiluminescent analysis, SO₂ by NDIR, and NO by NDIR, all as a function of time. The reduced results are shown in Figure 5. \( \frac{C_t}{C_0} \) is the ratio of the concentration of pollutant after a given number of liters of gas had passed through the sieve bed to the correct (baseline) emission level. (Thus a \( \frac{C_t}{C_0} \) of 1.0 means no reduction in pollutant concentration is occurring across the bed and a \( \frac{C_t}{C_0} \) of 0.0 indicates complete reduction: zero pollutant concentration after the bed.) The data show that for the test case of 65 grams of molecular sieve a 75 percent reduction in SO₂ and a 55 percent reduction in NO occurred for the first 25 to 30 liters of gas. From these data an SO₂ removal of 0.59 mg/g of sieve was estimated; the NO removal was 0.077 mg/g of sieve. The relative volumes also appear to be 3 parts of SO₂ for 1 part of NO...
Table 3. Series 3 results

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Drying agent</th>
<th>NO by chemiluminescent, ppm</th>
<th>NO by NDIR, ppm</th>
<th>SO₂ by wet chemistry, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1</td>
<td>None</td>
<td>232</td>
<td>ND</td>
<td>421</td>
</tr>
<tr>
<td>C-2</td>
<td>New molecular sieve</td>
<td>138</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>C-3</td>
<td>Regenerated molecular sieve</td>
<td>99</td>
<td>105</td>
<td>25</td>
</tr>
<tr>
<td>C-4</td>
<td>New Drierite</td>
<td>122</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>C-5</td>
<td>Regenerated Drierite</td>
<td>183</td>
<td>174</td>
<td></td>
</tr>
</tbody>
</table>

*In all cases refrigeration cooling was used to remove the initial portion of the water.*

*Since water vapor strongly interferes with NDIR analyzers it was not possible to use these analyzers without moisture removal.*

Figure 5. Emission reduction across a 65-gram molecular sieve bed
Section Conclusions/Recommendations

A. Use of a solid sorbent drying material prior to NO analysis can lead to erroneously measured NO concentrations in SO\textsubscript{2} laden flue gases. Drierite and molecular sieve have both been shown to be susceptible to this problem in varying degrees; calcium chloride dehydrate appears to be a possible alternative but needs a more complete analysis. The results are rudimentary at best but even so they suggest the serious need for a detailed chemical-analytical study to provide definitive guidelines for NO\textsubscript{x} sampling.

B. Both Drierite and molecular sieve have been shown capable of simultaneous NO and SO\textsubscript{2} "removal" when both are present even in low concentrations. Experimental work should be undertaken to define the fate of the species; i.e., is the NO being retained on the surface of the sorbent in some form or is it coming through the bed in a form not detected by the analyzer (e.g., NO\textsubscript{y})?

C. Since this concept potentially offers simultaneous NO\textsubscript{x} and SO\textsubscript{x} removal, work should be undertaken to assess the feasibility of using it for flue gas treatment. Future work should develop data on the effect of sorbent composition and structure, NO\textsubscript{x} and SO\textsubscript{x} concentrations, and regeneration times so that a reasonable economic analysis can be conducted.

A. Tense, Person, and Voice Used With Nonreoccurring Processes

When writing a nonreoccurring process, one must follow certain rules for using tense, person, and voice. First, let's consider the rule for the use of person. If you examine the preceding nonreoccurring process, you will discover that one person is used throughout the paper. Is this first person? Second person? Third person? Note that the description of the experiment employs third person. This
is normal; descriptions of scientific experiments usually employ the third person.⁹ According to W. Paul Jones,¹⁰ a nonreoccurring process sometimes is described with the first person. However, this occurs when the author is the performer of the process and when a special interest is attached to the performer. For example, such an interest can occur when the writer wishes to record that he, either alone or with fellow workers, conducted the experiment. Sometimes a researcher needs to write for the historic record that he or his group was responsible for the work. An example of an experiment which employs the first person because there is a special historic interest attached to the performer is Benjamin Franklin's experiment with electricity.

In the winter following I conceived an experiment, to try whether the clouds were electrified positively or negatively; but my pointed rod, with its apparatus, becoming out of order, I did not refit it till towards the spring, when I expected the warm weather would bring on more frequent thunder-clouds.¹¹

Therefore, we can state Rule 1 for writing about non-reoccurring processes.

**Rule 1 for Nonreoccurring Processes**

When writing about a nonreoccurring process, use the third person. Use the first person only if the following two conditions are met: 1) the author is the performer of the process and 2) it is important to report that the author personally is the performer of the process because there is a special interest attached to him.

Now, let's examine "Interactions of Stack Gas Sulfur
and Nitrogen Oxides on Dry Sorbents" for tense and voice. Before looking at this experiment description section by section, quickly reread the entire experiment (pages 34-41). Notice that more than one tense is used throughout the description of this experiment. However, is one tense used more than any others? If so, what is it? Note that the past tense is used in the majority of the experiment. This is logical because a nonreoccurring process occurs and is completed at a specific time and place in the past, and the past tense describes actions which occur and are completed in the past. However, the past tense is not the only tense used in the passage. So, let's examine the experiment description to discover the rules for tense usage with non-reoccurring processes. Let's begin with Section I.

Introduction

(1) During recent experimental testing, the Combustion Research Section (CRS) of EPA's Control Systems Laboratory observed that sampling and analytical procedures previously utilized for measuring NO\textsubscript{X} emissions from natural gas and light oil combustion were not satisfactory for measuring nitrogen oxides (NO\textsubscript{X}) in sulfur oxide (SO\textsubscript{X}) laden gases. (2) For example, sulfur dioxide (SO\textsubscript{2}) levels of 1600 ppm (equivalent of 2.5 percent sulfur fuel) resulted in measured NO\textsubscript{X} concentrations of less than half the actual level. (3) The problem was finally isolated to the dry sorbent system used to remove water from the gas sample prior to the analytical instrumentation.

Look at the verbs in all three sentences. Notice that they all use the same tense. What tense is it? It is the past tense. Why is the past tense used in all three sentences?
All three sentences make statements about "recent experimental testing." Sentence 1 states an observation that was made during the testing. Sentence 2 cites a result that occurred during the testing, while sentence 3 describes an action that happened during the testing. Note that this testing is not happening now; it occurred in the past and was completed in the past. Therefore, the past tense is used in sentences 1, 2, and 3 because this tense describes an action which occurs and is completed in the past. Thus, we can now state Rule 2 for nonreoccurring processes.

**Rule 2 for Nonreoccurring Processes**

When describing an action that occurred in the past and was completed in the past, use the past tense.

Now, let's examine Section I for voice. Notice that sentences 1 and 2 employ the same voice while sentence 3 uses a different voice. What voice do sentences 1 and 2 use? What voice does sentence 3 employ? Sentences 1 and 2 use the active voice while sentence 3 employs the passive voice. Why? Notice that in sentences 1 and 2 it is important to know the identity of the agent. In sentence 1, it is important to know who did the observing while in sentence 2 it is important to know what caused the result. Also, in these sentences, the writer wants to emphasize the agents. He does this by making them the grammatical subjects of the sentences. Therefore, the writer employs the active voice in these sentences for two reasons: 1) he wants to emphasize
the agents and 2) he thinks it is important to identify the agents. Now, let's see why the writer employed the passive voice in sentence 3. What is the agent in sentence 3? It is the same as the agent in sentence 1--the Combustion Research Section of EPA's Control Systems Laboratory. Is it important to identify the agent in this sentence? Is it important to emphasize it? It is not important to identify or to emphasize the agent in this sentence. What is it important to identify and emphasize? It is important to identify and emphasize the verb's result, problem. Therefore, the writer uses the passive voice so that he can identify and emphasize the result of the verb, problem, by making it the grammatical subject of the sentence. We can now state Rule 3 for writing about nonreoccurring processes.

**Rule 3 for Nonreoccurring Processes**

The active voice is used when it is important to emphasize the agent.

The passive voice is used when it is important to emphasize the goal, target, or result of the verb, or when the agent is obvious, unimportant, or unknown.

We are now ready to examine Section II.

(1) It is well known (e.g. Sundaresan et al.) that certain drying materials such as commercial zeolites and silica gel have the ability to selectively adsorb NO\textsubscript{X} from nitric acid tail gases where the NO\textsubscript{X} concentration is in excess of 2000 ppm. (2) Previous CRS work had shown that NO adsorption and/or reaction had not occurred with the molecular sieve and Drierite drying agents utilized in the standard CRS analytical train; however, all prior work had been done with essentially sulfur free flue gases. (3) The purpose of the work reported herein was to
briefly investigate the observed SO$_x$/NO$_x$/drying agent interactions and to define what further work, if any, should be done in the area.

Notice that this section employs several tenses. Let's look at each sentence to discover why it uses the tenses it does.

Sentence 1 contains three verbs, and all three employ the same tense. What tense is it? It is the present tense. Note that this sentence states a general fact about certain drying materials. A general fact describes an action which always happens. A general fact describes what happened when the action took place in the past and what will occur when the action is performed in the future. A general fact describes an action which is not unique to a particular experiment. Sentence 1 describes a general fact because it describes an action that always occurs with certain drying materials. This sentence employs the present tense because, in English, the present tense is used to express general facts. Therefore, we can now state Rule 4 for nonreoccurring processes.

**Rule 4 for Nonreoccurring Processes**

When stating a general fact, use the present tense.

Now, let's examine sentence 2. Like sentence 1, it employs three verbs. Let's look at the first verb in sentence 2. What tense does it use? It employs the past perfect tense. In English, the past perfect tense describes an action in the past which occurs and is completed before another action
in the past. The following diagram should help to clarify this.

```
<table>
<thead>
<tr>
<th>Action occurring before B</th>
<th>Action occurring before C (now)</th>
<th>Action occurring now</th>
</tr>
</thead>
<tbody>
<tr>
<td>(past perfect tense)</td>
<td>(past tense)</td>
<td>(present tense)</td>
</tr>
</tbody>
</table>
```

Figure 4.1. Relationship of tense to time

The "previous CRS work" described in sentence 2 occurred and was completed before the work by Sundaresan et al. Furthermore, the work by Sundaresan et al. occurred and was completed in the past. The following diagram illustrates these facts.

```
<table>
<thead>
<tr>
<th>Previous CRS work (completed before the work by Sundaresan et al.)</th>
<th>Work done by Sundaresan et al. (completed before now)</th>
<th>Work being done now</th>
</tr>
</thead>
<tbody>
<tr>
<td>past perfect tense</td>
<td>past tense</td>
<td>present tense</td>
</tr>
</tbody>
</table>
```

Figure 4.2. Relationship of tense to time in the first verb of sentence 2 in Section II

Therefore, because the "previous CRS work" was completed before the work by Sundaresan et al., the past perfect tense must be used to describe the "previous CRS work" when it is discussed in reference to the work by Sundaresan et al. Thus, we can state Rule 5 for nonreoccurring processes.
Rule 5 for Nonreoccurring Processes

Use the past perfect tense to describe an action in the remote past which has occurred before another action in the more recent past when you write sentences which describe the relationship between the remote and recent past actions.

Now, consider the remaining verbs in sentence 2. What tense do they employ? Notice that they, too, employ the past perfect tense. Why? Note that these verbs also describe actions that occurred during the "previous CRS work" which took place before the work by Sundaresan et al. Thus, they follow Rule 5 and use the past perfect tense.

Finally, let's examine the verbs in sentence 3. Notice that the first verb, was, uses the simple past tense. Why? What is it expressing? It is expressing a characteristic of the "stack gas sulfur" experiment. Since this experiment occurred and was completed in the past, this verb follows Rule 2 and employs the past tense. Now, let's examine the second verb in sentence 3, should be done. Note that it consists of the modal should plus the base form of be plus the past participle of the principal verb, do. The modal is used here because this statement expresses an advisory obligation. An advisory obligation is one which ought to occur but which does not have to occur. An advisory obligation can also be expressed with the modal ought to. We can now state Rule 6.
Rule 6 for Nonreoccurring Processes

When stating an advisory obligation, use the modal should or the modal ought to.

We are ready to examine Section II for voice. Let's consider the first clause in sentence 1, it is well known. This clause employs the passive. It does so because the agent is obvious—the agent is everyone. However, this clause is a special passive construction. In this clause, the target of the verb is not the subject of the clause. The target of the verb know is the that-clause (that certain drying materials such as ... ) which follows the verb. The subject of it is well known is a "dummy" it, an it which does not refer to anything. Although it would be grammatically correct to make the that-clause the subject of is well known, this was not done because readers of English do not like "front-heavy sentences." Therefore, verbs whose results are that-clauses and whose agents are obvious, unimportant, or unknown often use the following construction: It + passive verb + that-clause. We can now state Rule 7 for nonreoccurring processes.

Rule 7 for Nonreoccurring Processes

When a verb has a result which is a that-clause and an agent which is obvious, unimportant, or unknown, use the following construction:
It + passive verb + that-clause.

