How to Study Chemistry

You, like many students, may view chemistry and physics as difficult. You may seem overwhelmed by new terms, ideas, equations, and methods of problem-solving. You may find it hard to transpose and apply the information from your textbook and classes to actual problems. We hope that this document can help you. It will act as a guide for:

- reading science textbooks
- note taking
- test preparation
- problem solving techniques
- preparation for final exams

Overview

It's important to recognize that chemistry is a problem-solving class. Major themes and principles are stressed, and one major goal is that the student will be able to apply these principles to understand and solve problems. You should understand that in a science course, *a significant portion of your time will be spent solving problems*. THIS IS A MATHEMATICS BASED COURSE, and mathematics will be used to solve problems.

An overview of the topic can help you organize your thoughts and allow you to use your studying time to its maximum benefit. Your goal is not to remember formulas – but to understand the underlying principles. It is inevitable that you will forget a formula, and if you have an understanding of the underlying principle, you can generate the formula for yourself.

Take these steps to get an overview of the topics that will be covered. Use the overview to "get the big picture" and integrate new material into your overall view of the subject.

1. Examine the course syllabus carefully and read the description of the course that the teacher provides. Ask about the underlying themes that will be covered. (Your teacher will not choose topics at random, rather "there is a method to the madness.")

2. Preview the textbook:

   A. Read the introduction and table of contents.

   B. Read any notes to the student that are included and the preface.

   C. Check the course outline to see what chapters are assigned and which are omitted. If they are not assigned in the same order as in the table of contents, ask about your teacher's decision to alter the order of presentation. However, remember that the textbook is not the "be all and end all" of the topic.

D. Look at the appendix of the book.
   1. Tables and location.
   2. Are answers to some or all of the problems there?

E. Glance at some of the problems in the textbook. How are they worked out? Is this the same approach that your teacher uses?

Reading Your Science Textbook

Most students make the mistake that reading a science textbook is like reading a mystery novel. Read it as fast as possible, cover to cover (or chapter by chapter) and then figure out who did it in the last chapter. This approach will not work in a science class. You must learn to be an *active reader*.

An active reader is one that pauses to think about what was just read. They relate the material just read to previous material. They make sure that they understand the material and its application to the topic at hand. They ask themselves questions so that they are sure that they understand the material. Reading a science textbook requires a pen, paper, and a calculator. Work the practice problems and the examples. This is the only way that you can make sure that you understand the material.

Reading the text and solving homework problems is a cycle: Questions lead to answers that lead back to more questions. An entire chapter will often be devoted to the consequences of a single basic principle. You should look for these basic principles. Science is built around these basic laws. All of the problems that you will face in a science course can be analyzed by means of one or more of these laws.

Many times in science, a problem is first analyzed in great detail. Then the results of the problem are generalized into more abstract concepts. You should understand the generalizations made, and you should refer back to the specific case that was studied and make sure that you understand how the general theory applies to the specific problem.

Guidelines to follow for reading:

1. Use the topic or section headings as a guide. Use the preview that you did prior to the class. Understand why you are doing this chapter or topic. Start by reading the chapter summary first. This will give you an idea of what you are trying to read and what you are to get out of reading the chapter.

2. Make connections between your notes and your readings. Write down connections between the example problems done in class and the reading.

3. Write down ANY questions that you have in your notes. Leave room for answers and make sure that your teacher answers those questions.

4. Make a list of all terms in the chapter.

5. Read the homework problems first. If specific homework problems have not yet been assigned, select several and look these over. This gives you an idea of why you are studying this topic and what your teacher expects you to be able to do.

6. Read actively with questions in mind. A passive approach wastes your time. Read with a pencil and paper beside the book to jot down questions and notes. **Read to learn, not to cover material.** If it takes you three times to read through a section, so be it...just make sure you understand it. **DO THE PRACTICE PROBLEMS**...they are there for a reason.

7. Add notes from the textbook into the margins of your lecture notes.

8. *Read the margins of your textbook*. Many important connections are covered in the margins and sometimes mnemonic devices are discussed.

9. During your reading you will notice sections, equations, or ideas that apply directly to assigned problems. After you have read such a section, stop and try to apply it to the homework problem. Often textbooks break their homework problems into the sections of the chapter. Also, many textbooks "pair" their questions with two (or more) problems covering the same material. Look over the problem that wasn't assigned – it just may be on the test, and it is one way that you can check yourself to see if you truly understand the concept.

The interplay of reading and problem solving is part of the cycle:

question → answer → question → answer.

Active reading helps your understanding and is far more effective than reading alone.

Lectures and Notetaking

Just as you are to be an active reader, you must be an active listener. If you are, then your notes will be more complete and accurate.

1. Read ahead. Ask the teacher what will be covered next (or check the syllabus) and preview the sections to be covered. Make a list of the new terminology, units of measurement, and concepts that you will encounter. Look at the diagrams, figures, and tables - try to formulate what point each is trying to illustrate.

2. Re-read your notes from the previous class. They are the basis for your new material.

3. Listen very carefully at the beginning and end of the class. This is when many of the key concepts will be introduced or reiterated. Too often, students miss this

information.

