chapter 8 SPECIAL PROCEDURES:

DON'T USE MOUSE TRAPS ON ALLIGATORS ... NOR BANDAIDS ON TOOTHACHES !!!

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Don't Use Mousetraps on Alligators Nor Bandaids on Toothaches!

This chapter departs from the format used in most of this book. Instead of being a "time sequence" chapter, we will deal here with a few of the special cases that come up only in certain courses.

The 6 procedures we will discuss are:

Section 8.1 Memorization (in all courses, but especially in languages, biology, etc.)

Section 8.2 Problem Solving (e.g., engineering, chemistry, physics, etc.)

Section 8.3 Laboratory Courses (e.g., sciences, agriculture, etc.)

Section 8.4 Analyzing (e.g., philosophy, political science, architecture, etc.)

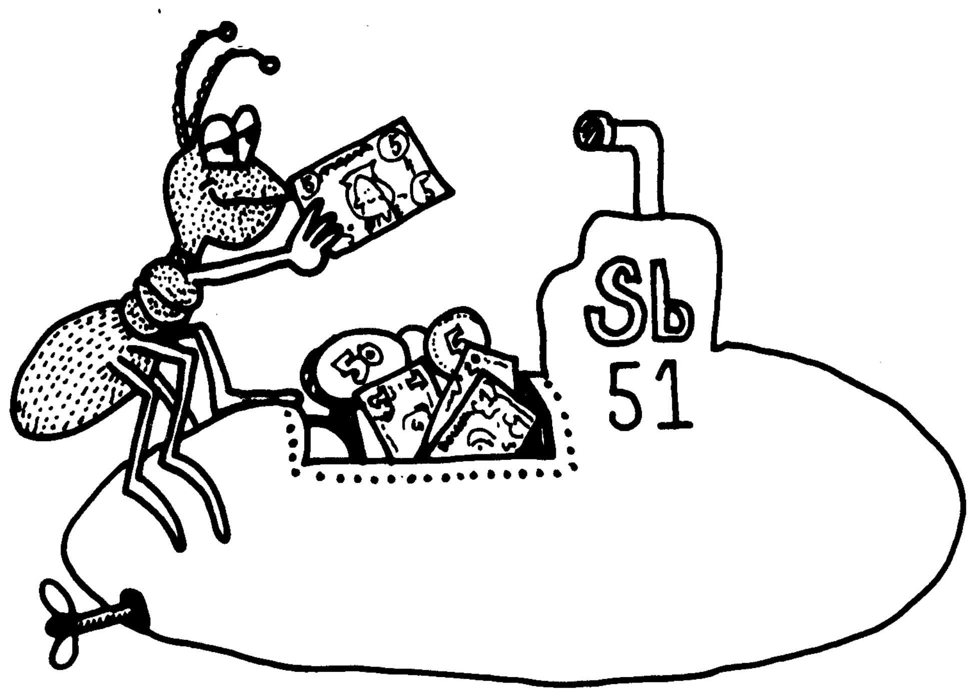
Section 8.5 Writing (e.g., English, journalism, etc.)

Section 8.6 Library Work (e.g., for term papers, etc.)

8.1 MEMORIZATION

This is an activity that most of us detest! Rote memory is the very ***lowest*** level of learning. Fortunately, it requires ***NO*** special talent. In addition to the standard procedures of "flash cards" (pages 86-87) and "late night" memory work (page 10), there are two special "tricks":

1. Make associations.
2. Use as many senses as possible.



Successful associations are CRAZY ones. The more ridiculous the association, the better it will stick. In chemistry, we have to ***memorize*** the symbol Sb for the element antimony. (Doesn't make sense, does it?) But a silly picture can relate it in a way that the word antimony (sounds like "ant-money") will make you recall the submarine (sub) and Sb (pronounced "Sb") will make us think of that rich ant.

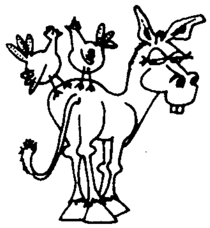
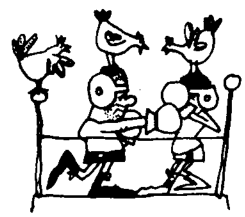
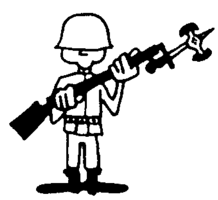
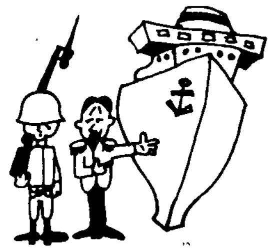
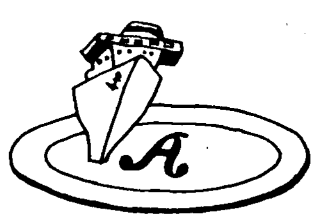
For ***lists*** that must be memorized, the associations should connect items 1 and 2; then they should connect items 2 and 3; then they should connect items 3 and 4; etc. For example, memorize the following list of names in order. (They were Greek City States.)

