You should begin the writing process by analyzing your constraints

**Audience**
- Who they are
- What they know
- Why they will read
- How they will read

**Purpose**
- To inform
- To persuade

**Occasion**
- Format
- Formality
- Politics and ethics
- Process and deadline
Three aspects of writing affect the way that readers assess your documents:

- Content
- Style
- Form
Style is the way you communicate the content to the audience

Illustration

Structure

Language

[Peterson, 1987]
Form embodies the format and mechanics of the writing

format
  typography
  layout

mechanics
  grammar
  usage
  punctuation
  spelling
We can split the writing process into stages

Getting in the Mood

Writing the First Draft

Revising, Revising, Revising

Finishing
Avoiding Common Errors of Grammar

One of the most important skills a writer can have is the ability to compose clear, complete sentences. The sentence is the basic unit of communication in all forms of English.

Funk, McMahan, and Day

*Elements of Grammar*
Not all mechanical errors bother readers in the same way

Errors that disturb
- run-on sentence
- its/it’s
- spell checker ignored

Errors that distract
- missing intro comma
- faulty parallelism
- unclear pronoun ref

Errors that few even notice
- different from/than contraction
- split infinitive
The most important aspect of grammar is understanding what a sentence is

**Sentence:** A sentence is a group of words with a subject and a verb that expresses a complete thought.

**Fragment:** A fragment is a group of words that is missing a subject or a verb or does not express a complete thought.

**Run-on:** A run-on is two or more independent clauses that are not joined properly, for instance, a common mistake is to have a comma between the clauses.
Rubidium has no major uses, however, it is more common in the earth than zinc, copper, or nickel.

Although carbon dioxide occurs naturally, man has dramatically increased its concentration this past century.

Several systems can detect plastic explosives. For example, thermal neutron activation systems, nitrogen sniffer systems, and enhanced x-ray systems.
Making lists parallel is another important aspect of grammar.

Printed circuit board relays are limited to small coil voltages, contact ratings, and lack multi-pole configurations.

Printed circuit board relays are limited to small coil voltages and contact ratings, and lack multi-pole configurations.
Placing a modifier in its appropriate place is also important in grammar

These proteins indicate to the body what hormones should be given off among other things.

These proteins indicate, among other things, to the body what hormones should be given off.

In meeting the staff of the Parks Department, the greatest problem was that of water leakage.

From the staff of the Parks Department, we learned that the greatest problem was that of water leakage.
Unclear pronoun references cause ambiguities

Because the receiver presented the radiometer with a high flux environment, it was mounted in a silver-plated stainless steel container.  

If you receive an e-mail titled "Win A Holiday," do *not* open it. It will erase everything on your hard drive. Forward this e-mail out to as many people as you can. This is a very malicious virus and not many people know about it.
Although equations are separated by white space, they should be treated as part of the sentence.

To calculate the strain, $\varepsilon$, we used equation 1:

$$\varepsilon = \frac{\sigma}{E}, \quad (1)$$

where $\sigma$ is the stress estimated by FEPC and $E$ is the modulus of elasticity of aluminum.
Two common usage errors are possessives and subject-verb disagreements.

The criteria for assessing the environmental effects of acid rain (are / is) given in the next section.

So far, the daily number of engineers applying (has / have) remained constant.

The goggles protect a (persons / person’s) eyes from any damaging effects that a laser could cause.

In accordance with my (boss’ / boss’s) schedule, the first series of computers was replaced.
To decide upon the verb tense in a document, you first plant a reference flag for \( t = 0 \).

<table>
<thead>
<tr>
<th>Past Tense:</th>
<th>Present Tense:</th>
<th>Future Tense:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events that have already occurred</td>
<td>Timeless details or details at time of reading</td>
<td>Events that will occur after project</td>
</tr>
</tbody>
</table>

- **Past Tense:**
  - The pressure was...
  - For the experiment, we assumed...
  - As was shown back in Figure 1...