Now, look at the remaining two clauses in sentence 1. What voice do they use? Note that they employ the active voice because it is important to emphasize their agents. Now,
Examine the verbs in sentences 2 and 3 for voice. Notice that the first two verbs in sentence 2, *had shown* and *had occurred*, and the first verb in sentence 3, *was*, employ one voice while the last verb in sentence 2, *had been done*, and the last verb in sentence 3, *should be done*, use another voice. What voices are these? Why do these verbs employ these voices? You should be able to answer these questions. In doing so, consider the agents. Consider if they are obvious, unimportant, or unknown. Also, consider if the author wants to emphasize the agent or the result of the verb. While making your decision, refer to Rule 3, p. 45.

We are ready to examine Section III.

(1) A three part approach was utilized. (2) First, controlled mixtures of ambient air, nitric oxide (NO), and SO$_2$ were prepared, passed through various types of drying systems, and then sampled to determine the expected interferences and/or interactions. (3) Next, the tests were repeated using actual flue gas from a propane flame with and without SO$_2$ present. (4) Finally, the work was extended to full scale testing on a package boiler burning residual oil with 0.9 percent sulfur.

Examine the verbs in the four sentences. They all employ the same tense. What tense is it? It is the simple past tense. Why do these verbs employ the same tense? Consider what they describe. They describe the three-part approach of the experiment performed by the Combustion Research Section of EPA's Control Systems Laboratory. The experiment occurred and was completed in the past. Therefore, in describing this experiment, the author followed Rule 2 and
used the simple past tense.

Now, consider the voice of the verbs in Section III. These verbs employ the same voice. It is the active voice or the passive voice? Note that it is the passive voice. Why? To answer this question, consider the agents of the verbs. What are they? Notice that all the verbs have the same agent. It is the Combustion Research Section of EPA's Control Systems Laboratory. The agent is obvious. Therefore, it is not necessary to state the agent in the sentences. Thus, the author follows Rule 3 and uses the passive voice.

Let's go on to Section IV.

Isothermal Testing With Known Gas Concentrations

(1) Under combustion conditions it is not possible to measure the amount of NO in a given flue gas stream without first removing the water of combustion. (2) (Failure to do so will result in water vapor condensation in the sample cell and/or instrument interference.) (3) Therefore, in the first test series ambient air (with appropriate NO and SO\textsubscript{2} added) was utilized instead of actual flue gas so that the sample could be run directly to the appropriate analyzer. (4) The purpose of this series was to define which elements, if any, of the standard drying system needed further investigation.

First, let's look at the tenses of the verbs in this section. Consider the verb in sentence 1. It employs the present tense. Why? Notice that this sentence states a general fact—i.e., a condition in the past which will probably prevail in the future. Therefore, this sentence follows Rule 4 and uses the present tense. Now, look at the
verb in sentence 2. It employs a different tense. What tense is it? This sentence uses the future. You might be wondering why this sentence employs the future because this sentence, like sentence 1, expresses a general fact. Because sentence 2 does state a general fact, it could employ the present tense. Thus, it is possible to state sentence 2 as:

*Failure to do so results in water vapor condensation in the sample cell and/or instrument interference.*

However, sentence 2 expresses a special kind of general fact. Note that sentence 2 states a possible result of a condition expressed in sentence 1. Therefore, the events of sentence 2 will occur only after the events in sentence 1 have taken place. Thus, in sentence 2, it is logical to employ a tense which expresses a time that follows the time in sentence 1. Remember that sentence 1 uses the present tense. Since the future follows the present, it is logical to employ the future tense in sentence 2. Therefore, we can now state Rule 8 for nonreoccurring processes.

**Rule 8 for Nonreoccurring Processes**

When stating a general fact which is the result of another general fact, use either the present tense or the future.

Now, examine the tenses of the verbs in sentences 3 and 4. These verbs employ the same tense, the simple past tense. Notice that these sentences make statements about the specific experiment performed by the CRS. Since this experiment occurred and was completed in the past, the verbs
describing it employ the past tense.

We are now ready to consider the voices used in Section IV. Note that the active voice is used in every sentence except for sentence 3. In sentence 3, the passive voice is employed because, once again, the agent is obvious. It is the CRS. Also, notice the special "dummy" it construction in sentence 1. The writer could have expressed this sentence in the following manner:

Under combustion conditions, to measure the amount of NO in a given flue gas stream without first removing the water of combustion is not possible.

The grammatical subject of the above sentence is the long phrase to measure the amount of NO in a given flue gas stream without first removing the water of combustion. However, readers of English do not like "front-heavy sentences." Therefore, English speakers prefer to move the long phrase to the end of the sentence and make a "dummy" it the grammatical subject. Notice that in sentence 1 it is followed by is plus an adjective, possible.

Now, let's consider Section V.

(1) Figure 1 shows the experimental facility used for this test series. (2) Basically, it was designed to allow sampling a gas flow of ambient air with and without NO and/or SO\(_2\). (3) Both the NO and SO\(_2\) came from laboratory cylinders through precalibrated rotameters into the sampling duct ahead of the mixing section. (4) Sampling was accomplished via a standard quartz combustion probe. (5) From the probe the sample went either directly to the analyzer (baseline tests) or to the system component being checked (e.g., the ice bath) then
to the analyzer. (6) All NO analysis in this series was done with a chemiluminescent analyzer.

The verbs in this section employ two tenses. The verb in sentence 1 employs one tense while the verbs in the remaining sentences use the other tense. What is the tense employed by the verb in sentence 1? It is the present tense. Previously, we have seen how the present tense is used to express a general fact about a process. However, note that sentence 1 does not express a general fact, at least not a general fact as we have defined that concept. What, then, is the reason for its use of the present tense? Notice that the verb in sentence 1 makes a statement about Figure 1. Furthermore, the verb states an action that Figure 1 performs when the reader looks at it. Thus, to the reader the figure performs the action now. Since the present tense expresses an action performed now, the verb in sentence 1 employs this tense.

We are now ready to state Rule 9.

**Rule 9 for Nonreoccurring Processes**

When describing an action that a figure, a table, or data perform at the moment that the reader looks at them, use the present tense.

Now, look at the verbs in the remaining sentences. What tense do they employ? They use the simple past tense because they describe how the experimental facility was used in the CRS experiment, an experiment which occurred and was completed in the past.

Before we take a look at Section VI, let's consider the
voices used in Section V. Both the passive and active voices are employed in this section. What sentences use the active voice? What sentences use the passive voice? Note that sentences 1, 3, and 5 employ the active voice because the author wishes to emphasize the agents by making them the grammatical subjects of the sentences. However, sentences 2, 4, and 6 employ the passive voice because:

1) the agent, which is the same in each sentence, is obvious—it is the CRS—and

2) the author wishes to emphasize the results of the verbs by making them the grammatical subjects of the sentences.

We can now examine Section VI.

(1) The results of three tests are shown in Table 1. (2) In tests A-1 through A-5, the stream being sampled contained only ambient air and approximately 200 ppm NO. (3) As the data indicate, none of the common drying schemes had any significant effect on the measurement. (4) In tests A-6 through A-10, sufficient SO₂ was added to the air stream to give about 1600 ppm in the mixture. (5) As the data indicate, both the Drierite and the molecular sieve led to radical reductions in the measured NO level initially; however, with time both appeared to "saturate" and the NO asymptotically approached the correct value. (6) These data suggest that some type of NOₓ/SOₓ interaction was occurring; however, unfortunately during this series it was not possible to measure SO₂ to determine its fate. (7) It was also noted that, if the bulk of the flow (the ambient air) was replaced by pure nitrogen, no NO/SO₂ interaction was observed. (8) This fact suggests that O₂ and/or water vapor was also involved. . . .
Let's examine the verb in sentence 1. Notice that it employs the present tense. To discover why, think about the action that the verb expresses. This action is showing. The agent, the author, shows the results of the tests to the reader at the time that the reader looks at Table 1. To the reader, this moment is now. Therefore, the present tense is employed in sentence 1 because this tense expresses an action happening now. We can now state Rule 10.

**Rule 10 for Nonreoccurring Processes**

When describing an action that the author performs at the moment that the reader reads the article, use the present tense.

Now, let's look at the verbs in sentences 2, 3, 4, and 5. We already know the rules for their use. The verb in sentence 2, contained, employs the past tense because it describes some tests performed during the CRS experiment, an experiment which occurred and was completed in the past. Thus, this verb follows Rule 2. The first verb in sentence 3, indicate, follows Rule 9 and employs the present tense because this verb describes an action that the data in Table 1 perform at the moment that the reader looks at them. However, like the verb in sentence 2, the last verb in sentence 3, had, and the verb in sentence 4, was added, follow Rule 2 and use the past tense because they describe the CRS experiment. The first verb in sentence 5, indicate, follows Rule 9 and uses the present tense, while the remaining three verbs in this sentence follow Rule 2 and employ the past
tense. You should be able to state why.

The verbs in sentence 6 employ the present tense, past tense, and a special past tense. Let's consider the first verb, suggest. It follows Rule 9 and uses the present tense because it describes an action that the data perform to the reader at the time that the reader looks at them. Now, examine the third verb, was. It follows Rule 2 and employs the past tense because it describes an action performed during the CRS experiment. The second verb, was occurring, also describes an action performed during the CRS experiment. This verb follows Rule 2 in that it employs the past tense. However, it employs a special past tense, the past progressive. The past progressive emphasizes some moment in the past that is the center of attention.\(^\text{16}\) It expresses an action or a situation that is "in progress at the moment under consideration ... or is characteristic of the period being considered, in contrast to an earlier time when it was not, a future time when it will not be, or both."\(^\text{17}\) Thus, by using the past progressive in the second verb in sentence 6, the author emphasizes the moment under consideration, the time of tests A-6 through A-10. Also, he expresses the idea that some type of NO\(_x\)/SO\(_x\) interaction happened only during tests A-6 through A-10. The action endured throughout the tests, but it did not occur before the tests nor did it take place after the tests. To compare the use of the past
progressive with the simple past tense, consider the verb in sentence 2, **contained**. The author does not use the past progressive here because this action endured longer than the time period he is explaining--the air stream contained ambient air and approximately 200 ppm NO before tests A-1 through A-5 occurred. Furthermore, look at verbs 2, 3, and 4 in sentence 5, **led**, **appeared**, and **approached**, respectively. They describe actions which occurred only during tests A-6 through A-10, the time period emphasized. However, note that these actions did not **endure throughout** the time period; they endured only for parts of it. Thus, the author did not use the past progressive with these verbs. It should be noted that the progressive tense usually is not used with status verbs. Status verbs are those which express:

1) an involuntary subjective experience, such as sensory perception, judgments, conclusions, emotional states, etc. (see, doubt, prefer, hate, etc.), and

2) conditions or relationships between two or more objects (belong, contain, deserve, equal, own, etc.).

We can now state Rule 11.

**Rule 11 for Nonreoccurring Processes**

Use the past progressive with a non-status verb that describes a past action if you want to do the following:

1) emphasize a certain moment in the past and 2) express that the action of the verb endures during that moment.

Let's examine sentence 7. What actions do its verbs describe? All three verbs describe what happened during
tests A-6 through A-10 of the CRS experiment. Thus, these verbs follow Rule 2 and employ the past tense. However, note that the second and third verbs of this sentence, was replaced and was observed, state a condition and its result. Also, notice that the condition occurred and was completed before the result; no NO/SO₂ interaction was observed after the bulk of the flow was replaced by pure nitrogen. The following diagram illustrates this.

```
the bulk of
the flow
replaced by
pure nitrogen

                                        no NO/SO₂ interaction
                                        observed

past                                now
```

Figure 4.3. Time relationship of a past condition and a past result

Since the condition took place before the result, you might be wondering why the author employed the simple past tense rather than the past perfect tense when stating the condition. Actually, the author could have used the past perfect tense to state the condition. So, sentence 7 could read:

```
It was noted that, if the bulk of the flow (the ambient air) had been replaced by pure nitrogen, no NO/SO₂ interaction was observed.
```

However, as the above diagram illustrates, the condition in this sentence immediately preceded the result. Thus, the actions of the condition and the beginning of the result
occurred at approximately the same time. Since these actions took place at approximately the same time, they can employ the same tense. Therefore, to emphasize the immediacy of the two actions, the author used the simple past tense to express both the condition and its result. We can now state Rule 12.

**Rule 12 for Nonreoccurring Processes**

When describing a condition which occurred and was completed immediately before a result where the result has been expressed in the simple past tense, you can employ either the simple past tense or the past perfect tense to express the condition. However, by using the simple past tense for the condition, you will emphasize the immediacy of the two actions.

The verbs in sentence 8 are easy to analyze since we already know the rules for their use. Notice that the first verb, suggest, describes an action that "this fact" performs at the time that the reader looks at it. Thus, this verb follows Rule 9 and employs the present tense. On the other hand, the second verb, was involved, states an action performed during the CRS experiment. Thus, this verb follows Rule 2 and uses the past tense.