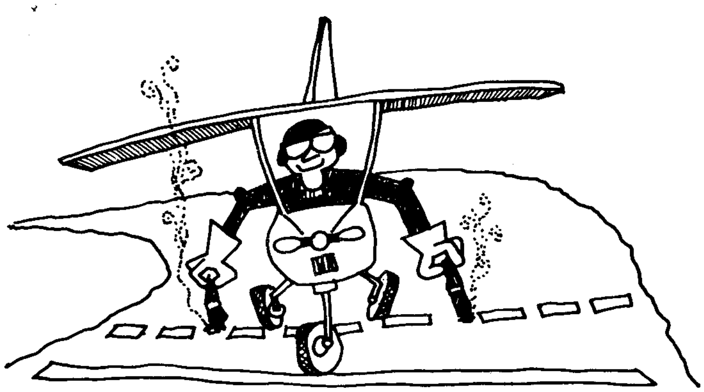
Athens
Sparta
Corinth
Militus
Syracuse
Platea

Again, "silly pictures" can be used to help in memorization, and to ***link*** items in a list (as shown in Table 8.1). At first, "silly mental pictures" may seem difficult to invent. If this is a problem, simply sit down ***with a group*** of students and have an ***ABSOLUTE NONSENSE*** party. Take any list you want and ***compete*** with each other at being silly. When you start to act like giggling five-year-olds at a slumber party, you've got the idea.

The "outlandish mental picture" can remind you of a word, of a phrase, of a listing, or of an acronym. One of the nuts writing this book must "put out all cigars" on the taxiway lines where airplanes stop before moving onto the runway. It makes absolutely no difference that he doesn't smoke cigars in the plane. He ***associates*** the broken lines in this area with cigars through a goofy mental picture. This ensures that he checks the critical pre-flight acronym: (page 86).

Table 8.1. "Silly Picture" Memory Aid/Linkage

CITY STATES	"MENTAL PICTURES"	LINKAGE
Athens		Jack*ass* (pronounce with a *lisp*, i.e., "ath") with *hens*
Sparta		*hens* → *spar* (boxers sparring)
Corinth		*spar* → *core* (boxer removes apple core)
Militus		*core* → *military* (apple core on a military bayonet)
Syracuse		*military* → *"sir, a cruise"* (sounds like "Syr-a-cruse")
Platea		*"sir, a cruise"* → *plate "A"* (spelling is Platea, even if pronunciation is different)



C ontrols movement

I nstrument settings

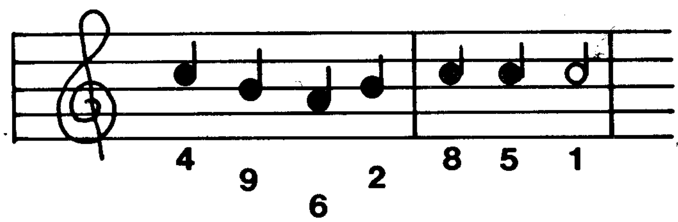
G as valve settings

A ttitude (trim) settings

R un up engine

S et radio frequencies.

The second memory "trick" is using as many senses as possible. The "cigar" acronym works better if you ***imagine*** the smell of cigars burning the paint from the taxiway line. It's even better if you ***imagine*** the sound of them being stubbed out. It's also better if you ***"feel"*** the plane being brought to a halt by "cigar brakes". The logic of this process is that we connect different paths of neurons in our brain with each way we view the "picture". You can easily prove this to yourself with something as simple as dialing a telephone number. Do you dial the first 3 numbers and then look back at the number before you dial the other four? You'll never have to do that again if you simply put a tune to it. 496-2851, for example, can be set to the tune of "Mary Had a Little Lamb". You don't have to sing it out loud–just thinking the numbers to the tune is enough.



It's true that we don't usually put telephone numbers into our permanent memory, but the principle is the same. The more neuron connections we make in the brain, the easier it is to find one that's still intact when we want to remember.

For many routine memory tasks (e.g., names and symbols of chemical elements, identification of skeletal parts in biology, names and dates of U.S. presidents, etc.), FLASHCARDS are ***very*** useful. To prepare these, cut 3" x 5" cards in half (to give 3" x 2½" cards). On one side of a card, write "half" of the information (e.g., symbol of a chemical element, sketch of a bone location, dates of a president's term in office). On the other side of the card, write the "other half" of the information (e.g., name of the chemical element, name of the bone, name of the president).

To use flashcards ***effectively***, most of your work ***must*** involve WRITING "what's on the other side of the card". Stack the flashcards so that all "top" sides have the same ***kind*** of information (e.g., symbols of chemical elements). Then write on a piece of paper the "matching information". Check if you got it right. If you did, put that card aside. If you got it ***wrong***, SCRATCH OUT YOUR WRONG ANSWER, WRITE THE CORRECT ANSWER, and place the card on the bottom of the stack for another trial.

After you've completed the stack once, turn all the cards over and repeat the process. For example, if you got the presidents' names ("given" their terms of office), now try to get the terms from looking at their names.

If you combine flashcards with the "mental picture tricks" (page 84), the process is even more effective. Use your flashcards on a ***regular*** basis for memory review. In some of your review times, recite the memory information aloud to yourself or work with a couple of friends in a "flashcard game". However, ***don't*** neglect a regular WRITING review, since this is especially effective ***and*** writing best helps recall proper ***spelling*** of the words involved.

If you want to pursue this "memory area" further, some of the best books are:

How to Improve Your Memory & Concentration; Kellet, Michael; New York: Monarch Press, 1977

Memory Matters; Brown, Mark; Newton Abbot [England]: David & Charles, 1977

Techniques for Efficient Remembering; Laird, Donald A. & Laird, Eleanor C.; New York: McGraw Hill, 1960

How to Master Your Memory; Lewis, Dave; Houston, Tex.: Gulf Publications Co., 1962

8.2 PROBLEM SOLVING

This section deals with "how to set up a problem so that you may calculate an answer". It deals with cases where some measurement is involved, such as in chemistry, physics, engineering, animal science, geology, finance, etc., etc., etc.

The process we will use simply assumes that the answer we seek is a fact (is true). It also assumes that the necessary data to make the calculation are somehow available (but often not entirely stated in the problem).

