

How to study and take exams

Studying strategies

1. Skim a chapter before reading it and develop questions that you should be able to answer afterwards.
2. **Use recall.** Read a page, look away, and recall main ideas. Retrieval practice is far more effective than simply rereading. Try to explain a concept in your own words. Rereading is not effective- it gives you the illusion you understand. Highlighting your text is not effective.
3. **Test yourself.** Be able to solve a problem without looking at the solution. Glancing at a solution is not effective. Any activities that involve testing yourself- that is, activities that require you to retrieve or generate information- will make your learning both more durable and flexible. Simulate exams.
4. **Space your repetition** by studying the subject some each day. Cramming is not effective. Test yourself more often on things you are not good at.
5. **Interleave different types of problems;** i.e., switch between different types of problems.
6. Focus for 25 minutes (use a timer) un-interrupted.
7. **Take breaks.** Do not study more than 60 minutes without a break. When stuck on a problem, stop, do something else. When you come back to it later, it will be easier to solve.
8. Early in the day is the best time to study. Do the hardest thing early in the day.
9. Find multiple isolated places (i.e., places without distractions) to study. Do not study in the same location every time.
10. **Get enough sleep and exercise regularly.** Regular exercise can improve both memory and learning ability.
11. **Work with others,** but make sure a study session is focused on studying.
12. Take advantage of office hours.
13. Turn off email, cell phones, Facebook, etc..

Strategies for Taking Exams

Read through the entire exam first.

Set time limits for each question.

Try a hard problem first, if stuck after a few minutes, do an easy problem. Repeat.

Check your work.

Time management

Record all deadlines in a calendar.

Use a weekly to-do list -plan your week at beginning of week.

Make up a daily to-do list the night before; schedule specific time periods for each item.

Add new to-do items or deadlines to right side of daily to-do list. Transfer these to calendar or to-do list in evening.

Strategies for success

Sit in the front of the class.

Be an active participant.

Multitasking does not work.

Use OneNote (including shared notebooks).

Use Evernote.

Use Dropbox or equivalent.

OneNote or Slack App for team communication instead of email.

Brains use both focused and diffuse modes for learning. Activate the diffuse mode by exercise or sleep. Learning usually requires times when you're not consciously working on the problem.

More details on studying strategies

Maximum benefit

Practice testing had the most evidence supporting its benefits for learning across context and over time.

Practice testing: enhance retention by triggering elaborative retrieval processes. Practice testing may enhance how well students mentally organize information. Repeated practice testing works best when spaced. Practice tests show significant advantages over restudy.

High benefit

Distributed practice: spread study activities over time; do not cram- better to spread the same study time over longer time. Distributed learning over time benefits long-term retention more than learning in one effort. Spacing with longer lags better than spacing with shorter lags. Distributed practice testing is better than distributed study.

Elaborative interrogation: generate an explanation for why an explicitly stated fact or concept is correct. Appears to enhance learning by integrating new information with existing prior knowledge. Indicate both similarities and differences between related entities.

Elaborations should be self-generated rather than provided. Maybe more useful for discrete factual information.

Self-explanation: explain how new information is related to known information, or explain steps during problem solving. Key is to explain some aspects of processing during learning. Example- Why did you calculate the work by multiplying external pressure?

Interleaved practice: helps distinguish among kinds of problems. Also, with time between type of problem, students must retrieve from memory how to solve type of problem.

Low benefit

Highlighting and rereading were found to have low utility in benefitting learning outcomes.

References

Dunlosky et al., Psychological Science in the Public Interest 14, 4-58 (2013)

A Mind for Numbers: How to Excel at Math and Science by Barbara Oakley, Penguin, New York, New York, 2014. I highly recommend reading this book.

How to Become a Straight-A Student: The Unconventional Strategies Real College Students Use to Score High While Studying Less, by Cal Newport (\$11). This book is excellent, but some of his suggestions are probably not good ones for thermodynamics.

10 Steps to Earning Awesome Grades (While Studying Less) by Thomas Frank, This book is good and the kindle version is only \$0.99.

Getting Things Done by David Allen. I highly recommend this book, which discusses time management.

Deep Work by Cal Newport, Good book on using your time effectively.

Bjork Learning and Forgetting Lab <http://bjorklab.psych.ucla.edu/research.html>

Forget What You Know About Good Study Habits, New York Times, http://www.nytimes.com/2010/09/07/health/views/07mind.html?_r=2&ref=health

Applying Cognitive Psychology to Enhance Educational Practice: <http://bjorklab.psych.ucla.edu/research.html>

Why Multi-Tasking is Worse than Marijuana For Your IQ <http://www.forbes.com/sites/vanessaloder/2014/06/11/why-multi-tasking-is-worse-than-marijuana-for-your-iq/#2cbf2c484e51>

Screencasts on LearnChemE.com

[How to study using screencasts](https://www.youtube.com/watch?v=ZMBjHm9gkwk) (<https://www.youtube.com/watch?v=ZMBjHm9gkwk>)

[How to study 1](https://www.youtube.com/watch?v=MMHih0RSt3s) (<https://www.youtube.com/watch?v=MMHih0RSt3s>)

[How to study 2](https://www.youtube.com/watch?v=Uebdd3ewMxg) (<https://www.youtube.com/watch?v=Uebdd3ewMxg>)

[How to study 3](https://www.youtube.com/watch?v=8LTPt2izYxo) (<https://www.youtube.com/watch?v=8LTPt2izYxo>)