Now, let's look at the voices used in Section VI. Notice that the author employs voice in this section similar to the ways he used it in other sections. He generally uses the active voice. He uses the passive voice when the agent is obvious. For instance, note the agents in the passive sentences in this section. In sentence 1, the agent of the
verb are shown is obviously the author. Furthermore, the agent of the other passive verbs—was added (sentence 4), was noted (sentence 7), was replaced (sentence 7), was observed (sentence 7), and was involved (sentence 8)—is, again, obviously, the CRS.

Before studying Section VII, let's examine the footnotes to Table 1 for tense and voice.

(1) Total sample flow was 71 liters/hr (2.5 scfh).
(2) The flue gas sample flowed through a particulate filter to prevent clogging instrument sampling lines. (3) There was no evidence that this filter adversely affected measured NO readings.) (4) A dry layer air filter pack #99/97 Microsorban made by Delbag Co. was used to remove particulates.

(5) Fresh drying agent materials were weighed on a triple-beam balance for each sample requiring an agent.

All the verbs in the footnotes contain the same tense. These verbs describe actions of the CRS experiment, which occurred and was completed in the past. Therefore, all of the verbs follow Rule 2 and employ the past tense. Furthermore, these verbs use the active voice except for those times when the agent is obvious and the author does not wish to emphasize it. The verbs in sentences 4 and 5 employ the passive voice because the agent, in both sentences, is obviously the CRS and the author does not wish to emphasize this agent.

Now, we are ready to examine Section VII.

Hot-Flow Testing—Propane Combustion Doped With SO₂
(1) In the second test series, flue gas from propane combustion was artificially doped with SO₂
on a controlled basis. (2) The purpose of this series was to investigate the NO\textsubscript{x}/SO\textsubscript{2} interaction on as nearly a practical system as possible and to still be able to control the SO\textsubscript{2} concentration in the flue gas stream being sampled.

You already know the rules for the use of tense and voice in this section. Note that the past tense is used in the verbs of both sentences. To discover why, consider what actions these verbs are describing. Also, notice that the verb in sentence 1 employs the passive voice while the verb in sentence 2 uses the active voice. To find out why, consider the agents of these sentences. Are they obvious? Does the author want to emphasize them? You should now be able to state what rules for tense and voice the author follows in this section.

You also already know the rules for tense and voice that the author employs in Section VIII.

(1) The results of this test series are presented in Table 2. (2) In tests B-1 through B-4, the only major pollutant in the flue gas being sampled was NO (since propane contains no sulfur and this combustor does not produce significant carbon monoxide, unburned hydrocarbons, or NO\textsubscript{2}). (3) As in the first test series, all of the drying methods gave essentially the same NO concentration level; there was no evidence of any unusual interactions. (4) (The sample could not be run directly to the analyzer without the ice bath due to water condensation in the analyzer cell.)

The verb in sentence 1 describes an action the author performs at the time that the reader looks at Table 2. Thus, this verb follows Rule 10 and uses the present tense.
However, the first verb in sentence 2 employs the past tense. It does so because it describes an action of the CRS experiment which occurred and was completed in the past. Therefore, it follows Rule 2. Like the verb in sentence 1, the second and third verbs in sentence 2, contains and does produce, use the present tense. However, they do not employ this tense for the same reason as the verb in sentence 1. Note that these verbs in sentence 2 state a general fact. Therefore, they use the present tense because of Rule 4. On the other hand, the verbs in sentences 3 and 4 are like the first verb in sentence 2, was, in that they employ the past tense and these verbs do so for the same reason as the first verb in sentence 2. These verbs follow Rule 2 and employ the past tense because they describe actions of the CRS experiment. Finally, the author uses Rule 3 to employ voice in this section. The author uses the passive voice when the agent is obvious and when he does not wish to emphasize it. For instance, in sentence 1, the agent of the verb are presented is obviously the author. The author does not want to emphasize himself by making himself the subject of the sentence, so he employs the passive voice. Furthermore, in sentence 4, the agent of the verb could be run is also obvious—it is the CRS. The author does not want to emphasize this agent; instead, he wants to emphasize samples, the result of the verb. So, he uses the passive voice.
Now, let's look at Section IX.

**Hot-Flow Testing--Residual-Oil-Fired Package Boiler**

(1) The final test series was conducted in a 60-hp residual-oil-fired package boiler. (2) The purpose of this series was to confirm the previous results with flue gas from a typical commercial system and to quantify the actual effects. . . .

You know the rules for the use of tense and voice in this section. Note that the verbs in both sentences use the same tense. What tense is it? Why do they use this tense? What is the rule they follow? Notice that sentence 1 employs one voice while sentence 2 employs the other voice. What voice does sentence 1 use? Why? What voice does sentence 2 use? Why? State the rule which makes these sentences employ the voices they do.

Let's look at Section X.

(1) The results of tests C-1 through C-5 are shown in Table 3. (2) In test C-1, no drying agent (other than the refrigeration cooler) was used to remove water vapor prior to the emission analysis. (3) The 232 ppm NO is considered to be the baseline emission for this unit. (4) In the next four tests, new and regenerated molecular sieve and Drierite samples were used for final sample drying. (5) New implies the material had just been received from the manufacturer; regenerated implies the material had been used on several prior occasions for water removal and then "regenerated" by heating to drive off absorbed water.) (6) The data indicate that:

(7) 1. With both molecular sieve and Drierite some reduction in NO does occur across the drying material, confirming the Series A and B results.

(8) 2. The process involves simultaneous reaction of both NO and SO\(_2\).

(9) 3. Regenerated molecular sieve gave the largest reductions in both NO and SO\(_2\).
You already know the rules for the use of the verb tenses in sentences 1 through 3. The verb in sentence 1 employs the present tense because it describes an action, showing, that the author performs at the time that the reader looks at Table 3. The verb in sentence 2 uses the past tense because it describes an action that the CRS completed in the past. Like the verb in sentence 1, the verb in sentence 3 uses the present tense. However, it does not employ the present tense for the same reason. Note that the present tense is used here because the sentence states a general fact.

Now, let's examine sentence 5. Notice that the first verb uses the present tense. Does it employ this tense because the author performs an action at the time the reader reads the passage? Because a table, a figure, or some data perform an action at the time the reader looks at it? Because the sentence expresses a general fact? The answer to each question is "no." To discover why the present tense is used in this sentence, note what action the verb is performing. It is defining new. To state definitions, you employ the present tense. Thus, we now have Rule 13.

**Rule 13 for Nonreoccurring Processes**

When defining, use the present tense. Notice that the third verb in sentence 5, implies, also defines--it defines regenerated. Therefore, it follows
Rule 13 and employs the present tense. Furthermore, look at the second verb, had been received, and the fourth verb, had been used, in sentence 5. They use the same tense. What tense is it? It is the past perfect. Although it might not be obvious to you, the fifth verb in sentence 5, regenerated, also employs the past perfect. In English, if a coordinating conjunction, such as and, or, but, connects verbs which employ the same auxiliaries and the same tense, the auxiliaries may be stated only with the first verb. It is understood that the remaining verbs use the auxiliaries. Thus, in sentence 5, it is understood that regenerated employs the auxiliaries had been. Why do these verbs use the past perfect? If you review Rule 5, you will remember that when you want to describe the relationship between two past actions and one action is more remote than the other, you use the past perfect tense to describe the more remote action. What action is more recent than the actions expressed in the second, fourth and fifth verbs in sentence 5? If you read sentence 4, you will note that the "next four tests" (tests C-2 through C-5) are being described. Thus, the beginning of these tests is the more recent action. Since these tests were completed in the past, the verbs describing them employ the simple past tense while the verbs expressing the more remote actions use the past perfect. The following diagram illustrates the relationship
between the beginning of tests C-2 through C-5 and the actions expressed in the second, fourth, and fifth verbs in sentence 5.

Figure 4.4. Relationship of time to tense for recent and remote past actions

Note that the actions more remote than action D do not occur simultaneously. In fact, B is more remote than C, and A is more remote than B. However, even though actions A, B, and C take place at different times in the past, they employ the same tense. They do so because, as a group, they are more remote than action D. Also, English has no special tense to indicate an action occurring before an action expressed in the past perfect. This relationship can be expressed in English; however, words other than verbs are used to do so. These words are usually adverbs. Let's examine sentence 5 to see how the author indicates that A happens before B and B before C. The author states:
... the material had been used on several prior occasions for water removal and then "regenerated" ...

Then indicates that one action follows another action. In this clause, then makes it clear that the regeneration of the material (action B) follows the usage of the material for water removal (action A). Thus, we know that action A takes place before action B, but how do we know that both of these actions occur before action C? Notice that in describing action C, the author says:

... the material had just been received from the manufacturer ... 

Just modifying a verb means that the action the verb expresses took place immediately before another action. Thus, just in the above clause means that the material was received from the manufacturer (action C) a very short time before the beginning of tests C-2 through C-5 (action D). So, we can conclude that action C is more recent than actions A and B. Furthermore, we know that actions A and B are more remote than action C because the author states that actions A and B happened on "several prior occasions." Prior means "before" or "previous." However, prior, by itself, does not mean "immediately before" or "immediately previous." To mean "immediately before" or "immediately previous," prior must have just, or another word which means "immediately," in front of it. Therefore, since prior expresses a more remote action than just prior or immediately prior, we know
that actions A and B precede action C. We can now state

Rule 14 for nonreoccurring processes.

**Rule 14 for Nonreoccurring Processes**

When describing the relationship between remote and recent past actions, use the past perfect for all the remote actions. If you want to indicate the order of occurrence of the remote actions, use adverbs, such as then, just, prior, just prior, to modify the verbs.

Now, let's look at sentences 6, 7, 8, and 9. Sentences 6, 7, and 8 employ the present tense, but not always for the same reason. One of the sentences uses the present tense because of Rule 9, while the other sentences use it because of Rule 4. What is the sentence that follows Rule 9? What are the ones that follow Rule 4? Sentence 6 follows Rule 9 because the verb describes an action that the data perform at the time the reader looks at it. However, sentences 7 and 8 follow Rule 4 because they describe general facts that were discovered from the results of the tests. Now, look at sentence 9. It, too, describes a result of the tests. However, notice its verb. What tense does it employ? It employs the past tense rather than the present tense. Why should it use the past tense while the verbs in sentences 7 and 8 use the present tense? The reason is that the result of the test stated in sentence 9 is not a general fact. Unlike a general fact, this result probably will not occur again if the experiment is repeated. Therefore, it is a
result specific to these tests. Since the tests occurred and were completed in the past, the past tense is used to state their results.

An examination of Section X for voice shows that this section employs both the active and the passive voices. When you examine this section, you will notice that the author often employs the passive voice. What verbs in this section use the passive? Why? The author uses the passive when the agent is obvious. For instance, in sentence 1, the agent is obviously the author. In sentence 2, the agent is the CRS. The agent in sentence 3 is not so specific as the agents in sentences 1 and 2. However, it is still obvious—it is anyone who knows about the baseline emission of the unit used for test C-1. In the remaining verbs which employ the passive in this section—the verb in sentence 4 and the second, third, and fourth verbs in sentence 5—the agent is, again, obviously the CRS. Because the agents of these verbs are obvious, the author does not wish to emphasize them by making them the grammatical subjects of the verbs. Furthermore, he thinks it is unimportant even to mention these agents in the sentences. Thus, he employs the passive voice. Now, consider the verbs in this section that use the active voice. Notice that the author employs the active voice with these verbs because he feels it is important to emphasize the agents by making them the
Let's consider Section XI.

(1) It should be noted, however, that eventually the measured emission approached the baseline level as the drying material "saturated." (2) To quantify this phenomenon, three tests were run where flue gas was drawn through 65 grams of regenerated molecular sieve and the emissions were monitored in turn for NO by chemiluminescent analysis, SO₂ by NDIR, and NO by NDIR, all as a function of time. (3) The reduced results are shown in Figure 5. (4) \( C_t/C_0 \) is the ratio of the concentration of pollutant after a given number of liters of gas had passed through the sieve bed to the correct (baseline) emission level. (5) (Thus a \( C_t/C_0 \) of 1.0 means no reduction in pollutant concentration is occurring across the bed and a \( C_t/C_0 \) of 0.0 indicates complete reduction: zero pollutant concentration after the bed.) (6) The data show that for the test case of 65 grams of molecular sieve a 75 percent reduction in SO₂ and a 55 percent reduction in NO occurred for the first 25 to 30 liters of gas. (7) From these data an SO₂ removal of 0.59 mg/g of sieve was estimated; the NO removal was 0.077 mg/g of sieve. (8) The relative volumes also appear to be 3 parts of SO₂ for 1 part of NO...