- **Present Tense:**
  - Air is 79 percent nitrogen.
  - Figure 1 shows...
  - The computer code in Appendix B includes...

- **Future Tense:**
  - Future work will focus on....
The verb tenses of sentences that refer to the document depend upon position

Introduction

This report *presents* a design for connecting light emitting diodes to the HC11 microcontroller.

Results and Discussion

...Figure 1 *shows* the circuit that connects the light emitting diodes to the HC11 microcontroller.

Conclusions

This report *has presented* a design for connecting light emitting diodes to the HC11 microcontroller. As *was shown* in Figure 1, the circuit...
## Use numerals when referring to measurements

### When to use numerals

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific measurements</td>
<td>3 volts, 2 seconds, 1 m/s</td>
</tr>
<tr>
<td>Percentages</td>
<td>15 percent</td>
</tr>
<tr>
<td>Monetary figures</td>
<td>$3000</td>
</tr>
<tr>
<td>Large numerals</td>
<td>5 million</td>
</tr>
</tbody>
</table>

### When to write out numbers

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counting (one or two words)</td>
<td>twenty-three gages</td>
</tr>
<tr>
<td>Informal measurements</td>
<td>two hours</td>
</tr>
<tr>
<td>First word of sentence</td>
<td>Thirty-three...</td>
</tr>
</tbody>
</table>
The Craft of Editing

Editing isn’t a cosmetic process. It’s a thinking process.

Richard Rhodes, author
*Making of the Atomic Bomb*
Although editing is a large subject, we will focus on the editing that occurs in the sign-off process.

Editing documents:
- Reviewing
- Line editing
- Online editing
- Proofreading

Reducing friction:
- Actions by authors
- Actions by editors
Before editing someone’s document, you should first consider your constraints:

- Audience of Document
- Process to Publish Document
- Other Editors of Document
- Politics and Ethics
- Format of Document
- Formality of Document
- Politics and Ethics
Three aspects of the writing affect the way that editors assess documents

Content
Style
Form
Editing for content involves deciding what message to send.

- Is the content complete?
- Is the content appropriate?
- Is the content correct?
Editing for style involves deciding how to communicate the message.
Editing for form concerns whether the communication is properly presented.
What variables determine how much change you make?

- Importance of Change
- Consistency of Change
- Disposition of Writer
- Difficulty of Change
A well-done edit has three characteristics: clarity, consistency, and hierarchy.
Reducing the friction between editors and authors calls for action on both sides

Authors
- Identifying constraints
- Submitting outlines early
- Allotting time for editors
- Mulling over criticisms

Editors
- Identifying pet peeves
- Negotiating gray areas
- Establishing boundaries
- Controlling tone
- Understanding authors
When editing someone’s writing, consider tone

Lead with the positive

Editor

Author

Edit one another as you would wish to be edited
Structure: the Strategy of Style

If a man can group his ideas, then he is a writer.

Robert Louis Stevenson
Beginnings prepare readers for understanding the work

**Title**
- orients readers to document

**Summary**
- tells readers what happens in document

**Introduction**
- prepares readers for the middle
Effects of Humidity on the Growth of Avalanches
A strong title orients readers to your area of work

Effects of Humidity on the Growth of Avalanches

Effects of Humidity on the Growth of Electron Avalanches in Electrical Gas Discharges
A strong title also separates your work from everyone else's work

Studies on the Electrodeposition of Lead on Copper
A strong title also separates your work from everyone else's work

Studies on the Electrodeposition of Lead on Copper

Effects of Rhodamine-B on the Electrodeposition of Lead on Copper
Several names for summaries exist

Summary

Technical Abstract

Informative Abstract

Abstract

Descriptive Abstract

Executive Summary
Although several names exist for summaries, there are essentially two approaches

This paper describes a new inertial navigation system for mapping oil and gas wells. In this paper, we will compare the mapping accuracy and speed for this new system against the accuracy and speed for conventional systems.

