

---

## PROBLEM-SOLVING TIPS FOR MATH AND SCIENCE

---

*Cited from website:*

<http://www.muskingum.edu/~cal/database/content/gen-science2.html>

### **Four-Step Approach to Solving Problems**

Many students read physical science textbooks as if they were reading a novel. That is, they read a chapter through from beginning to end as if it were a narrative. However, the purpose of physical science texts is to teach students problem-solving techniques. Therefore, the critical information is in the sample problems and illustrations, not in the written word. Words are only supporting elements in these texts. They are there to explain processes to the student. All of this means three things. Readers should:

- \* Concentrate on learning problem-solving techniques.
- \* Pay primary attention to sample problems in any given chapter; written text should be treated as secondary - as a source for explaining the problems and solutions themselves.
- \* Actively work through the sample problems in the text - most of the critical information is in these problems. This means that you should do as much writing (that is, solving problems) as reading while you work through a chapter (BEFORE doing homework).

*A four-step procedure for reading physical science books is recommended. The process helps readers become more actively involved in problem-solving.*

- \* Survey the chapter to get a general overview of its contents.
- \* Read the chapter until you reach a sample problem. Work through that problem before reading any further.
- \* As soon as a given sample problem is understood, work through a problem of the same kind at the end of the chapter.
- \* Take a break between sample problem / end-of-chapter units.

This four-step procedure is discussed in more detail below.

### **1. Survey the Chapter**

Take 10-15 minutes to survey the chapter - read headings, subheadings, italicized words, and glance at tables, illustrations, and sample problems. Also, read the first paragraph of each section and read the chapter summary. As you survey the chapter ask yourself these questions:

- \* What main questions is the chapter addressing?

\* Are the main concepts based on concepts or processes discussed earlier in the text? If so, look them up before you read this chapter.

\* What new concepts are discussed in the chapter? List them, leaving space for definitions, on a separate page of your notebook. You can fill in the definitions later.

\* What are the operational formulas in this chapter? List them in your notebook, leaving space for later explanation. When you read the chapter, you'll write a few words defining each formula by an example of the kind of problem it solves. Put an asterisk (\*) next to each formula in the chapter so that your later reading will be more directed.

\* Are there unanswered questions that arouse your curiosity? If so, list them and bring them up in class.

When you finish doing the short survey, write questions that reflect the ideas expressed in chapter headings and subheadings. It's best to write these questions in the margins of the book, next to the headings and subheadings they reflect. This will help you read to answer questions later.

Finally, turn to the problems at the end of the chapter. Read through them, looking for groups of questions that are similar to each other. Put a bracket around each set of problems that seem to go together.

Now that you have surveyed the chapter, you are ready for step two.

## 2. Read and Work Problems

Once you have surveyed the chapter, turn back to the beginning of the chapter. In its first pages, you will see a sample problem that, except for specific numbers used, is similar to the problems in your first, end-of-chapter problem set. Find this problem and write the page number on which it appears next to the matching end-of-chapter problems.

Reread the text preceding the sample problem.

Try to solve the sample problem, using the following method:

\* Cover the lower part of the problem with a 3 x 5 card and try to predict the next step. Use the surrounding text to help you.

\* Write your predictions for each step on your 3 x 5 card. Reading physical science texts must be an active process, and it often involves more writing than actual reading.

\* If you get stuck, put an asterisk (\*) next to the part of the problem that confuses you. By analyzing the points that confuse you, your instructor will be able to spot your most frequent error patterns. Keep a list of these error patterns to help you check future work.

## 3. Work Extra Problems

As soon as you understand the problem, solve one of the similar problems at the end of the chapter.

#### **4. Take a Break**

Take a break after solving the first problem and a sample problem from the end of the chapter that has been solved successfully.

#### **Repeat the Problem-Solving Process**

Turn to the next set of problems you bracketed at the end of the chapter during the survey step. Looking back at the text, find the sample problem most similar to problems in this group.

Read the text preceding this sample problem.

Try to solve the sample problem using note cards and the surrounding text as a guide.

As soon as you understand the problem, solve one of the similar problems at the end of the chapter.

Take a break after each problem has been solved and a sample problem from the end of the chapter has been solved successfully. Don't hesitate from taking breaks after completing each section. Shorter, more concentrated study is more effective than studying for long periods of time.

#### **Some Final Strategies**

If there are several end-of-chapter problems illustrating a particular type of problem in the text, do these extra problems later in the week to test your memory and understanding.

Make a list of important terms or names for each chapter. Keep the list in your notebook, and test yourself on the items for 3-5 minutes at the start of each study session.

#### **Another Problem-Solving Approach**

Don't start problems until you have studied your lecture notes. Divide problems by type. When practicing, time yourself.

Make a list of what is given in the problem and what is to be found.

Try to develop a chain of logical steps leading either forward from the known quantities to the ones you have to find or from the unknown to the given quantities. If necessary, work from both ends to the middle, until you find a logical connection.

Express these logical steps in the form of equations.

Combine the equations and solve them for the unknown.

Check your answer by determining whether it is reasonable in magnitude. If you are unsure, substitute the answer into the original relations and see whether it fits consistently. Work problems backward, forward, and from both ends to the middle (C. Krause, CAL).