Step 1. The Answer

It may sound backwards at first, but you ***must*** start by identifying what you are looking for. To understand how necessary this is, try answering the following question: "What is the correct answer to the question the author of this section had in mind while he wrote this nonsense?" It's impossible to answer that because, if I don't tell you the question, you don't have a chance of being able to answer it. ***Read the question (problem) until you can definitely identify what you are trying to calculate***. Now WRITE the answer, except for the unknown numerical value. Put an "equal sign", (=), in front of it and a question-mark, (?), for the numerical value of the answer.

Examples:

$$= ?\ \frac{\text{cm}}{\text{sec}}\ \text{horizontal velocity}$$

$$= ?\ \text{g}\ Na_2SO_4\ \text{used}$$

$$= ?\ \frac{\$\ \text{profit}}{1\ \text{day}}$$

$$= \frac{?\ \text{lbs sorgum}}{1\ \text{ton of feed}}$$

$$= \frac{?\ \text{lbs barite}}{100\ \text{lbs drilling mud}}$$

Now re-read the preceding examples using the phrase "FOR EVERY" wherever the horizontal "divided by" line appears. $\frac{?\ \$\ \text{profit}}{1\ \text{day}}$ is read, "How many (the "?") dollars profit FOR EVERY one day?" The last example reads, "How many pounds of barite FOR EVERY 100 pounds of drilling mud". Notice that this is the same as, "What weight-percent barite is in the drilling mud?"

One final word about "writing the answer": You MUST distinguish the answer from any similar measurements. Thus, $\frac{\text{cm}}{\text{sec}}$ (cm FOR EVERY sec) is not enough if we want ***horizontal velocity*** in a problem that also contains non-horizontal velocity. Likewise, "grams" is not the answer in the second example. We need "grams of Na_2SO_4 ***used***" (note that "g Na_2SO_4" ***won't*** do if ***some*** of the Na_2SO_4 was ***used*** and some of it was ***not*** used). The words (and symbols) you use to state the answer don't matter as long as they clearly ***identify it to you AND they distinguish it from any other similar measurements.***

Step 2. Locate the Answer

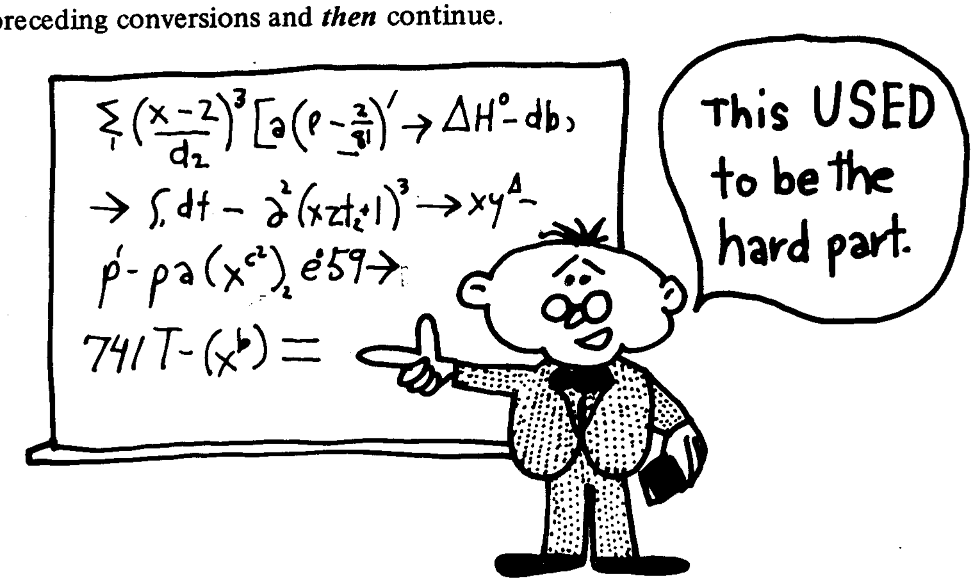
You MUST have some piece of data which "contains the answer", either totally or in part. If the total answer isn't given, look for the numerator of the answer. For example, 0.7g of calcium per lb of sorgum ***does*** contain the numerator of our fourth sample answer. This says 0.7g of calcium FOR EVERY pound of sorgum ($\frac{0.7\text{g Ca}}{1\ \text{lb sorgum}}$) . It also says $\frac{1\ \text{lb sorgum}}{0.7\text{g Ca}}$ (one pound of sorgum FOR EVERY 0.7 g of calcium). Any statement which does not include "FOR EVERY" simply states "THERE IS (ARE)". For example, "419 ft rope" simply says, "There are 419 feet of rope".

Step 3. Solve the Problem

In any simple problem, we are merely converting from one type of measurement to another. To see how this works, try converting (showing ***complete*** setups):

a. 4 feet to inches.
b. 34 quarters to dimes.
c. 10^6 ounces to tons.
d. 10^{-4} days to milliseconds.

Do the preceding conversions and ***then*** continue.



In "problem" (a) you used the "conversion factors" $(\frac{12 \text{ inch}}{1 \text{ foot}})$; in (b) you probably used the two "conversion factors" $(\frac{25 \text{ cents}}{1 \text{ quarter}})$ and $(\frac{1 \text{ dime}}{10 \text{ cents}})$; in (c) you used $(\frac{1 \text{ lb}}{16 \text{ oz}})$ and $(\frac{1 \text{ ton}}{2000 \text{ lb}})$; in (d) the "conversion factors" would be $(\frac{24 \text{ hr}}{1 \text{ day}})$, $(\frac{60 \text{ min}}{1 \text{ hr}})$, $(\frac{60 \text{ sec}}{1 \text{ min}})$, and $(\frac{1000 \text{ millisec}}{1 \text{ sec}})$. In each of these problems, you have used "conversion factor(s)" that you know well. Also in these cases you have not changed the ***type*** of measurement, i.e., length in (a), money in (b), mass in (c), and time in (d).