This paper describes a new inertial navigation system that will increase the mapping accuracy of oil wells by a factor of ten. The new system uses three-axis navigation that protects sensors from high-spin rates. The system also processes its information by Kalman filtering (a statistical sampling technique) in an on-site computer. Test results show the three-dimensional location accuracy is within 0.1 meters for every 100 meters of well depth, an accuracy ten times greater than conventional systems.
A document's introduction prepares readers for the discussion.

Topic?
Importance?
Background?
Arrangement?
The introduction defines the scope and limitations of the work.

**Proposed Study on Effects of Alcohol on Life Expectancy**

- Three classes of drinkers: non-drinkers, moderate drinkers, heavy drinkers
- Ten-year study
- Men surveyed
- Other effects, such as exercise, not considered
- Medical histories not considered
- Women may not experience the same effects

**Scope**

**Limitations**
In the middle of a report, you present your work

Choose a logical strategy

Make sections and subsections

Heading
  Subheading
  Subheading
Heading
  Subheading
  Subheading
  Subheading
Heading

[Sandia, 1985]
Section headings should be descriptive and parallel

Non-Parallel
Non-Descriptive

Introduction
Background
Marx Generators
Line Pulse
Beam Generation
Transporting Beam
Pellets
Results
Conclusions

Parallel
Descriptive

Introduction
Past Designs for Particle Beam Fusion
New Design for Particle Beam Fusion
  Charging Marx Generators
  Forming Line Pulse
  Generating Particle Beam
  Transporting Particle Beam
  Irradiating Deuterium-Tritium Pellets
Results of New Design
Conclusions and Recommendations
In a strong ending, you analyze results and give a future perspective.

Conclusions
Analysis of Results

Analyze results from overall perspective

Future Perspective

Several options:
- Make recommendations
- Discuss future work
- Repeat limitations
Failing to cite the contribution of others can be a fatal flaw in your career.

James Watson surreptitiously looked at Rosalind Franklin’s work.

Watson did not give enough credit to Franklin.
Language: the Way We Use Words

Short words are the best, and short words when old are best of all.

Winston Churchill
Generalities that are not anchored with specifics are soon forgotten

After recognizing some problems with the solar mirrors, we took subsequent corrective measures.
Generalities that are not anchored with specifics are soon forgotten.

After recognizing some problems with the solar mirrors, we took subsequent corrective measures.

After finding that high winds (and not hail) had cracked the ten solar mirrors, we began stowing all mirrors in a horizontal position during thunderstorms.
For precision, you must choose the appropriate level of detail

Operations at the plant stopped momentarily because the thermal storage charging system desuperheater attemperator valve was replaced.
For precision, you must choose the appropriate level of detail

Operations at the plant stopped momentarily because the thermal storage charging system desuperheater attemperator valve was replaced.

Operations at the plant stopped for 1.5 hours so that a valve in the thermal storage system could be replaced.
The goal of this study is to develop a commercialization strategy for solar energy systems by analyzing factors impeding early commercial projects (i.e., SOLAR ONE) and by identifying the potential actions that can facilitate the viability of the projects.
Complex wording buries ideas

This study will consider why current solar energy systems, such as Solar One, have not reached the commercial stage and will find out what steps we can take to make these systems commercial.

The goal of this study is to develop a commercialization strategy for solar energy systems by analyzing factors impeding early commercial projects (i.e., SOLAR ONE) and by identifying the potential actions that can facilitate the viability of the projects.
The goal of the work was to confirm the nature of electrical breakdown of nitrogen in uniform fields at high pressures and electrode gaps which approach those obtained in engineering practice, prior to the determination of the processes which set the criterion for breakdown in the above-mentioned gas in uniform and non-uniform fields of engineering significance.
The goal of the work was to confirm the nature of electrical breakdown of nitrogen in uniform fields at high pressures and electrode gaps which approach those obtained in engineering practice, prior to the determination of the processes which set the criterion for breakdown in the above-mentioned gas in uniform and non-uniform fields of engineering significance.