First, let's look at sentence 1, which contains three verbs. The first verb, should be noted, consists of the modal should plus the base form of be plus the past participle of the principal verb, note. We already know the reason for this construction--the verb expresses an advisory obligation, so it follows Rule 6 and employs the modal should. Now, let's look at the last two verbs in sentence 1. Note that they employ the same tense. What is it? Why do they employ it? These verbs describe actions which occurred during the CRS experiment, an experiment which was completed.
in the past. Therefore, these verbs use the past tense. However, notice that these verbs state a condition and its result.

**Condition:** as the drying material "saturated"

**Result:** eventually the measured emission approached the baseline

You might be thinking that Rule 12 applies here since it describes what tenses to use with conditions and their results. However, Rule 12 applies only to certain conditions and results. It applies to conditions which take place and are completed immediately before their results. If you examine the condition in sentence 1, you will notice that the condition takes place immediately before the result and continues until the result is completed. The following diagram demonstrates this fact.

![Diagram](image)

**Figure 4.5.** Time relationship of the condition and result in sentence 1, Section XI

Because the condition and its result begin at approximately the same time and occur simultaneously, they **must** employ the same tense. Since the condition and result describe the past
The CRS experiment, the tense they employ is the past tense. Rule 12 does not apply to this condition and result because Rule 12 allows a condition which has occurred in the past immediately before a result to employ either the past tense or the past perfect tense. The condition in the previous diagram cannot employ the past perfect because this condition was not completed before the result began. Therefore, we need a new rule to describe the above condition and its result.

**Rule 15 for Nonreoccurring Processes**

When a condition starts immediately before a result and continues to occur at the same time as the result, the condition and the result must employ the same tense. If the condition and the result express actions that occurred and were completed in the past, they employ the past tense.

Now, let's look at sentences 2 and 3. The verbs in sentence 2 use the past tense while the verb in sentence 3 employs the present tense. To understand why, consider the actions the verbs are describing. The verbs in sentence 2 describe actions performed during the CRS experiment. Therefore, they follow Rule 2 and use the past tense. However, the verb in sentence 3 describes an action that the author performs at the time that the reader looks at Figure 5 of the CRS experiment description. Therefore, this verb follows Rule 10 and employs the present tense.

At first glance, sentence 4 seems puzzling. Notice that
it states a condition and its result.

Condition: after a given number of liters of gas had passed through the sieve bed to the correct (baseline) emission level

Result: $C_t/C_0$ is the ratio of the concentration of pollutant

However, it seems strange that the verb in the condition should employ the past perfect tense while the verb in the result should use the present tense. Why is this so? This sentence is easy to understand if we add a clause that is implied.

$C_t/C_0$ is the ratio of the concentration of pollutant which resulted after a given number of liters of gas had passed through the sieve bed to the correct (baseline) emission level.

Now, the tenses are understandable. Notice that the first verb, is, is really not stating the result of the condition. This verb defines the ratio $C_t/C_0$ to the reader. Thus, since this verb states a definition, it follows Rule 13 and employs the present tense. The second verb, resulted, and third verb, had passed, state the result and its condition, respectively.

Condition: after a given number of liters of gas had passed through the sieve bed to the correct (baseline) emission level

Result: [the ratio $C_t/C_0$] resulted

Thus, the second and third verbs follow Rule 12. Both the condition and the result occurred in the past. However, the condition was completed before the result took place. Therefore, the author used the past tense to describe the
result and the past perfect tense to describe the condition. The author could have used the past tense to express the condition, since the condition occurred immediately before the result. However, he did not want to express the immediacy of the relationship between the condition and the result. Therefore, he used the past perfect tense, instead.

Now, let's consider sentence 5. Notice that the three verbs in this sentence state general facts. Therefore, they follow Rule 4 and use the present tense. However, note that the second verb, is occurring, employs a special present tense, the present progressive. Why? As stated earlier, for nonstatus verbs, a progressive tense expresses an action or a situation that is "in progress at the moment under consideration . . . or is characteristic of the period being considered, in contrast to an earlier time when it was not, a future time when it will not be, or both." Therefore, by using the present progressive for the second verb in sentence 5, the author indicates that the action it describes, occurring, endures only for the time being considered. The time being considered in this sentence is the time it takes for a given number of liters of gas to pass through the sieve bed to the correct (baseline) emission level. Thus, the present progressive indicates that the occurrence of no reduction in pollutant concentration endures throughout this time; however, it does not occur before this time, nor does
it take place after this time. We can now state Rule 16 for nonreoccurring processes.

**Rule 16 for Nonreoccurring Processes**

Use the progressive with a nonstatus verb that employs the present tense if you want to express the idea that the action of the verb endures for a certain moment under consideration.

Sentences 6, 7, and 8 are easy to analyze because they review some of the rules for tense usage. Look at the first verb in sentence 6, *show*. It follows Rule 9 and uses the present tense because this verb describes an action that the data for Figure 5 perform at the time the reader looks at the figure. Now, examine the second verb in sentence 6, *occurred*, and the two verbs in sentence 7, *was estimated* and *was*. These verbs describe actions of the CRS experiment. Thus, they follow Rule 2 and employ the past tense because the CRS experiment was completed in the past. Finally, consider the verb in sentence 8, *appear*. Like the first verb in sentence 6, this verb employs the present tense. Furthermore, like the first verb in sentence 6, this verb uses the present tense because of Rule 9. "The relative volumes" are data contained in Figure 5. Therefore, the present tense is used in this sentence because these data perform the action of *appearing* at the time the reader looks at Figure 5.

As in the other sections, the author employs both the active and passive voices in Section XI. He employs the active voice when he wishes to emphasize the agent by making
it the grammatical subject of the sentence. He uses the passive voice when the agent is obvious and he wishes to emphasize the result of the verb by making it the grammatical subject of the verb. Now, examine the verbs in Section XI. If the verb is in the passive voice, explain why the agent is obvious. If the verb is in the active voice, explain why it is important to emphasize the agent by making it the grammatical subject of the verb.

Now, let's look at the footnotes to Table 3.

(1) In all cases refrigeration cooling was used to remove the initial portion of the water.

(2) Since water vapor strongly interferes with NDIR analyzers it was not possible to use these analyzers without moisture removal.

We already know the rules for the use of tense and voice in these sentences. Notice that sentence 1 describes an action of the CRS experiment. Thus, it follows Rule 2 and employs the past tense because this experiment was completed in the past. Furthermore, this sentence follows Rule 3 and employs the passive voice because the agent, the CRS, is obvious. Now, look at the verbs in sentence 2. The first verb states a general fact about water vapor and NDIR analyzers. Thus, this verb follows Rule 4 and uses the present tense. Furthermore, this verb follows Rule 3 and employs the active voice because it is important for the author to emphasize the agent, water vapor, by making it the grammatical subject of
the verb. The second verb, was, uses the past tense. Like
the verb in sentence 1, this verb describes an action of the
CRS experiment. Therefore, it employs the past tense because
of Rule 2. This verb also employs the active voice. However,
it does not do so because the author wishes to emphasize the
grammatical subject, it. The author wants to emphasize to
use these analyzers without moisture removal. However, as
we already know, readers of English do not like front-heavy
sentences. Thus, the author did not make the phrase to use
these analyzers without moisture removal the grammatical
subject of the sentence. Instead, for this sentence, the
author used a special construction--It + be + adjective +
that-clause--which uses "dummy" it as the grammatical
subject.

We are ready to consider the final section of this
experiment, Section XII.

Conclusions/Recommendations
A. (1) Use of a solid sorbent drying material
prior to NO analysis can lead to erroneously
measured NO concentrations in SO₂ laden flue gases.
(2) Drierite and molecular sieve have both been
shown to be susceptible to this problem in varying
degrees; calcium chloride dehydrate appears to be
a possible alternative but needs a more complete
analysis. (3) The results are rudimentary at best
but even so they suggest the serious need for a
detailed chemical-analytical study to provide
definitive guidelines for NO₂ sampling.
B. (4) Both Drierite and molecular sieve
have been shown capable of simultaneous NO and SO₂
"removal" when both are present even in low
concentrations. (5) Experimental work should be
undertaken to define the fate of the species;
i.e., is the NO being retained on the surface of the sorbent in some form or is it coming through the bed in a form not detected by the analyzer (e.g., NO₂)?

C. (6) Since this concept potentially offers simultaneous NOₓ and SOₓ removal, work should be undertaken to assess the feasibility of using it for flue gas treatment. (7) Future work should develop data on the effect of sorbent composition and structure, NOₓ and SOₓ concentrations, and regeneration times so that a reasonable economic analysis can be conducted.

This section differs from the others in that it no longer describes the actions of the CRS experiment. Instead, it discusses the results of the experiment and gives recommendations for future experiments. Therefore, since this section does not describe actions occurring and completed in the past, it no longer uses the past tense. Let's see what tenses this section does use.

First, let's examine paragraph A. Look at sentence 1. It states a general fact that is derived from the results of the experiment. Therefore, this sentence follows Rule 4 and employs the present tense. Now, consider sentence 2. Its first verb, have been shown, uses a tense we have not discussed before. This tense is the present perfect. Why is it used here? Usually, the present perfect describes an action which began in the past and is still continuing in the present. For instance, consider the sentence Jim has studied chemistry for three years. This sentence means that Jim began to study chemistry three years ago and Jim is still studying chemistry now. The following diagram illustrates
Jim began studying chemistry 3 years ago. Jim is still studying chemistry now.

Figure 4.6. One meaning of time indicated by the present perfect

Also, the present perfect describes an action which occurred and was completed in the past but which is seen in reference to the present and the future. For instance, examine the sentence Mary has been to France three times. This sentence means that Mary's trips occurred and were completed in the past. However, this sentence also means that up to now, Mary has taken three trips to France. Perhaps, in the future, she will take more trips, and so the number will change. Thus, the present perfect expresses the idea that a past action has the possibility of occurring again in the future. The following diagram illustrates this.

Mary went to France, Mary went to France, Mary went to France, Mary might go to France.

past now future

Figure 4.7. Another meaning of time indicated by the present perfect
Like the verb in this sentence, the first verb, have been shown, in sentence 2 describes an action which occurred and was completed in the past but which is seen in reference to the present and the future. Thus, the first clause in sentence 2 means that up to now the Drierite and molecular sieve have both been shown to be susceptible to this problem. However, possibly future experiments might prove one or both of them not to be susceptible to this problem. The following diagram shows this.

Figure 4.8. The meaning of time indicated by the present perfect in the first clause of sentence 2, Section XII

Thus, we can now state Rule 17 for nonreoccurring processes.

**Rule 17 for Nonreoccurring Processes**

Use the present perfect to describe an action which 1) began in the past and is still continuing in the present or 2) occurred and was completed in the past but which is seen in reference to the present and the future.

Now, let's consider the remaining verbs in sentence 2, appear and needs, and the verbs in sentence 3, are and
suggest. These verbs are similar in that they employ the present tense. Furthermore, they do so for the same reason. What reason is this? Note that these verbs discuss the data resulting from the CRS experiment. The data are present in the description of the experiment at the time the reader reads it. Thus, the present tense is used to describe this data. We can now state Rule 18.

**Rule 18 for Nonreoccurring Processes**

When describing the data or concepts of an experiment, use the present tense.

Now, let's consider paragraph B. The verbs in sentence 4 might seem puzzling at first. Notice that sentence 4 states a condition and its result.

**Condition:** when both Drierite and molecular sieve are present even in low concentrations

**Result:** both Drierite and molecular sieve have been shown capable of simultaneous NO and SO₂ "removal"

The following diagram shows the relationship between the condition and the result, and the meaning of time in sentence 4.

![Diagram showing time meaning in sentence 4](image)

**Figure 4.9.** Time meaning in sentence 4, Section XII
You might be wondering why the condition employs the present tense while the result uses the present perfect. How can this be? Because the condition immediately precedes the result, shouldn't the condition employ either the same tense as the result or a tense expressing a time prior to the result? Usually, this is how one expresses such a condition and its result. However, sentence 4 is a special expression of a condition and its result. In this sentence, the author tries to express the idea that the condition and its result have proven to be general facts up to now. In the future, they may or may not continue to be general facts. To state a general fact, one uses the present tense, while to express the idea that something that has occurred up to now might or might not happen again in the future, one employs the present perfect. Therefore, in this sentence, the present tense is used in the condition to show that the condition and result are general facts, and the present perfect is used in the result to show that the condition and result are general facts up to now and that in the future they may or may not continue to be general facts. Thus, we can now state Rule 19.

**Rule 19 for Nonreoccurring Processes**

When stating a condition and result which have proven to be general facts until now but which may or may not be general facts in the future, use the present tense when stating the condition and the present perfect when stating the result.
Now, look at the verbs in sentence 5. We already know the reasons for the use of their tenses. The first verb in sentence 5, should be undertaken, expresses an advisory obligation for future experimenters. Thus, it follows Rule 6 and employs the modal should. The remaining verbs, is being retained and is coming, make statements about the general process of which the CRS experiment was a specific example. Therefore, these verbs express general facts. So, they follow Rule 4 and employ the present tense. Furthermore, these verbs state actions which endure as the NO crosses the bed. Thus, since they endure for a certain moment under consideration (the crossing of the bed), they follow Rule 16 and use the present progressive.