A second type of "conversion factor" relates different types of measurements. The following examples illustrate this second type of "conversion factor". Again, showing ***complete*** setups, convert:

	Problem	**Conversion Factor**
e.	20 feet to dollars.	(at a price of) $\frac{50 \text{ cents}}{1 \text{ foot}}$
f.	\$15 to lbs.	(at a fee of) $\frac{19 \text{ cents}}{1 \text{ lb}}$
g.	6 gallons to hours.	(at a flow of) $\frac{0.1 \text{ pint}}{1 \text{ hour}}$
h.	300 miles to seconds.	(at a speed of) $\frac{450 \text{ miles}}{1 \text{ hour}}$
i.	700 ml to kilograms.	(for a density of) $\frac{7.50 \text{ g}}{1 \text{ ml}}$

In these problems, of course, some other "conversion factors" are also required, i.e., $\frac{\$1}{100¢}$ in (e) and (f), $\frac{8 \text{ pints}}{1 \text{ gallon}}$ (or alternately $\frac{4 \text{ quarts}}{1 \text{ gallon}}$ ***and*** $\frac{2 \text{ pints}}{1 \text{ quart}}$) in (g), $\frac{3600 \text{ sec}}{1 \text{ hour}}$ (or $\frac{60 \text{ sec}}{1 \text{ min}}$ ***and*** $\frac{60 \text{ min}}{1 \text{ hour}}$) in (h), and $\frac{1 \text{ kilogram}}{1000 \text{ g}}$ in (i).

Note that every "conversion factor" simply makes a statement of the form:

"There are (X) FOR EVERY (Y)".

For example, we say,

"There are (36 inches) for every (1 yard)".
"There are (75 cents) for every (3 quarters)".
"There is (1 yard) for every (36 inches)".

We can express the known density of Pt by saying, "There are (21.3 g Pt) for every (1 ml Pt)", or from the same piece of data, "There is (1 ml Pt) for every (21.3 g Pt)". Any true statement which relates two quantities may be used as a "conversion factor" (e.g., the statements of price, fee, flow, speed, and density in examples (e) through (i) in the preceding discussion).

Remember that the horizontal line, which separates the numerator and the denominator of these statements when written as fractions, is called "for every". The same line may also be called "in a given", "in each", "per", or "per unit of". These are quite equivalent statements. Now, if you make an "X for every Y" statement, you have it in a mathematical form. See how many different "conversion factors" you can obtain from the following statements.

> "Three chemists produced 41 grams of compound 'Q' in five days. Each chemist operated 5 extraction columns for a period of 8 hours each day. The compound 'Q' produced was bottled in 12 vials, each of which contains 1.5 ml of the material, and the entire lot was sold for $3000.00."

[Hint: Two or more "conversion factors" may be combined to give another "conversion factor" (see, e.g., $(\frac{3600 \text{ sec}}{1 \text{ hour}})$ above.]

After you have written your list of "conversion factors", see if you have included the following: gross income of each chemist per day, density of compound 'Q', vials of product per chemist, vials produced per day, and gross income per column in one day. Did you identify others?

IN SETTING UP ANY SIMPLE PROBLEM, WE TAKE OUR DATA AND "CONVERT" IT TO THE DESIRED UNITS (i.e., to the units of the answer).

To check whether your setup of a problem is correct, just ask three simple questions:

1. Do all the units in the setup cancel, except those desired in the answer? (A simple "There is" statement can be in the numerator, e.g., 419 ft rope, or in the denominator, e.g., $\frac{1}{419 \text{ ft rope}}$.)
2. Is each separate statement in the setup true? (This is necessary to get a true answer.)
3. Have I made the numbers, as well as the units, *the same* on both sides of the mathematical equation?

Now check these three conditions for the following solutions to the sample problems (a) through (i) from our earlier discussion:

a. $(4 \cancel{\text{feet}}) (\frac{12 \text{ inches}}{1 \cancel{\text{foot}}}) = 48 \text{ inches}$ (Note that there is no problem in "cancelling" a singular unit and a plural unit.)

b. $(34 \cancel{\text{quarters}}) (\frac{25\cancel{¢}}{1 \cancel{\text{quarter}}}) (\frac{1 \text{ dime}}{10\cancel{¢}}) = 85 \text{ dimes}$ or

$(34 \cancel{\text{quarters}}) (\frac{10 \text{ dimes}}{4 \cancel{\text{quarters}}}) = 85 \text{ dimes}$

c. $(10^6 \cancel{\text{ounces}}) (\frac{1 \cancel{\text{lb}}}{16 \cancel{\text{oz}}}) (\frac{1 \text{ ton}}{2000 \cancel{\text{lbs}}}) = 31 \text{ tons}$

d. $(10^{-4} \cancel{\text{days}}) (\frac{24 \cancel{\text{hrs}}}{1 \cancel{\text{day}}}) (\frac{60 \cancel{\text{min}}}{1 \cancel{\text{hr}}}) (\frac{60 \cancel{\text{sec}}}{1 \cancel{\text{min}}}) (\frac{1000 \text{ millisec}}{1 \cancel{\text{sec}}}) = 8.6 \times 10^3 \text{ millisec.}$

e. $(20 \cancel{\text{ft}}) (\frac{50\cancel{¢}}{1 \cancel{\text{ft}}}) (\frac{\$1}{100\cancel{¢}}) = \$10$

f. ($15) $(\frac{19¢}{1\ \text{lb}})$ WRONG START!!! The statement "19¢ for *every* 1 lb" is true, but it places "money" in the numerator so that it can never cancel "money" (in $) which is *also* in the numerator. This partial setup is ***wrong***, because it does NOT give us the desired units (it would give us the correct number of $(\frac{\text{"\$} \times ¢\text{"}}{\text{lb}})$, but those units don't make any sense).