At high pressures (760 torr) and typical electrode gap distances (1 mm), the electrical breakdown of nitrogen was studied in uniform fields.
Ambiguities occur for many reasons

The proposed schedule is discussed below for the next four years.

As light hydrocarbons evaporate the oil vapor pressure falls.

Although engineers realized the design flaws in the Titanic soon after its sinking in 1912, the reasons for the severe damage inflicted by the iceberg remained a mystery until its discovery in 1985.
Pretentious diction often causes problems with tone

- approximately
- facilitate
- implement
- individualized
- operationability
- utilization

- about
- cause; bring about
- carry out
- individual
- can operate
- use
A new process for eliminating nitrogen oxides from diesel exhaust engines is presented. Flow tube experiments to test this process are discussed. The percentage decrease in nitrogen oxide emissions is revealed.

This paper presents a new process for eliminating nitrogen oxides from the exhaust of diesel engines. To test this process, we performed experiments in flow tubes. These experiments revealed a 99 percent decrease in nitrogen oxide emissions.
By the late Middle Ages, cities throughout Europe were building Gothic cathedrals. The only way, however, that architects could test a new design was to build the cathedral, a process that took more than forty years. Unfortunately, many cathedrals caved in during or after construction. What took forty years to test in the Middle Ages could have been done in minutes on a supercomputer.

William Wilson
Illustration: The Meshing of Words With Images

Keep it as simple as possible, yet no simpler.

Albert Einstein

X-ray photograph of DNA [Rosalind Franklin, 1952]
Two types of illustrations exist: tables and figures.

Table 1. Reactor power levels in Chernobyl accident [Wolfson, 1991].

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Power Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/25</td>
<td>1:00 am</td>
<td>3200 MW</td>
</tr>
<tr>
<td>4/25</td>
<td>2:00 pm</td>
<td>1600 MW</td>
</tr>
<tr>
<td>4/25</td>
<td>11:10 pm</td>
<td>1600 MW</td>
</tr>
<tr>
<td>4/26</td>
<td>1:00 am</td>
<td>30 MW</td>
</tr>
<tr>
<td>4/26</td>
<td>1:19 am</td>
<td>200 MW</td>
</tr>
<tr>
<td>4/26</td>
<td>1:23 am</td>
<td>2,000,000 MW</td>
</tr>
</tbody>
</table>

Figure 1. Simplified diagram of nuclear reactor [Wolfson, 1991].
When presenting numerical data, you choose between tables and graphs.

Table 2. Blood glucose levels [Carlson, 1982].

<table>
<thead>
<tr>
<th>Time (hour)</th>
<th>Normal (mg/dl*)</th>
<th>Diabetic (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>midnight</td>
<td>100.3</td>
<td>175.8</td>
</tr>
<tr>
<td>2:00</td>
<td>93.6</td>
<td>165.7</td>
</tr>
<tr>
<td>4:00</td>
<td>88.2</td>
<td>159.4</td>
</tr>
<tr>
<td>6:00</td>
<td>100.5</td>
<td>72.1</td>
</tr>
<tr>
<td>8:00</td>
<td>138.6</td>
<td>271.0</td>
</tr>
<tr>
<td>10:00</td>
<td>102.4</td>
<td>224.6</td>
</tr>
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<td>161.8</td>
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</tr>
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* decaliters/milligram
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</tbody>
</table>

* decaliters/milligram

Figure 11. Blood glucose levels for normal individual and diabetic [Carlson, 1982].
Line graphs are common in engineering and science.

Figure 3. Computational and experimental temperatures for laminar diffusion flames [Sandia, 1987].
For clarity, you should introduce and explain illustrations in the text

..., as shown in Figure 7.

Figure 7. Title of figure. Some formats allow you extra sentences to explain unusual details.
This material is taken from the work of Dr. Michael Alley of Virginia Tech.

These slides and others of a similar style are found at his website

http://www.writing.eng.vt.edu/

along with examples and writing exercises