Now, let's consider paragraph C. The first verb in sentence 6, offers, describes a concept of the experiment. Therefore, it follows Rule 18 and uses the present tense. However, the second verb in sentence 6, should be undertaken, expresses an advisory obligation for future experimenters. Therefore, it follows Rule 6 and uses the modal should. The first verb in sentence 7, should develop, also follows this rule and employs the modal should because it, too, states an advisory obligation for the future experimenters. Finally, let's consider the second verb in sentence 7, can be conducted. This verb states a possible future action of experimenters. Therefore, it employs the future tense.
(You might think that can expresses present time here. It does not. Can is both the present and future form of the modal which expresses ability. So, here, can expresses future time.) Therefore, we can state our final rule for nonreoccurring processes.

**Rule 20 for Nonreoccurring Processes**

When describing a future action, use the future tense. If the verb employs a modal, use that form which expresses future time.

To end our discussion of Section XII, let's examine it for voice. Notice that the author uses the active voice except for those verbs whose agents are obvious or unknown. What verbs employ the passive voice? Are their agents obvious or unknown? The verbs which use the passive voice in this section are the first verb in sentence 2, the first verb in sentence 4, the first and second verbs in sentence 5, the second verb in sentence 6, and both verbs in sentence 7. For the first verb in sentence 2 and the first verb in sentence 4, the agent is the same. It is obviously the CRS. The agent is also the same for the first verb in sentence 5, the second verb in sentence 6, and both verbs in sentence 7. Again, this agent is obvious--it is future experimenters. However, the agent for the second verb in sentence 5 is not obvious. It is unknown, for no one knows for certain what is doing the retaining. Therefore, as usual, the author employed the passive voice for those verbs whose agents he thought unimportant to emphasize because
these agents are obvious or unknown.

B. Exercises for Nonreoccurring Processes

A. For each number, write a sentence which expresses the time relationship in the diagram.

1. beginning of the boiling of the water  
   | |  
   | |  
   | |  
   3 minutes ago now  
   | |  
   | |  
   | |  
   | |  
   (Rule 17)

2. cooling of the steel  
   | |  
   | |  
   | |  
   past now  
   | |  
   | |  
   | |  
   (Rule 15)

3. cleaning of the rock sample by John  
   | |  
   | |  
   | |  
   past  
   | |  
   | |  
   | |  
   analysis of the rock sample by Mary  
   | |  
   | |  
   | |  
   now  
   | |  
   | |  
   (Rule 5)

In this sentence, describe action A in relation to action B. Hint: Use before.

4. condition: placement of the ebony on the surface of the water  
   | |  
   | |  
   | |  
   past  
   | |  
   | |  
   | |  
   result: the sinking of the ebony  
   | |  
   | |  
   | |  
   now  
   | |  
   | |  
   | |  
   (Rule 12)

a) Express this condition and result so that you emphasize that the condition occurred immediately before the beginning of the result
b) Express this condition and result so that you do not emphasize that the condition occurred immediately before the result.
5. condition: mixing of all the oxygen with the air result: igniting of the candle by the experimenter

For this sentence, use a tense which indicates that the condition and the result are general facts.

6. killing skinning sectioning analysis of the of the of the rat by rat by muscles of muscles Jim Mary the rat by of the Alice rat by Joe

To express the relationship between these actions, you might want to use more than one sentence.

7. condition: a rat in a -0°C temperature for 3 hours result: decrease in the activity of the rat perhaps the condition and its result will occur again with the same or different results

B. The following is an excerpt from an experiment by Henry Cavendish. Notice that it is written in the first person. Rewrite this excerpt so that it is expressed entirely in the third person. To do so, you might want to change some of the sentences from active to passive. Therefore, review Rules 3 and 7 before you begin writing.
Experimental Determination of the Law of Electric Force

The intention of the following experiment was to find out whether, when a hollow globe is electrified, a smaller globe enclosed within it and communicating with the outer one by some conducting substance is rendered at all over or under-charged; and thereby to discover the law of the electric attraction and repulsion.

I took a globe 12.1 inches in diameter, and suspended it by a solid stick of glass run through the middle of it as an axis, and covered with sealing-wax to make it a more perfect non-conductor of electricity. I then enclosed this globe between two hollow pasteboard hemispheres, 13.3 inches in diameter, and about 1/20 of an inch thick, in such manner that there could hardly be less than 4/10 of an inch distance between the globe and the inner surface of the hemispheres in any part, the two hemispheres being applied to each other so as to form a complete sphere, and the edges made to fit as close as possible, notches being cut in each of them so as to form holes for the stick of glass to pass through.

By this means I had an inner globe included within a hollow globe in such manner that there was no communication by which the electricity could pass from one to the other.

I then made a communication between them by a piece of wire run through one of the hemispheres and touching the inner globe, a piece of silk string being fastened to the end of the wire, by which I could draw it out at pleasure. Having done this I electrified the hemispheres by means of a wire communicating with the positive side of a Leyden vial, and then, having withdrawn this wire, immediately drew out the wire which made a communication between the inner globe and the outer one, which, as it was drawn away by a silk string, could not discharge the electricity either of the globe or hemispheres. I then instantly separated the two hemispheres, taking care in doing it that they should not touch the inner globe, and applied a pair of small pith balls, suspended by fine linen threads, to the inner globe, to see whether it was at all over or undercharged.

From this manner of trying the experiment it appears:

First, that at the time the hemispheres are electrified, there is a perfect communication by metal between them and the inner globe, so that the electricity has free liberty to enter the inner globe if it has any disposition to do so, and moreover that this communication is not taken away till after the wire by which the hemispheres are electrified
is removed.

Secondly, before the hemispheres begin to be separated from each other, the wire which makes the communication between them and the globe is taken away, so that there is no longer any communication between them by any conducting substance.

Thirdly, from the manner in which the operation is performed, it is impossible for the hemispheres to touch the inner globe while they are removing, or even to come within $\frac{4}{10}$ of an inch of it.

And Fourthly, the whole time of performing the operation is so short, that no sensible quantity of electricity can escape from the inner globe, between the time of taking away the communication between that and the hemispheres, and the approaching the pith balls to it, so that the quantity of electricity in the globe when the pith balls are approached to it cannot be sensibly different from what it is when it is enclosed within the hemispheres and communicating with them.

The result was, that though the experiment was repeated several times, I could never perceive the pith balls to separate or show any signs of electricity.

C. Fill in the blanks of the following selection with the proper form and tense of the verbs given in parentheses. Before doing so, review Rules 2 through 20.

The Production of Alcohol in the Animal Body

Introduction

It (be) well known that epinephrin (to play) some part in the metabolism of carbohydrate. Its injection into animals (to raise) remarkably the level of blood sugar and (to cause) glycosuria.

Now, the author (to publish) in a previous report (This journal, 1926) that hyperalcoholemia (to be) observed in various sorts of asphyxiation, which, as (be) shown by many investigators, (to disturb) carbohydrate metabolism like adrenalin.

In the present work, the influence of epinephrin on the amount of blood alcohol (to be) studied, in order to know if epinephrin (to behave) in the same manner as asphyxiation in changing the level of blood alcohol.
Material and Method

Fowls and rabbits (to be) employed as experimental animals. 0.1% solution of adrenalin manufactured by Sankio Co. Ltd. (to be) injected hypodermically or intravenously.

For the determination of blood alcohol, the same method as in the previous reports, as well as the author's modification of Widmark's micromethod (1925) (to be) applied. The blood (to be) taken from the carotid of fowls and from the ear vein of rabbits at certain intervals after the injection of adrenalin. The technique and procedures (to be) almost the same as before.

Discussion

The results of the present experiments (to prove) the fact that hyperglycemia or the disturbance of carbohydrate metabolism by the injection of adrenalin (to accompany) a remarkable hyperalcoholemia.

As I (to show) already in the previous reports (1926, 1927) that hyperalcoholemia (to occur) in asphyxiated animals and hypoalcoholemia (to manifest) itself in animals injected with insulin, I (to believe) that the change in the amount of blood alcohol (to go) always hand in hand with that of blood sugar in various sorts of disturbances of carbohydrate.

This fact (to throw) some light upon the problem as to the source of blood alcohol. It (to be) hitherto believed that blood alcohol (to be) split from sugar.

Ford (1858) (to state) that dextrose (to be) normally destroyed in the circulation by the alcoholic fermentation, the resultant alcohol being oxidized in successive steps of transformation, and that this destruction of sugar (to be) one of the main sources of animal heat.

Schweisheimer (1913) (to observe) a difference between the amount of alcohol in the human blood before and after the meal time.

But the fact that the augmentation of blood alcohol (to take) place at the same time with the increase of blood sugar and that it (to occur) almost simultaneously with hypoglycemia (to suggest) strongly that blood alcohol, or at least one part of blood alcohol (to appear) in the blood as a direct product of the decomposition of a carbohydrate higher than glucose, such as glycogen, glycoproteids, etc.

The parallel increase and parallel decrease of blood alcohol and blood sugar (to make) it impossible
to believe that alcohol and sugar (to come) from the same source at the same time.

The question whether the combustion of superfluous sugar in the blood of animals injected with adrenalin (to be) promoted or not, (to be) not yet definitely settled, and many arguments (to be) forwarded pro and con from various sides, but most of the recent investigators (to seem) to deny the promoted combustion of sugar since the respiratory quotient (to be) not raised by the injection of adrenalin.

If the combustion of sugar (to be) not promoted by adrenalin and if sugar (to be) the only source of blood alcohol, hyperalcoholemia not (to appear) in adrenalin-hyperalcoholemia.

Summary
The amount of physiological alcohol in the blood of animals (to be) increased by the injection of adrenalin.

D. Write a well-developed description of biochemical studies of the effect of cooling upon the muscle. To do so, follow Jones's outline for writing process descriptions. Also, review Rules 1 through 20 before you begin writing.

Biochemical Studies on the Effect of Cooling Upon the Muscle

Introduction

General facts of previous experiments:

1. Akatsuka (1927)
condition: application of severe cold on carp
result: decrease of creatine content in the carp's muscle

(Rule 8)
2. Pfluger (1878)
condition: decrease in body temperature of a homoiothermic animal
result: acceleration of animal's metabolism
(Rule 8)

3. Riesser (1917)
condition: decrease in body temperature of a rabbit to 30°-28° C.
result: increase in creatine content of muscle of the rabbit
(Rule 8)

Possible reason for difference in findings of Akatsuka, and Pfluger and Riesser:
difference in kind of animal--one homoiothermic, the other poikilothermic

Well-known fact: possible to make a homoiothermic animal poikilothermic artificially
by the injection of curare to decrease the animal's body temperature several degrees below normal

Purpose of the experiment: to test the following condition and result
condition: homoiothermic animal made poikilothermic artificially
result: decrease of animal's muscle creatine
(Rule 8)
Description of the Steps

Selection of healthy albino rats, mostly male, weighing 140-260 grams
(reason for the use of albino rats in the experiment: the albino rat easily cooled)
Injection of the rats with curare
Placement of six animals in a wooden box with a cover consisting of wire gauze
Placement of the box into the freezing room (-160°C.)
Observation of the animal by the experimenter:
   Upon immediate placement in the freezing room: animal uneasy but active
   After two hours: animal still active
   After six to seven hours: animal miserable, no reaction to stimuli
Killing of the animal by chloroform
Immediate skinning of the animal after its death
Cutting out of the muscles of the hind extremities
Removal of fatty tissue, bone, connective and nervous tissue, as completely as possible
Chopping and mixing of the muscle
Performance of the following determinations with this mixed muscle tissue by use of the methods in parentheses
1. creatine (Folin method)
2. preformed creatinine (Folin method)
3. total nitrogen (Macro-Kjeldahl method)

Results

Indication of the data:

1. condition:
   application of cold (-160°C.) on a poikilo-thermized homoiothermic animal for a short duration (2 hours)
result: slight increase of muscular creatine in the animal

(Rule 8)
2. condition:
application of
cold (-16°C.)
on a poikilo-
thermized
homiothermic
animal for a
long duration
(6 hours)

result: decrease in
the animal's muscular
creatine by 8 percent

(Rule 8)

Resemblance of the effect of the application of
cold for 6 hours on the muscular creatine
content of a curarized albino rat to that of
the application of cold on the muscular
creatine content of carp, the degree of
decrease amounting up to 22-23% of the
normal value

E. Write a description of a nonreoccurring process. The process should be one with which you are thoroughly familiar. Follow the examples given in this chapter. Before writing the description, review the rules for the use of person, voice, and tense with nonreoccurring process descriptions (Rules 1 through 20).
V. SETS OF DIRECTIONS

A special type of reoccurring process is a set of directions. A set of directions is a step-by-step explanation of a process so that the reader can repeat the process. Thus, a set of directions tells how to do something, such as how to build a fire or how to develop a film. The following outline is a plan for writing about a set of directions. You will notice that this outline is similar to W. Paul Jones's outline for process descriptions.24

I. Introduction
   A. Definition of the process
   B. General information: when, where, by whom performed
   C. Preparation
      1. Time, place, conditions [if necessary]
      2. Materials and apparatus
   D. Precautions to insure safety, quality, etc. [if necessary]
   E. List of the steps

II. Description of the steps (a heading for each)
   A. Description of Step 1
      1. Definition and purpose [if necessary]
      2. Explanation of the step as a whole
      3. Materials and apparatus required
      4. Directions (numbered and separately paragraphed)
   B, C, etc. Description of Steps 2, 3, etc.