To get the correct setup, simply realize that if there is a fee of "19¢ *for every* lb". then it is *also* true that there is "1 lb *for every* 19¢" of fee paid.

$$(\cancel{\$}15)\left(\frac{1\ \text{lb}}{19\cancel{¢}}\right)\left(\frac{100\cancel{¢}}{\cancel{\$}1}\right) = 78.9\ \text{lb.}$$

g. $(6\ \cancel{\text{gal}})\left(\frac{1\ \text{hr}}{0.1\ \cancel{\text{pt}}}\right)\left(\frac{8\ \cancel{\text{pt}}}{1\ \cancel{\text{gal}}}\right) = 480\ \text{hrs.}$

h. $(300\ \cancel{\text{mi}})\left(\frac{60\ \cancel{\text{min}}}{450\ \cancel{\text{mi}}}\right)\left(\frac{60\ \text{sec}}{1\ \cancel{\text{min}}}\right) = 2400\ \text{sec.}$

(Some mental arithmetic was done here.)

i. $(700\ \cancel{\text{ml}})\left(\frac{7.50\cancel{\text{g}}}{1\ \cancel{\text{ml}}}\right)\left(\frac{1\ \text{kg}}{1000\cancel{\text{g}}}\right) = 5.25\ \text{kg}$

It will be extremely helpful to your understanding to stop part-way through writing a mathematical setup and ask, "What have I calculated up to this point?". The units will tell you. The units will alert you to any errors you have made. When there are unnecessary data, the units will tell you what isn't needed. When there is not enough information given, the units will tell you ***what data*** are missing (so you can look it up, recall it from memory, or design an experiment to measure the needed data). But how do you write the correct units? Units are simply a description of what the number means–write your own units so that they clearly describe the meaning of the number ***to you.***

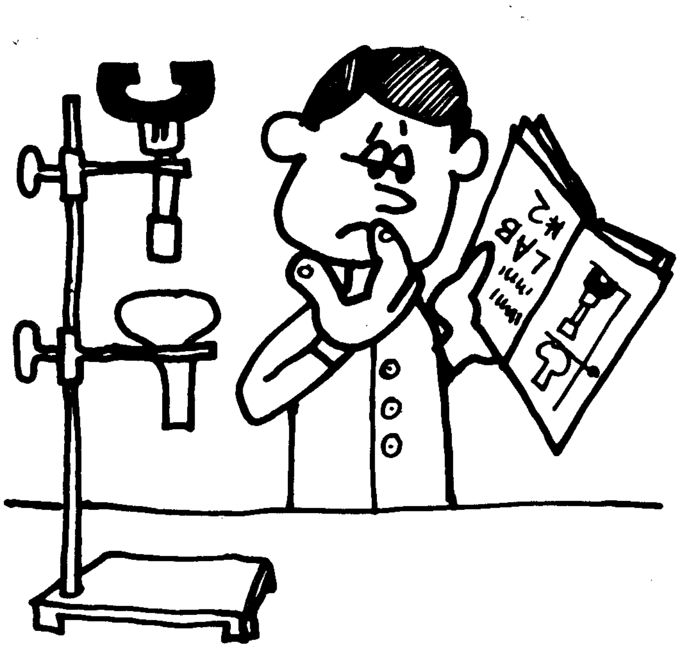
Many excellent "How to Solve Problems" type books are on the market if you wish to read further. Some are "Study Guides" that accompany texts (e.g., T. E. Taylor's *Study Guide for Chemical Principles*, Benjamin Cummings, 1971).* The Schaum's Outlines are also good aids for specific courses. W. A. Winkelgren's *How to Solve Problems*, W. H. Freeman & Co., 1974, is good for developing highly advanced reasoning to use with exceptionally complex problems.

8.3 LAB COURSES

Laboratories are usually the MOST FUN of all your courses ***or*** the MOST FRUSTRATING. But the difference is ***not*** manual dexterity! Those who love lab courses ***know*** what is going on and are thinking about ***why*** they are doing each step. The frustrated lab student will have one hand tied to the lab manual to keep his place while he simply "follows directions".

The good news is that the FUN way to do labs also requires the least TOTAL time. What it does require, however, is time spent BEFORE you actually enter the lab. This is a very specific PRE-GUESSING activity (see page 22). Each lab exercise will have a very specific OBJECTIVE (usually given in the title). Focus your attention on that objective and then figure out ***how*** each step in the procedure leads you toward that objective. One way to do this is to ask yourself, "What would go

*Much of the information in Section 8.2 was taken from this reference. The permission of Benjamin Cummings, publisher, is gratefully acknowledged.



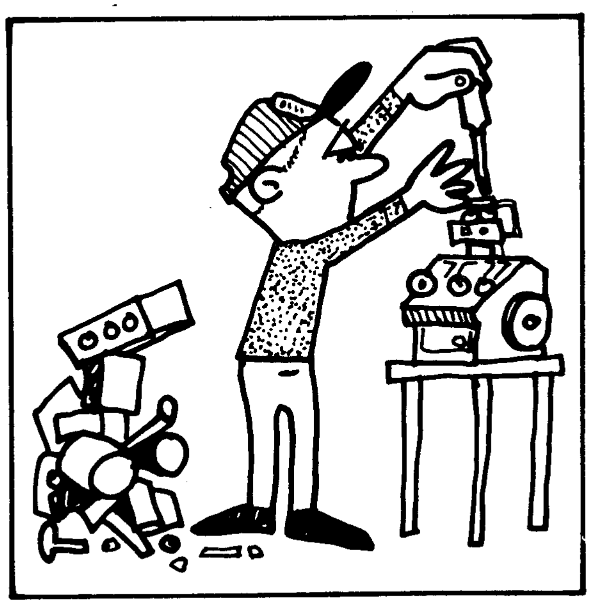
wrong if this step were omitted?", or, "What would happen if this step were changed (e.g., by using a different piece of apparatus or a different reagent)?" This process will pinpoint those parts of the experiment that you still don't understand. If you can't figure them out or find the answers in your text, have the questions ready to ask your instructor as you ENTER THE LAB a few minutes before the class starts.