4. Use a list of abbreviations consistently throughout your notes. Make a table of them for future reference. Just remember that these are shortcuts and not to be used in formal writing.

Examples are:

A. → Leads to
B. ⇒ Implies
C. b/c Because
D. b/f Before
E. ∀ For all
F. ∃ There exists
G. ϶ Such that
H. ∴ Therefore

5. Use a comfortable note taking method for science classes. Use the margin for later comments, questions, and textbook references.

6. Take notes in outline form showing major topics, sub-topics and their relationship.

7. Copy not only what is on the board but also the important points that the teacher talks about. When copying diagrams, artwork is less important than completeness.

8. If you fall behind in your note taking, leave a space in your notes and go on. You can fill in your notes later with the help of a classmate or your textbook.

9. The only dumb question is the one that you don't ask. Don't be embarrassed to ask your teacher questions. If you don't understand, **ASK** – that is what your teacher gets paid for. Since your teacher is human, they can even make a mistake when writing something on the board.

10. That night, review and edit your notes. You don't need to rewrite them. At this time you may want to add an outline to your notes. Also, use the margin to make reference from your textbook to your notes.

11. As you review your notes, write out any questions that come to mind. Leave space for the answer and then ask your teacher the next day.

12. Remember that most of your notes will be examples of problems. *Copy the problem down completely, follow all steps and make reference as to why each step was done*.

13. These are your notes, but remember several points:
    A. Your classmates may need to copy them.
    B. You may need them in college as a reference.
    C. Make your notes so that a reasonable, intelligent person can follow them.

Taking the Test

1. If your test has multiple choice questions on it, check to see how the points are awarded. If all of the multiple choice questions are the same value, then don't spend a long time doing a hard problem when you could have done five easier questions in the same length of time. Save the hard questions until the end.

2. Estimate the answer to the question. Determine the **units** that the answer **MUST** have.

4. Show all of your work on the problems. Most teachers will give partial credit for problems that you have not finished or solved correctly. Make sure that your work is in the format that your teacher wants.

5. Check your answer with your estimate. Check to make sure that ALL of the units work out. Often problems can be done simply by unit analysis.

Problem Solving

Chemistry is a problem-solving class. Problem solving requires you to answer several questions:

- What am I asked to find?
- What information am I to use?
- Do I have all of the information to solve the problem?
- If not, are there other problems that I must do first to get me all of the information?
- What principles or laws apply?
- Have I seen other problems like this one?
- If so, what can I apply from them to solve this problem?
- How can I go about applying the information to solve the problem?
- Does my solution make sense?

You must be able to see beyond the surface of the problem. Look for the real meaning of the problem...find the "meat" of the problem. Many students just look at a problem and say, "I can't do this" but yet when they analyze the problem they can solve it.

The steps in solving a problem are:

1. Read the problem
   - A. List out all information given – ***include the units***.
   - B. List the unknown – what the problem wants you to find.

2. Draw a diagram of the problem

      1. Identify all compounds in the problem and write their

formulas correctly.

2. If it involves a chemical reaction, BALANCE THE REACTION first.

3. Set up the problem the way that your teacher instructs you to. Each type of problem has its own method of diagramming the information.

3. Plan the problem.
   A. Write out the *basic equation(s)* that will be used to solve the problem.
   B. Solve the basic equation to find the *working equation(s)*, the equation that is solved for the unknown.
   C. Make sure that your formulas are appropriate, don't try to use the Ideal Gas Law on a solid.
   D. Think of the relationships involved in the problem. Are there ways to get missing information that you will need to solve the overall problem? Remember, if you are given distance and rate, you also have the time (after you solve for it).

4. Solve the problem. Put the numbers into the working equation, **WITH THE UNITS** and work out the problem. Use ***unit analysis*** to make sure that you arrived at an answer that is consistent with your work.

5. **SHOW ALL OF YOUR WORK**.

6. Ask yourself:
   A. Does this answer make sense?
   B. Are the units appropriate for the problem?

Final Exam Preparation

The first step in preparing for an exam is to organize your time. Write out a schedule listing which topic you are going to cover at which time. Remember, ***spend most of your time working problems***, most science tests are problem based and the more problems you do, the better prepared you will be. **You cannot cram for chemistry: it is a science in which one topic builds upon another**.

1. Organize your time and workspace
   A. Plan what you are going to be studying and when.
   B. Organize your study area to have all material needed and to minimize distractions.

2. Work with a study group to review notes, labs, and problems.
   A. Outline the material.
   B. Use concept maps for the material.
   C. Work problems together.
   D. Explain the meaning of new terminology to each other, or illustrate its use in a problem.

3. Quickly review the notes of the major topics the night before.

4. For your final exam:
   A. Start studying two weeks before the test date.
   B. Review your notes in order of presentation.
      1. Remember that science is cumulative and that topics covered the first day of class may be on the final.
      2. Rework example problems from the beginning of the year.
   C. Review your old homework and rework old problems.