III. Synthesis: summary of the whole procedure (if needed)
   A. Appropriate concluding statements

The following is an example of a set of directions.

Stratifying Seeds25

Section Introduction
I  Stratification is the process of soaking and
Section chilling seeds just prior to sowing. It somewhat simulates natural seeding conditions, where seeds remain dormant all winter on cold, wet ground. With the beginning of warm spring weather, the seeds quickly germinate.

Stratification is recommended for seeds of all coniferous species to obtain complete and even germination. An unstratified seed will sometimes lie dormant in the seed bed for several months up to an entire year. Detailed instructions for stratifying the seeds of all major tree species are found in Agricultural Handbook No. 450.

The following table of stratification periods for species of conifers commonly grown in the Pacific Northwest was taken from this Handbook.

Table 1. Stratification periods used by pacific northwest nurserymen

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abies amabilis</td>
<td>Pacific silver fir</td>
<td>28</td>
</tr>
<tr>
<td>Abies concolor</td>
<td>Concolor fir</td>
<td>28</td>
</tr>
<tr>
<td>Abies grandis</td>
<td>Grand fir</td>
<td>28-42</td>
</tr>
<tr>
<td>Abies procera</td>
<td>Noble fir</td>
<td>28-42</td>
</tr>
<tr>
<td>Picea pungens</td>
<td>Colorado blue spruce</td>
<td>30-50</td>
</tr>
<tr>
<td>Picea sitchensis</td>
<td>Sitka spruce</td>
<td>34-41</td>
</tr>
<tr>
<td>Chamaecyparis</td>
<td>Port-Orford-cedar</td>
<td>0-30</td>
</tr>
<tr>
<td>Lawsoniana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lirix occidentalis</td>
<td>Western larch</td>
<td>21-60</td>
</tr>
<tr>
<td>Pinus contorta</td>
<td>Lodgepole &amp; shore pines</td>
<td>28-35</td>
</tr>
<tr>
<td>Pinus lambertiana</td>
<td>Sugar pine</td>
<td>80</td>
</tr>
<tr>
<td>Pinus monticola</td>
<td>Western white pine</td>
<td>42-82</td>
</tr>
<tr>
<td>Pinus nigra</td>
<td>Austrian pine</td>
<td>38-46</td>
</tr>
<tr>
<td>Pinus ponderosa</td>
<td>Ponderosa pine</td>
<td>28</td>
</tr>
<tr>
<td>Pinus sylvestris</td>
<td>Scotch pine</td>
<td>2-60</td>
</tr>
<tr>
<td>Pseudotsuga menziesii</td>
<td>Douglas-fir</td>
<td>20-40</td>
</tr>
<tr>
<td>Thuja plicata</td>
<td>Western red cedar</td>
<td>35-40</td>
</tr>
<tr>
<td>Tsuga heterophylla</td>
<td>Western hemlock</td>
<td>21-30</td>
</tr>
</tbody>
</table>

Equipment

The following equipment is needed for the stratification of seeds: a shallow pan, water, a polyethylene bag, string, a refrigerator, a thermometer, towels, and a window screen or newspaper.
Stratification is completed in three steps: the soaking of the seeds, the storing of the seeds in a refrigerator, and the drying of the seeds.

First Steps
1. Place the seeds in a shallow pan and cover them with water.
2. Soak the seeds overnight at normal room temperatures. Depending on the stratification period, this should be done three to eight weeks prior to planned sowing.

Second Steps
3. Drain the water off the seeds.
4. Place them in a polyethylene bag tied loosely to emit air.
5. Store the bag of soaked seeds in a refrigerator set at 350-40°F. (20-40°C.) and store for the number of days shown in Table 1. This temperature should be verified by using a thermometer.

Third Steps
6. A few hours before sowing, remove the seeds from the refrigerator.
7. Tumble the seeds in towels to dry the surface of the seed coats.
8. Finish drying the seeds by placing them on a window screen or a newspaper.

The seeds are now ready to sow.

Caution
Stratified seeds should be handled gently to prevent loss of viability.

A. Tense, Person, and Voice Used With Sets of Directions

One cannot write about a set of directions by using just any tense, person, or voice because there are certain rules one must follow. Let's examine the above example of a set of directions to discover these rules for using tense, person,
and voice.

First, let's examine Section I. Look at the underlined verbs.

(1) Stratification is the process of soaking and chilling seeds just prior to sowing. (2) It somewhat simulates natural seeding conditions, where seeds remain dormant all winter on cold, wet ground. (3) With the beginning of warm spring weather, the seeds quickly germinate.

Notice that the sentences use the same person. Do they use first, second, or third person? They all employ the third person. Also, notice that the sentences use the same tense. What tense is it? They all employ the present tense. Third person and the present tense are used in these sentences because these sentences are either defining stratification or stating general principles about stratification. Thus, Rule 1 for writing about a set of directions is:

**Rule 1 for Sets of Directions**

When defining, use third person and the present tense.

When stating a general principle, use third person and the present tense.

Now, let's look at Section II.

(1) Stratification is recommended for seeds of all coniferous species to obtain complete and even germination. (2) An unstratified seed will sometimes remain dormant in the seed bed for several months up to an entire year. (3) Detailed instructions for stratifying the seeds of all major tree species are found in Agricultural Handbook No. 450.

What person is employed in this section? Note that third person is used in all three sentences. However, the reason third person is used here is not always the same as
it was for Section I. Notice sentence 2. Like the sentences in Section I, it states a general principle; therefore, this sentence uses third person. However, sentences 1 and 3 employ the third person for a reason different from that used by sentence 2. Note that sentence 1 is a suggestion while sentence 3 is a fact. This brings us to Rule 2 for writing about a set of directions.

**Rule 2 for Sets of Directions**

When stating a suggestion, use the third person.

When stating a fact, use the third person.

Now, let's examine the verbs in the three sentences of Section II. They employ different voices. Is the verb in sentence 1 in active or passive voice? What about the verb in sentence 2? In sentence 3? The verbs in sentences 1 and 3 are in the passive voice while the verb in sentence 2 is in the active voice. Why does the writer use the passive voice in sentences 1 and 3 and the active voice in sentence 2? To answer this question, consider the agent (who or what is performing the action of the verb) in each sentence. In sentence 1, is it necessary to know the identity of the agent? Is it necessary in sentence 2? In sentence 3? In sentence 1, it is not necessary to identify the agent since the agent is obvious—the author is the agent because he is doing the recommending. Furthermore, the grammatical subject of the verb, *stratification*, is the idea the writer wants to emphasize in the sentence. One way to emphasize the goal,
or result, of the verb is to make the word that expresses that idea the grammatical subject of the sentence. Therefore, the writer puts sentence 1 in the passive voice because the agent is obvious and he wants to emphasize stratification. Similarly, the writer uses the passive voice for sentence 3; he wishes to emphasize detailed instructions, and he does not want to identify the agent because it is obvious—it is anyone. However, the writer puts sentence 2 in the active voice because it is necessary to know the identity of the agent, an unstratified seed, and the writer wants to emphasize the agent. Thus, we can now state Rule 3 for writing about a set of directions.

**Rule 3 for Sets of Directions**

- The active voice is used when it is important to emphasize the agent.
- The passive voice is used when it is important to emphasize the goal, target, or result of the verb or when the agent is obvious, unimportant, or unknown.

Although the passive sentences in Section II do not state the agent, some passive sentences state the agent in a by-phrase.

The rate of evaporation is controlled by the opening. The writer uses such a passive sentence when it is necessary to identify the agent and when it is important to emphasize the result or purpose of the verb by making that idea the grammatical subject of the sentence.

Now, let's consider the verb tenses used in Section II.
First, let's examine sentence 1.

Stratification is recommended for seeds of all coniferous species to obtain complete and even germination.

What tense does it employ? It employs the present tense.

Notice that this sentence states a suggestion. We can now state Rule 4.

Rule 4 for Sets of Directions
When stating suggestions, use the present tense.

Note that sentence 3 also employs the present tense.

Detailed instructions for stratifying the seeds of all major tree species are found in Agricultural Handbook No. 450.

It might seem logical to use the past tense in this sentence because the instructions were placed in the book at some time in the past. Nevertheless, the present tense is employed in this sentence because of the relationship between the agent and the principal verb. In this sentence, the agent is the reader, and the principal verb is find. Since the reader is able to find the detailed instructions now, at this moment, if he looks in the Handbook, the present tense is used in this sentence. This brings us to Rule 5.

Rule 5 for Sets of Directions
The present tense is employed for statements about instructions, tables, or illustrations which the reader can find, look up, or discover at the time that he looks at the instructions, tables, or illustrations.

Now, let's examine sentence 2.
An unstratified seed will sometimes lie dormant in the seed bed for several months up to an entire year.

What tense does it employ? This sentence uses the future tense. Why? This sentence expresses an action which has occurred in the past and which is likely to be repeated in the future. Because it states a potential action, one which is likely to occur in the future, this sentence employs the future tense. Actually, a sentence which expresses an action that has occurred in the past and which is likely to occur in the future can employ either the future tense or the simple present tense. Thus, sentence 2 could be stated in the following way.

An unstratified seed sometimes lies dormant in the seed bed for several months up to an entire year.

Therefore, we can now state Rule 6.

**Rule 6 for Sets of Directions**

Sentences which express an action that has occurred in the past and which is likely to reoccur in the future employ either the future tense or the simple present tense.

At this time, we are ready to consider Section III.

The following table of stratification periods for species of conifers commonly grown in the Pacific Northwest was taken from this Handbook.

What person does this sentence use? Notice that this sentence employs the third person. Why? Is the sentence a definition? A general principle? A suggestion? A fact? This sentence states a fact. Thus, it follows Rule 2 and employs the third person.
Now, consider the voice of this sentence. Is active or passive voice used here? With this sentence, the writer follows Rule 3. He employs the passive voice for two reasons: 1) he wants to emphasize the target of the verb and 2) the agent is obvious—it is the author because he was the one who took the table from the Handbook.

Now, let's look at the tense. Notice that this sentence employs a tense different from those used in the other sections. What tense is was taken? This sentence employs the past tense. Why? Notice that the agent of the sentence is the author. Therefore, this sentence describes an action performed by the author. This action was performed in the past and has been completed by the author. Thus, the past tense is used in this sentence. Now, we can state Rule 7.

**Rule 7 for Sets of Directions**

The past tense is used for statements about instructions, tables, or illustrations which the author found, looked up, or discovered at some time in the past.

Notice that Rule 7 is similar to Rule 5 because both make statements about instructions, tables, and illustrations. Let's review Rule 5.

**Rule 5 for Sets of Directions**

The present tense is employed for statements about instructions, tables, or illustrations which the reader can find, look up, or discover at the time that he looks at the instructions, tables, or illustrations.

At this point, let's examine Section IV.
Equipment

The following equipment is needed for the stratification of seeds: a shallow pan, water, a polyethylene bag, string, a refrigerator, a thermometer, towels, and a window screen or newspaper.

First, let's consider the voice of this sentence. Is active or passive voice used here? The writer has used passive voice in this sentence and has followed Rule 3 in doing so. Notice that the agent is obvious—it is anyone who stratifies seeds. Also, the target of the verb, the following equipment, is emphasized because it is the grammatical subject of the sentence.

Now, consider person and tense in this sentence. Notice that third person and present tense are used. Also, note that this sentence states a general fact about the process of stratifying seeds. A general fact about a process describes what happens every time the process is repeated. It describes what happened when the process took place in the past and what should occur when the process is performed in the future. For instance, this sentence in Section IV describes what equipment was needed when stratification was performed in the past and what equipment will be needed when it is performed in the future. In English, the present tense is used to describe actions which have occurred in the past and which can be repeated in the future. We can now state Rule 8.
Rule 8 for
Sets of Directions

When stating general facts about a process, use third person and the present tense.

Sometimes the future tense is used for general facts. For instance, the sentence in Section IV could be written in the following way:

The following equipment will be needed for the stratification of seeds: a shallow pan, water, a polyethylene bag, string, a refrigerator, towels, and a window screen or newspaper.

However, for general facts, the present tense is the preferred tense. 27

Now, let's consider Section V.

Procedure
Stratification is completed in three steps:
the soaking of the seeds, the storing of the seeds in a refrigerator, and the drying of the seeds.