Now you WILL do the experiment correctly. You will know where special CARE must be taken. You will collect all the necessary DATA. And, finally, you will be ready to write your LAB REPORT. If you prepared for this lab properly, you will probably be able to finish most of your "rough draft" report BEFORE you actually leave the laboratory. This gives you the added advantage of having your instructor's expert advice available while you are developing the report.

It is important that you *finish* your lab report, in final form, as soon as possible after the laboratory. Remember the "forgetting curve" (page 27)? If you complete your lab report immediately after lab (or as soon as you have a time available), you will have a ***better report*** and you will spend ***much*** less time preparing it.

The GOOD LAB STUDENT spends most of his/her time BEFORE and during the lab session. The POOR LAB STUDENT spends his/her time inefficiently during the lab and LONG AFTER the lab session. (The poor student usually prepares the report badly, and just prior to the next lab, when that time ***should*** be spent getting ***ready*** for that upcoming lab.)

8.4 ANALYZING



This is an important task in many courses at the beginning level. It becomes a more frequent task in higher level courses. The dictionary says that "analysis" means "to examine in detail". The other side of the coin is to take details and assemble them into a coherent whole. If you see the task as having these two parts, life gets a lot easier.

The first chore is, indeed, to break something down into detail.

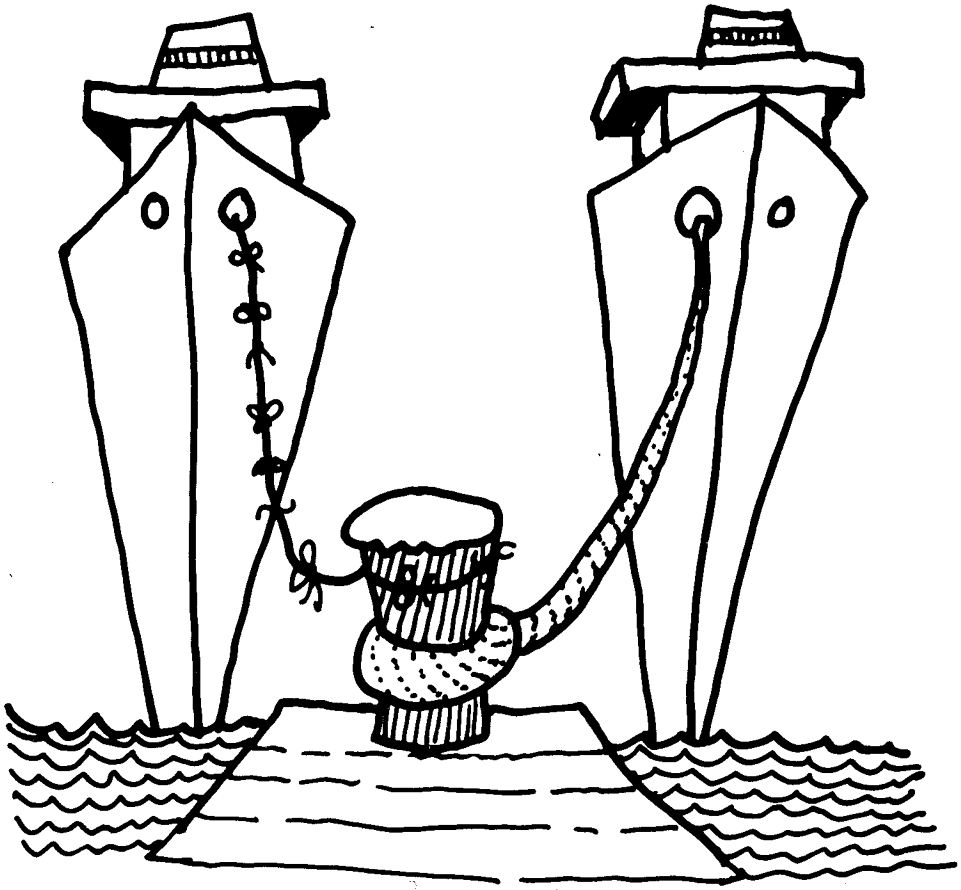
What are the parts?
What does each part mean?

What assumptions are present in each part?
    (We always make assumptions, but seldom state them.)
What parts exist that bear on the problem, but were not specifically stated?
    (e.g., Humans normally strive to stay alive!)

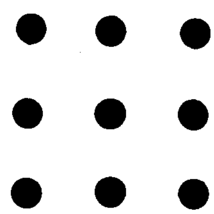
Most students fail to do this first step well ***because*** they limit themselves to their ***own*** point of view. As people mature (something we should ***continue*** to do throughout our entire lifetimes), they learn how to recognize the viewpoints of others. This does NOT mean we have to ***accept*** a different set of ideas. It ***does*** mean that we genuinely ***consider*** other points of view. If you came from the big city, how do "hicks" view the same issue? If you came from the farm, how do "city-slickers" see it? How does the opposite sex view the question? How do "old fogies" (like the authors) view it? Is the issue of equal importance to the different races? to different religions? to people in different economic levels? to those with different political persuasions? to people in different countries? The greatest sign of immaturity is to regard all these different views as a simple case of "I'm right and they're wrong". You have done the job properly when you can present the ***opposing*** views in a defensible and convincing manner.

To get all the pieces available, draw upon as many ***divergent*** sources as possible. Now you are ready for the second step: Put the pieces back together in a reasonable way. Here you can follow the basic procedures of WRITING discussed in Section 8.5, page 95.

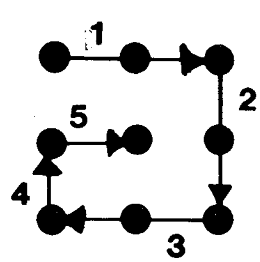
Remember, a lot of threads wound into cords and the cords wound together into a rope give you a much stronger product than each thread tied end to end.



We will always encounter problems which seem to defy analysis at first glance. But after a while, we can USUALLY develop a solution. If we focus on the ANSWER, that is an error in thinking. What we need to do is FOCUS ON WHAT BLOCKED OUR THINKING in the first place! When we learn to identify these MENTAL BLOCKS, we will be able to eliminate them in subsequent problems. As an example, try the little problem of connecting the nine dots in this pattern using straight lines connected end to end. The problem is to use as FEW straight lines as possible.

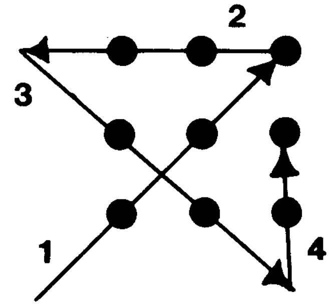


One solution uses five lines—but it CAN be done in fewer.



TRY this problem again BEFORE you turn the page for a “BETTER” solution.

The "BETTER" solution, using only four lines, clearly shows a MENTAL BLOCK to our original thinking. In the five-line "solution", we ***assumed*** that we had to stay inside the little square. That assumption BLOCKED our thinking. Now, focus on that MENTAL BLOCK and ***not*** on the "4-line-answer". Then read the problem again and try for a "less-than-4-line" solution. (One is shown on the bottom of page 97).



Once again, the MENTAL BLOCK becomes obvious when we look at a "3-line-solution". The rules didn't limit us to lines going through the ***center*** of each dot.

Finally, look on the bottom of page 99 for a "1-line-solution". The MENTAL BLOCK in this case was assuming that you couldn't fold the paper.

[If you enjoy this, ask yourself if there IS a "ZERO-line-solution". If you can't figure it out, try working on it with a "group-of-three" (page 44).]

Now, apply this LOOKING FOR MENTAL BLOCKS ***each*** time you struggle with a problem, and then find a solution.

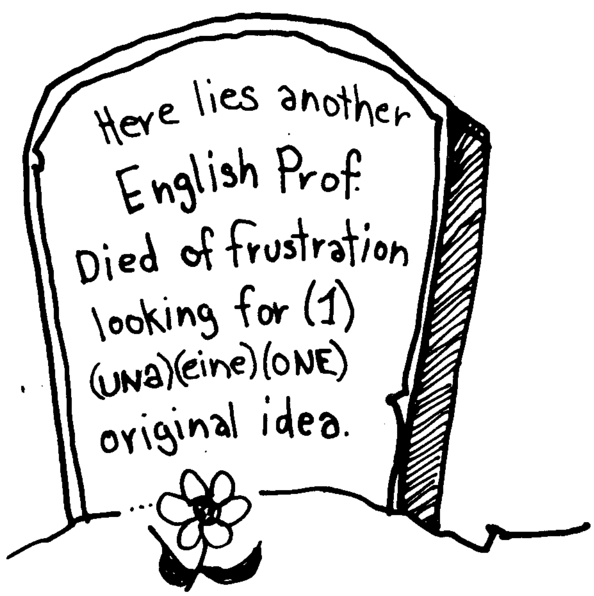
Some good references are:

J. L. Adams *Conceptual Blockbusting*, New York, W. H. Freeman Co., 1974 (for ways to overcome blocks to thinking)

M. Gardiner *Aha, Insight*, New York, W. H. Freeman Co., 1978 (for taking fresh, and simpler, looks at mathematical problems)

E. R. Emmet *Learning to Think*, Buchanan, N.Y., Emerson Books, 1980 (for formalizing logical reasoning)

8.5 WRITING



When you have a writing assignment, don't pity yourself . . . pity your poor teacher!

Just imagine how horrible it is to have to read and grade some 100 renditions of "The most interesting person I ever met" (48 mothers, 42 fathers, 8 ministers and 2 girlfriends). That's followed, one week later, by 100 near-carbon-copies of "How Mankind Changes the Environment". Disgust becomes nearly permanent the third week when only two stacks emerge for the topic "The Difference Between Men and Women".

Give your poor teacher a break! If you treat your teacher to an original idea, to a different feeling, to a fresh viewpoint, you will probably have a lot of other sins forgiven. Bad spelling, incorrect punctuation, and wrong tenses will be marked. BUT, they probably won't cut your grade half as badly as they would in a "typical" paper.