Do you notice any similarities between the sentence in this section and the sentence in Section IV? Like the sentence in Section IV, this sentence employs the passive. Also, it employs the passive for the same reasons as the sentence in Section IV does: 1) the writer wants to emphasize the result of the verb, and 2) the agent is obvious—it is anyone who stratifies seeds. Furthermore, this sentence is similar to the sentence in Section IV because it states a general fact about stratification. Thus, like the sentence in Section IV, this sentence employs the third person and the present tense.

We are now ready to examine Section VI.
First Steps
1. (1) Place the seeds in a shallow pan and cover them with water.
2. (2) Soak the seeds overnight at normal room temperatures. (3) Depending on the stratification periods, this should be done three to eight weeks prior to planned sowing.

First, let's consider sentences 1 and 2. These sentences give directions. What person and tense do they use? They use the second person imperative. Note that with the second person imperative, you is not stated. Notice that the writer did not say:

*You place the seeds in a shallow pan and you cover them with water.

When stating directions, it is inappropriate and unnecessary to write a sentence using you. Furthermore, in stating directions, it is inappropriate to employ the third person passive. For instance, it is inappropriate and wordy to say:

*The seeds are placed in a shallow pan and are covered with water.

The second person imperative is used for giving directions. Thus, we can now state Rule 9.

Rule 9 for Sets of Directions
When giving specific (not optional) directions, use the second person imperative.

Now, let's examine sentence 3. Does it give a specific direction? No, it states some optional, useful, additional information about the second direction. Notice that the second person is not used here. What person is used?

Third person is employed in this sentence. This fact
brings us to Rule 10.

**Rule 10 for Sets of Directions**

When stating useful, optional, additional information about an activity, use third person.

Also, note the tense employed in sentence 3. What is it? This sentence is different from the sentences in the previous sections because it employs a modal. The verb consists of the modal _should_ plus the base form of _be_ plus the past participle of the principal verb, _do_. The modal is used here because this statement expresses an advisory obligation. An advisory obligation is one which very likely ought to be performed for the process to be successful. However, the process might be successful even if the advisory obligation step is not performed. An advisory obligation can also be expressed with the modal _ought to_. Thus, we can now state Rule 11.

**Rule 11 for Sets of Directions**

When stating an advisory obligation, use the modal _should_ or the modal _ought to_.

Finally, notice that sentence 3 employs the passive voice. Why? To answer this question, consider who or what is the agent. Also, consider whether the writer emphasized the agent or the result of the verb. Note that this sentence follows Rule 3. The writer employed the passive because the agent is obvious—it is anyone stratifying seeds—and the writer wanted to emphasize the result of the verb.
Now, let's examine Section VII. It says:

**Second Steps**

3. Drain the water off the seeds.
4. Place them in a polyethylene bag tied loosely to emit air.
5. Store the bag of soaked seeds in a refrigerator set at 35°-40°F. (20°-40°C.) and store for the number of days shown in Table 1. This temperature should be verified by using a thermometer.

Look at instructions 3 and 4 and the first sentence in instruction 5. Compare them to instructions 1 and 2 in Section VI. Do you see any similarities? Like the first two instructions in Section VI, instructions 3 and 4 and the first sentence in instruction 5 of Section VII give directions. Thus, in writing these sentences in Section VII, the author has followed Rule 9: When giving directions, use the second person imperative.

Now, consider the second sentence in instruction 5. Note that it is similar to the second sentence in instruction 2 of Section VI in that it contains an advisory obligation. Therefore, Rules 10 and 11 apply to the second sentence in instruction 5 of Section VII as well as to the second sentence in instruction 2 of Section VI. Consequently, the second sentence of step 5 in Section VII employs third person and the modal should. Also, notice that the advisory obligation sentence uses the passive voice because the writer wishes to emphasize temperature rather than the agent.
Let's study Section VIII.

Third Steps
6. A few hours before sowing, remove the seeds from the refrigerator.
7. Tumble the seeds in towels to dry the surface of the seed coats.
8. Finish drying the seeds by placing them on a window screen or a newspaper.

Note that all these sentences employ the second person imperative. Why? By comparing these sentences to instructions 3 and 4 and the first sentence of instruction 5 in Section VII, you should be able to state the rule which calls for these sentences to use the second person imperative.

At this time, let's examine the sentence in Section IX.

The seeds are now ready to sow.

Consider the person and tense which this sentence employs. Note that it uses third person and the present tense. Why? Notice that this sentence is similar to the sentence in Section IV in that it states a general fact about a process. Thus, like the sentence in Section IV, the sentence in Section IX follows Rule 8.

Finally, let's conclude our examination of this set of directions by looking at Section X.

Caution Stratified seeds should be handled gently to prevent loss of viability.

First, let's consider the voice of this sentence. Notice that this sentence is in the passive voice. Why? There are two
reasons why this sentence follows Rule 3 and employs the passive voice: 1) the writer wants to emphasize the target of the verb, stratified seeds, and 2) the agent--anyone who stratifies seeds--is obvious. Second, let's examine the tense and person which this sentence employs. Note that this sentence uses third person and the modal should. Why? If you reread Rule 10, you will see that a sentence uses the third person when it expresses useful, optional, additional information about a process. Also, if you look at Rule 11, you will find that a sentence employs the modal should when this sentence states an advisory obligation.

B. Exercises for Sets of Directions

A. Read the following passage. For each sentence, decide whether it is important to emphasize the target of the verb--i.e., the agent is obvious, unimportant, or unknown. Change all such sentences to the passive voice. Leave those sentences whose agents must be emphasized in the third person active voice.

Tumbling and Separating Seeds from Pine Cones

A person separates seeds from pine cones by shaking or tumbling them over a coarse screen. The dislodged seeds and smaller impurities will fall through the screen leaving the cones and other large debris on top of the screen. The simplest type of seed extractor is a reinforced wooden box with its bottom replaced by a screen. The size of the screen needed depends on the species of the cone. A one-half inch screen is suitable for Douglas-fir. Large-seeded species, such as noble fir, require a 5/8-inch mesh. One should shake the box vigorously over a large box until all the loose seed passes through the screen.
One calls a more sophisticated type of seed extractor a squirrel cage tumbler. It consists of a hollow rectangular or cylindrical frame with wooden ends and screened sides. A person loads the cones into the cage through a trap door and rotates the cage on its axis by means of a hand crank or motor-operated drive pulley. He tumbles the cones until the seeds stop falling through the screen into a seed collection box placed under the tumbler.

The extracted seeds will be mixed with smaller impurities, such as needles, broken wings, and small fragments of cones. A second screening process can separate these small particles from the seeds.

B. Revise the passage in Exercise A so that it follows Rule 9 whenever possible.

C. Fill in the blanks of the following selection with the proper form and tense of the verb given in parentheses. Remember the rules cited in this chapter for using tenses.

Sowing Coniferous Seeds

Introduction
Sowing (to be) the method of planting seeds in the soil so that they (to grow). The best time to sow coniferous seeds (to be) late April or early May when the soil (to be) fine and crumbly and there (to be) no danger of frost. Just before sowing, the soil (to be) leveled, smoothed, and mulched with a hand rake. This (to guarantee) that the soil (to be) loose and crumbly, the best possible condition for sowing. A popular way to sow seeds (to be) to plant them in uniform rows. This method (to be) most commonly used because it (to make) weeding, cultivating, fertilizing, and root pruning easier.

Equipment
The following equipment (to be) needed for sowing seeds: a 2-by-4-inch board, shredded peat moss, and water.

Procedure
First Steps
1. (to decide) where to place the first row.
2. (to press) the edge of the 2-by-4-inch board into the soft ground to a depth of about \( \frac{1}{4} \) inch.
3. (to lift) the board carefully off the ground.
4. (to repeat) steps 2 and 3 until the impression left by the board (to stretch) the length of the row.

Second Steps
5. (to scatter) the seeds evenly by hand along the length of the impression. The proper number of seeds to sow per foot (to be) found in Table 1.
6. (to press) the seeds very gently into the soft soil with the edge of the 2-by-4-inch board. (not to press) the board heavily into the soil. This (to crack) the seed coats and (to destroy) their viability.

Third Steps
7. (to fill) the seeded impression with shredded peat moss to a depth of about ¼ inch. The moss (to conserve) moisture and (to help) prevent soil erosion.
8. (to sprinkle) the rows immediately with a fine spray of water.
9. (to repeat) steps 1 through 8 for each row. The rows (to be) placed 6 to 8 inches apart. The seeds (to be) now ready to germinate.

Table 1. Approximate seed bed densities for various species

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Douglas-fir</td>
<td>40,000</td>
<td>85</td>
<td>35</td>
<td>80</td>
<td>40</td>
<td>3½</td>
</tr>
<tr>
<td>Noble fir</td>
<td>18,000</td>
<td>24</td>
<td>35</td>
<td>300</td>
<td>160</td>
<td>32</td>
</tr>
<tr>
<td>Grand fir</td>
<td>23,000</td>
<td>28</td>
<td>35</td>
<td>250</td>
<td>125</td>
<td>17</td>
</tr>
<tr>
<td>Sitka spruce</td>
<td>140,000</td>
<td>60</td>
<td>35</td>
<td>120</td>
<td>60</td>
<td>1½</td>
</tr>
<tr>
<td>W. hemlock</td>
<td>300,000</td>
<td>66</td>
<td>35</td>
<td>130</td>
<td>65</td>
<td>¾</td>
</tr>
<tr>
<td>W. red cedar</td>
<td>400,000</td>
<td>51</td>
<td>35</td>
<td>140</td>
<td>70</td>
<td>6%</td>
</tr>
<tr>
<td>Ponderosa pine</td>
<td>12,000</td>
<td>59</td>
<td>35</td>
<td>120</td>
<td>60</td>
<td>16</td>
</tr>
<tr>
<td>Scotch pine</td>
<td>80,000</td>
<td>72</td>
<td>35</td>
<td>100</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Austrian pine</td>
<td>25,000</td>
<td>69</td>
<td>35</td>
<td>100</td>
<td>50</td>
<td>6</td>
</tr>
</tbody>
</table>
D. Write a set of directions for making sauerkraut. To do so, follow Jones's outline (p. 95). Also, use the following information and the illustrations. The illustrations will help you state specific details for the individual steps of the process. Review Rules 1 through 11 about verb tense, person, and voice before you begin to write this exercise.

**Introduction**

**Definition of sauerkraut:** cabbage cut fine, salted, and allowed to ferment until sour

**General information for good-quality sauerkraut:**
- Use only mature heads of cabbage
- Weigh the cabbage accurately to insure the correct proportion of cabbage to salt

**Equipment**
- 50 pounds of cabbage
- 1 1/4 cups of pure, granulated salt
- Scale
- Sharp knife
- Long pan
- Large crock
- Clean, white cloth
- Plastic bag filled with water

**Procedure**

**First Steps**
- Removing the outer leaves and undesirable portions of the cabbage
- Washing and draining the cabbage
- Removing the core of the cabbage
- Shredding the cabbage into pieces the thickness of a dime

**Second Steps**
- Weighing 5 pounds of shredded cabbage and placing it in a long pan
- Sprinkling 3 tablespoons of salt on top of the shredded cabbage
- Allowing the salted cabbage to stand until it begins to wilt
- Mixing the salt and the cabbage to distribute the salt evenly

**Third Steps**
- Packing the salted cabbage into a large crock
- Pressing the cabbage to draw out the juices until the juices just cover the shredded cabbage
Fourth Steps
Repeating the above steps until the entire 50 pounds of cabbage is shredded, salted, and packed.

Fifth Steps
Placing a clean, white cloth on top of the cabbage to protect it from dirt.
Placing a water-filled plastic bag on top of the cabbage in order to:
1) seal the sides of the container
2) prevent the exposure of the cabbage to the air
3) serve as a weight to keep the fermenting cabbage covered with brine.

Concluding Comments
Temperature for proper fermentation: 68° to 72° F.
Time needed for complete fermentation: 5 to 6 weeks.

Illustration 1

Illustration 2
Illustration 3

Illustration 4

Illustration 5
E. Write a set of directions for a simple process. The process should be one with which you are thoroughly familiar because you have performed it yourself. Follow the examples given in this chapter. Remember the rules for using person, tense, and voice.
VI. NOTES


5. The information for this passage was taken from George L. Bush, "Distillation," The World Book Encyclopedia, 1969.

6. The information for this passage was taken from Ewald E. Selkurt, "Digestion," The World Book Encyclopedia, 1969.

7. The information for this passage was taken from Ralph D. Strength, "Cells," The World Book Encyclopedia, 1969.


13. For more information about this construction and the two other constructions which employ "dummy" it and a that-clause, read pages 18-23 of this text (Chapter III).

For more information about this construction and the two other constructions which employ "dummy" it and a that-clause, read pages 18-23 of this text (Chapter III).

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17 English Language Series, Inc., pp. 35-36.


19 For a definition of status verbs, see page 58 of this text.

20 English Language Series, Inc., pp. 35-36.


24 Jones, pp. 131-32.


26 This action is sometimes described as habitual.

27 Jones, p. 118.

28 Adapted from Douglass and Ter Bush, p. 9.

29 Adapted from Douglass and Ter Bush, pp. 14-16.

30 The information and illustrations for this exercise were taken from U.S. Department of Agriculture, "Making Pickles and Relishes at Home," Home and Garden Bulletin, 92 (March, 1966), 23-27.
VII. BIBLIOGRAPHY


I want to thank Barbara Matthies for giving me the idea for this thesis, and I especially want to thank Dr. Quentin Johnson for all the time and effort he spent in giving me advice, helping me find materials, and editing my thesis. Also, I want to thank John Hugg for providing the typewriter I needed to type my thesis.
The following is the questionnaire that the author gave to the members of the English Department at Iowa State University in the Spring of 1977.

Foreign students taking English 104 and 105 often have composition problems that require special instruction. For my thesis, I plan to study some of these problems. Through this questionnaire, I hope to discover which foreign student composition problems you think are most frequent and serious. Your answers will help me concentrate on problems of the greatest concern. Please feel free to make comments throughout the questionnaire.

Please circle your answers.

1. How many years have you been teaching Freshman English?
   1  2  3  4  5-10  11-15  16 or more

2. Approximately how many sections of English 104 and 105 have you taught in the last two years?
   1  2  3  4  5-10  11-15  16-20  21 or more

3. What is the approximate number of foreign students you have had in English 104-105 in the last two years?
   0  1-5  6-10  11-15  16-20  21-30  31 or more

4. How many of these foreign students did you refer to the writing clinic?
   0  1  2  3  4  5-10  11-15  16-20  21-25  26-30  31 or more

5. It is sometimes said that the writing clinic can't help foreign students because the clinic is designed for American students. Have any of your foreign students felt this to be true? YES  NO  If YES, please explain.

6. Consider the following aspects of composition and, according to how the majority of your foreign students
have responded to composition, order these aspects from strongest to weakest (1=strongest, 4=weakest).

MATERIAL ORGANIZATION EXPRESSION MECHANICS

7. Within mechanics, which major errors have given your foreign students the most trouble?

8. I would like to know which aspects of composition you would like to see the foreign student English program (pre 104-105 level) emphasize more. Of course, all aspects are necessary, but it would help me if you would consider each group listed below and then circle what you think to be 2 or 3 of the most troublesome areas under each group.

Group I: Material

no significant controlling idea
not enough concrete and substantial details
inaccurate details
irrelevant details
sweeping generalizations
unstated assumptions
inadequate citation of sources
plagiarism
other (please name):

Group II: Organization

paper not developed around a central thematic concern
paragraphs neither coherent nor fully-developed
paragraphs not arranged in a logical order
ineffective or no transitions
inappropriate "journalistic" paragraphs
incorrect proportion and emphasis
conclusions which neither fit nor complete the papers
other (please name):

Group III: Expression

diction inappropriate for audience and/or subject
unvaried sentence structure
emphasis controlled ineffectively by subordination
unidiomatic diction
misapplied words or phrases (other than prepositions and articles)
wordiness
cliches
inappropriate figurative language
preposition errors
article errors
other (please name):

**Group IV: Mechanics**

1. run-together sentences
2. fragmentary and incomplete sentences, omitted words
3. dangling and misplaced modifiers
4. violations of parallelism, shifted and incomplete constructions
5. improper verb forms and verb sequences
6. improper pronoun forms, reference, and agreement
7. errors in adjective and adverb use
8. misuse of the semicolon
9. seriously excessive use of the comma
10. omission of punctuation necessary for clarity
11. apostrophe errors
12. misspelled words
13. other (please name):

9. Do you have any other suggestions for me as I decide the scope of my thesis project?

One hundred of these questionnaires were given to the members of the English Department. Fifty-four of these were returned to the author. The following are the results of questions 4 through 8 of the questionnaire. For each question, the possible answer is given on the left and the number of English Department members checking that answer is given on the right.

4. How many of these foreign students did you refer to the writing clinic?

0 students = 41
1 student = 5
2 students = 3
3 students = 0
4 students = 3
5 or more students = 0
5. It is sometimes said that the writing clinic can't help foreign students because the clinic is designed for American students. Have any of your foreign students felt this to be true? YES NO If YES, please explain.

YES = 2
NO = 7

Comments: The students have said that the writing clinic is too advanced while EFL is too basic. They need in-between help.

The students have said that the writing clinic does not have enough emphasis on vocabulary, syntactical order of sentences, verb conjugations, and verb tenses.

The students have complained that the clinic helpers always ask them to write on American topics.

6. Consider the following aspects of composition and, according to how the majority of your foreign students have responded to composition, order these aspects from strongest to weakest (1= strongest, 4= weakest).

MATERIAL ORGANIZATION EXPRESSION MECHANICS

This is how the people voted for the weakest aspect.

Material = 1
Organization = 1
Expression = 24
Mechanics = 25

This is how the people voted for the next weakest aspect.

Material = 0
Organization = 6
Expression = 19
Mechanics = 21

7. Within mechanics, which major errors have given your foreign students the most trouble?
8. I would like to know which aspects of composition you would like to see the foreign student English program (pre 104-105 level) emphasize more. Of course, all aspects are necessary, but it would help me if you would consider each group listed below and then circle what you think to be 2 or 3 of the most troublesome areas under each group.

Group I: Material

no significant controlling idea = 13
not enough concrete and substantial details = 32
inaccurate details = 1
irrelevant details = 8
sweeping generalizations = 27
unstated assumptions = 15
inadequate citation of sources = 3
plagiarism = 3
not being able to grasp the assignment = 3
unable to write about themselves = 1

Group II: Organization

paper not developed around a central thematic concern = 12
paragraphs neither coherent nor fully-developed = 24
paragraphs not arranged in a logical order = 6
ineffective or no transitions = 22
inappropriate "journalistic" paragraphs = 7
incorrect proportion and emphasis = 18
conclusions which neither fit nor complete
the papers = 5
inappropriate linkage of ideas = 1

Group III: Expression

inappropriate for audience and/or subject = 6
unvaried sentence structure = 12
emphasis controlled ineffectively by subordination = 10
unidiomatic diction = 42
misapplied words or phrases (other than prepositions and articles) = 25
wordiness = 10
cliches = 1
inappropriate figurative language = 5
preposition errors = 36
article errors = 30
faulty sentence structure = 1

Group IV: Mechanics

1. run-together sentences = 16
2. fragmentary and incomplete sentences, omitted words = 19
3. dangling and misplaced modifiers = 9
4. violations of parallelism, shifted and incomplete constructions = 16
5. improper verb forms and verb sequences = 37
6. improper pronoun forms, reference, and agreement = 15
7. errors in adjective and adverb use = 6
8. misuse of the semicolon = 3
9. seriously excessive use of the comma = 5
10. omission of punctuation necessary for clarity = 2
11. apostrophe errors = 6
12. misspelled words = 18
13. articles, prepositions = 1
14. ineffective punctuation, very little punctuation = 1
X. APPENDIX B

The following is a list of the rhetorical rules stated in Chapters III, IV, and V. They are listed by the chapter in which they are found.

Chapter III: Reoccurring Processes

Rule 1. When describing a reoccurring process, use the first person if the following two conditions are met: 1) the author is the performer of the process and 2) it is important to know that the author is the performer of the process. Otherwise, use the third person.

Rule 2. When defining, use the present tense.

Rule 3. When stating general facts about a process, use the present tense.

Rule 4. When stating an advisory obligation, use the modal should or the modal ought to.

Rule 5. When a condition and its result are general facts, use the present tense for the clause that states the condition and for the clause that states the result.

Rule 6. 6A: When a result and its conditions state general facts, all of the clauses that state them can employ the present tense.

6B: Because some immediate and preliminary clauses must start well before the result, these can be expressed in conditional clauses that use the present perfect.

6C: The best way to express a result and its conditions which are general facts is to use the present tense for stating the result and those conditions which directly cause the result—i.e., those which occur immediately before the result—and to use the present perfect for preliminary conditions—i.e., those which start before the result, but not
immediately before it.

Rule 7. The passive voice is used when it is important to emphasize the target of the verb or when the agent is obvious, unimportant, or unknown.

Rule 8. When a verb has a target which is a that-clause and an agent which is obvious, unimportant, or unknown, use the following construction: It + passive voice + that-clause.

Rule 9. For sentences which employ a that-clause, a "dummy" it as the grammatical subject, and the verbs appear, follow, seem, happen, occur, and turn out as the main verbs of the sentences, use the following construction: It + active verb + that-clause.

Rule 10. When a sentence employs "dummy" it as the grammatical subject and contains a that-clause, use the following construction when an adjective modifies the that-clause: It + be + adjective + that-clause.

Rule 11. When a verb which precedes a that-clause states a suggestion, command, preference, or some advice, or when an adjective which precedes the clause expresses necessity, importance, or possibility, the verb in the that-clause employs the simple base form.

Rule 12. When it is important to emphasize the agent, use the active voice.

Rule 13. When a condition starts immediately before a result and continues to occur at the same time as the result, the condition and the result must employ the same tense. If the condition and the result are general facts, the tense they employ is the present.

Chapter IV: Nonreoccurring Processes

Rule 1. When writing about a nonreoccurring process, use the first person if the following two conditions are met: 1) the author is the performer of the process and 2) it is important to report that the author personally is the performer of the process because there is a special interest attached to
him. Otherwise, use the third person.

Rule 2. When describing an action that occurred in the past and was completed in the past, use the past tense.

Rule 3. The active voice is used when it is important to emphasize the agent. The passive voice is used when it is important to emphasize the goal, target, or result of the verb, or when the agent is obvious, unimportant, or unknown.

Rule 4. When stating a general fact, use the present tense.

Rule 5. Use the past perfect tense to describe an action in the remote past which has occurred before another action in the more recent past when you write sentences which describe the relationship between the remote and recent past actions.

Rule 6. When stating an advisory obligation, use the modal should or the modal ought to.

Rule 7. When a verb has a result which is a that-clause and an agent which is obvious, unimportant, or unknown, use the following construction: It + passive verb + that-clause.

Rule 8. When stating a general fact which is the result of another general fact, use either the present tense or the future.

Rule 9. When describing an action that a figure, a table, or data perform at the moment that the reader looks at them, use the present tense.

Rule 10. When describing an action that the author performs at the moment that the reader reads the article, use the present tense.

Rule 11. Use the past progressive with a non-status verb that describes a past action if you want to do the following: 1) emphasize a certain moment in the past and 2) express that the action of the verb endures during that moment.

Rule 12. When describing a condition which occurred and was completed immediately before a result where the result has been expressed in the simple past tense, you can employ either the simple past tense or the
past perfect tense to express the condition. However, by using the simple past tense for the condition, you will emphasize the immediacy of the two actions.

Rule 13. When defining, use the present tense.

Rule 14. When describing the relationship between remote and recent past actions, use the past perfect for all the remote actions. If you want to indicate the order of occurrence of the remote actions, use adverbs, such as then, just, prior, just prior, to modify the verbs.

Rule 15. When a condition starts immediately before a result and continues to occur at the same time as the result, the condition and the result must employ the same tense. If the condition and the result express actions that occurred and were completed in the past, they employ the past tense.

Rule 16. Use the progressive with a non-status verb that employs the present tense if you want to express the idea that the action of the verb endures for a certain moment under consideration.

Rule 17. Use the present perfect to describe an action which 1) began in the past and is still continuing in the present or 2) occurred and was completed in the past but which is seen in reference to the present and the future.

Rule 18. When describing the data or concepts of an experiment, use the present tense.

Rule 19. When stating a condition and result which have proven to be general facts until now but which may or may not be general facts in the future, use the present tense when stating the condition and the present perfect when stating the result.

Rule 20. When describing a future action, use the future tense. If the verb employs a modal, use that form which expresses future time.
Rule 1. When defining, use third person and the present tense. When stating a general principle, use third person and the present tense.

Rule 2. When stating a suggestion, use the third person. When stating a fact, use the third person.

Rule 3. The active voice is used when it is important to emphasize the agent. The passive voice is used when it is important to emphasize the goal, target, or result of the verb or when the agent is obvious, unimportant, or unknown.

Rule 4. When stating suggestions, use the present tense.

Rule 5. The present tense is employed for statements about instructions, tables, or illustrations which the reader can find, look up, or discover at the time that he looks at the instructions, tables, or illustrations.

Rule 6. Sentences which express an action that has occurred in the past and which is likely to reoccur in the future employ either the future tense or the simple present tense.

Rule 7. The past tense is used for statements about instructions, tables, or illustrations which the author found, looked up, or discovered at some time in the past.

Rule 8. When stating general facts about a process, use third person and the present tense.

Rule 9. When giving specific (not optional) directions, use the second person imperative.

Rule 10. When stating useful, optional, additional information about an activity, use third person.

Rule 11. When stating an advisory obligation, use the modal should or the modal ought to.