With this in mind, any writing assignment needs to be thought of as THREE jobs:

1. Organization and Development.
2. Revision and Editing.
3. Proofreading.

8.5a Organization and Development

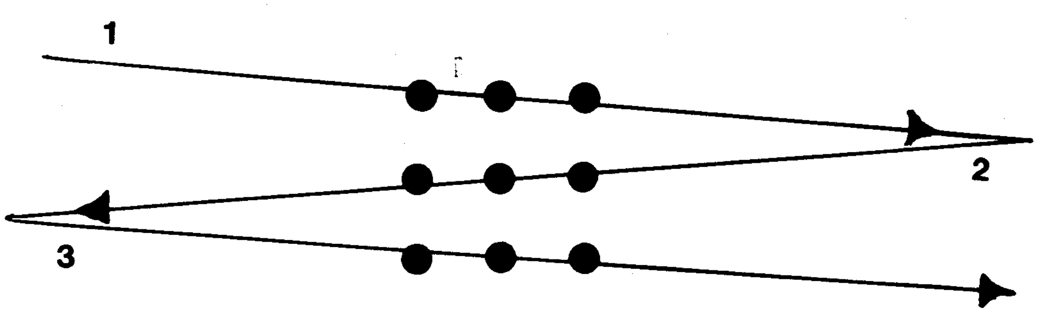
This involves a collecting of your knowledge, opinions and experience, plus data from your references. While it's true that you need to have your TOPIC ***in mind***, you have not thoroughly defined even the major idea that your paper intends to prove, yet. Students who start ***writing*** at this point simply wind up "practicing jump shots" at their waste basket. After you have made notes on your knowledge, ask yourself whether this knowledge is sufficient. "Do I need additional references?" "Are there things that are ***not*** known by anyone?" "What premises did the authors of my references have in mind?" NOW you can start to put some shape to these notes (an excellent exercise while you're simply walking, showering, or brushing your teeth). As the pieces start to fit together, you are developing the ***major idea that this paper is to prove*** (your TENTATIVE THESIS STATEMENT). Your "Idea Cards" (page 43) will come in handy at times.

Next you need to organize your notes into a TENTATIVE OUTLINE (but include sufficient detail so that you don't forget the logic which gave you that order). Then, try to write a rough draft. This will ***test the order*** of your tentative outline. If the ***order*** is working, ask yourself whether the THESIS STATEMENT is really worthy of support. If everything is still reasonable, defensible, AND HAS AN ORIGINAL IDEA IN IT, you are ready to write the body of the paper. The introduction CANNOT be written first, so continue in rough draft. Keep your purpose in mind, the audience you are addressing, the scope of your coverage and any attitudes that you wish to develop. What knowledge and/or opinions does your ***reader*** have?

With the body of your paper in rough draft you can now write your introduction and present your THESIS STATEMENT.

8.5b Editing and Revision

These are now done on the ***rough draft***. You are looking for concise statements, for coherence, for an easy-to-read style. The sentence patterns will greatly influence what the READER perceives



as he/she goes through the paper *for the first time*. Try it out on a friend to see if he/she reacts to it *the way* you want your *reader* to.

8.5c Proofreading

Only as a *final* step, PROOFREAD the paper for spelling, punctuation and grammar. When you have checked it thoroughly, get another person to repeat the process.

8.5d References

Excellent references for EACH of the 3 steps above include:

For ORGANIZATION and DEVELOPMENT

Campbell, W. G. and Ballou, S. V., *Form and Style, Theses, Reports, Term Papers,* 5th Ed., New York: Houghton Mifflin Co., 1978 (This includes very helpful sections on the use of the library and preparation of bibliographies.)

Houp, K. W. and Pearsall, T. E., *Reporting Technical Information*, 4th Ed. Encino, Calif.: Glenco Publisher, 1980. (This has many good examples and useful hints on resources and library use.)

For EDITING and REVISION

Casty, A., *Building Writing Skills*. New York: Harcourt Brace and Jovanovich, 1971. (Chapters 8 through 12 of this programmed text are excellent and easy to use. This book also contains some organization and development ideas.)

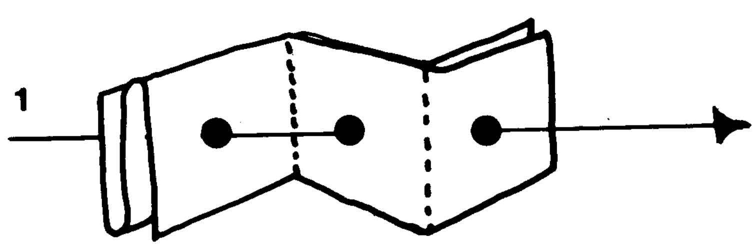
For PROOFREADING

Hook, J. N., *Competence in English*, 2nd Ed. New York: Harcourt Brace and Jovanovich, 1977. (This has easy to identify sections in a programmed text format. It is an excellent book to keep on your desk.)

8.6 THE LIBRARY

Your college's library contains a world of information, NOT just books. Try the following pop-quiz: "How would you locate the following items?"

a. The book reviews from last Sunday's *New York Times*?
b. The author of the quote "When I was one-and-twenty, I heard a wise man say, give pounds and crowns and shillings, but not your heart away."?
c. The periodicals in which W. L. Katz is currently publishing?
d. The producers of, and current prices for, 6 inch stainless steel pipe?
e. Reproductions of the Dutch masters (***not*** the cigars)?



f. A topographic map of Madagascar?
g. The Tokyo telephone directory?
h. The current members of the U.S. Senate ***Ways and Means Committee***?
i. All the books dealing with limnology?

That list could go on until you couldn't lift the paper it was printed on, but it would still never ask a question your librarians couldn't answer! For students who have not FULLY utilized the library yet (you WILL), the greatest single resource is the ***mind*** of the librarian. Any college librarian will gladly supply you with lists of services that are available, location guides, special facilities, and how YOU can benefit from all these resources. For any course, the textbook is ONE resource; your prof is a SECOND resource; and your library has THOUSANDS of additional resources. Even materials that are not in your library's collection are available ***through*** your library (e.g., "interlibrary loans").

The first two references in the previous section (Campbell and Ballou, and Houp and Pearsall) are excellent guides for finding information in the library, and for the form to use for footnotes and references. When these fail, or come up short, YOUR LIBRARIANS remain your ***best*** resources. You'll be happy you got to know them.