

Physics Forums Thread Starter: How to Approach My 10 Week Summer Study Plan

Warning! You can say that this is a long post.

Note that the questions can be found in the sections themselves or in appendix A

Introduction

I had planned to spend about the whole summer - about 10 weeks - studying in order to cover various subjects in the experimental sciences. I, unfortunately, wasted much of the summer. Now, I am left with about five and a half weeks at most to go through the crucial chunk of the material. This means that I'll have to cover the material during school as well. As a little background, I am in high school looking to go above the AP level in the sciences (granted, those courses are challenging, but I still want to go even farther¹). The subjects that I wish to cover include the following:

- Classical Mechanics
- Classical Electrodynamics
- Real Analysis (in both one and multiple variables)
- Complex Analysis
- Linear Algebra
- Ordinary Differential Equations
- Partial Differential Equations
- Molecular and Cell Biology
- Anatomy
- Physiology
- General Chemistry (using Oxtoby)
- Organic Chemistry
- Multivariable Calculus (for electrodynamics)

This is definitely a daunting task (and I am probably being "in over my head")! I have background in single variable calculus and introductory biology, if that helps. My "plan" was to cover the subjects that were scheduled for the upcoming school year so that I could skip those classes and take more advanced classes. Those classes are mechanics, probably electrodynamics, anatomy, physiology, and general chemistry.

At this point, all I've given you is information; this is a forum, so I'll ask some questions! *I'm not sure if I do use five weeks to cover mechanics, electrodynamics (and enough multivariable), anatomy, physiology, and general chemistry that I'll have enough time to cover the remaining subjects - real and complex analysis, ordinary and partial differential equations, linear algebra, and organic chemistry. For more information as to what level I want to cover these courses, see the "Textbook" section.*

¹ I haven't taken AP Chemistry or AP Physics C at the time of writing this

The “Techniques” section includes study techniques that I may plan to use in order to go through this material. The “Time Management and Allotment” section includes possible propositions on how I can cover the material in a timely manner.

Techniques

MATHEMATICS AND PHYSICS

I’ll just give a basic rundown; the details can be found from this thorough [answer](#) by Mark Eichenlaub on Quora (I’m not asking you to go through it all; it’s informative but long). From the answer, I quote:

Taken together, this yields enough practical advice to chew on for months or years. To summarize, when you are learning something new:

- Try to figure it out for yourself
- If you get stuck, take a peek at your textbook to get the main idea
- Teach the idea to someone else
- Once you've learned something, repeat the entire reasoning behind it for yourself, working through each detail
- Ask yourself Pólya's questions when you're stuck
- Use Young and Newport's techniques to map out the ideas of your class and relate them to your prior knowledge
- Make Anki decks and review them a few minutes a day to retain what you've learned
- Make sure your study sessions include all the principles of deliberate practice, especially feedback, challenge, and attention
- Build an image of yourself as someone motivated by learning and proud of having worked hard and effectively rather than as someone proud of being smart or renowned.
- Find an organizational system that lets you handle all the details of life smoothly and efficiently.
- Search for the flow state, notice when you enter it, and put yourself in position to find flow more and more often.
- Work on different subjects, reviewing both advanced and basic material. They will eventually all form together in your mind, and you're likely to have to take at least two passes at any subject before you understand it well.
- Take care of your physical health.

Basically, it’s about the “struggle”. Therefore, for physics and mathematics, I could try to prove every theorem/derivation that I can get my hands on to. Furthermore, I should try the challenging questions (and inevitably go to PF when I’m stuck after giving an honest effort). Occasional review in the form of “how was this question answered or proven” would be helpful. *My concern is how to do this method in an efficient way, since it seems like this would take a long time.* Other than that, this method appears to be foolproof as long as I put in the effort.

BIOLOGY AND QUALITATIVE CHEMISTRY

The previous section mentioned Anki decks, which I expect to be immensely useful for anatomy (I suspect that anatomy could be mastered with a lot of practice and memorization). *However, I’m not sure if approaching molecular and cell biology, general chemistry, organic chemistry, and physiology in the same way would be effective. Could I have some advice? Keep in mind that I am very detail-oriented but still want to see the big picture. A fast and effective note-taking method (or using the Anki decks) may be desired. However, you all know more, so I would like to hear what you have to say.*

Textbooks

- Mechanics
 - Morin
 - Goldstein (after Morin, if there is time)
- Electrodynamics
 - Griffiths (and possibly some of the problems in Purcell)
 - Jackson (after Griffiths, if there is time)
- Anatomy
 - Gray's Anatomy (41st edition)
- Physiology
 - Guyton
- General Chemistry
 - Oxtoby
- Organic Chemistry
 - Clayden
 - Advanced Organic Chemistry: Part A and Part B (Carrey), if there is time after Clayden; or, alternatively, March if there is time after Clayden
- Molecular and Cell Biology
 - Alberts
 - Watson
- Complex Analysis
 - Ahlfors
 - Conway (vol. 1 and vol. 2), possibly
 - Narasimham (only if I'm feeling very ambitious and have enough time as well as meeting the prerequisites)
- Real Analysis
 - I'm not sure; I'd like some recommendations. I've considered Rudin, Zorich (vol. 1 and vol. 2), Thompson - Bruckner, Loomis/Sternberg (for multiple variables)
 - Other suggestions would be appreciated
- Ordinary Differential Equations
 - I'm in a similar situation here as with real analysis; which book(s) should I use? I've considered Hirsch/Smale (if I use this, it would be desirable to use editions 1 and 2), Ross, Miess, Perko, Coddington (the Theoretical one), possibly Arnol'd
- Partial Differential Equations
 - I've considered using Strauss for this one
- Linear Algebra
 - Kenneth - Hoffman
 - I may use another book such as Strang just so I can also do "mechanical" problems so that I am not just left with the theory
 - Note: this is not to say that Strang's "Linear Algebra and It's Applications" is easy or that it is not theoretical

Time Management and Allotment

By now, you can probably tell that there is an immense amount of material that I want to go through. In fact, I've calculated that I would have to cover about 15,500 pages of science/math in about 10 weeks. Of course, page count is not the most important factor; one page of challenging problems would most likely take longer than a page of text with diagrams. Nonetheless, numerically, this means I must average about 3 minutes to read a page if I spend 12

hours a day studying. This is extremely fast, especially since I am concerned about the detail. Even if I spend 15 hours a day studying, this leaves me with 4 minutes to complete a page, which is better, but it is still a stretch. This still is not possible though for the challenging problems. Is there a magic number of how long a problem should take before I give in (note that I don't readily give up on some problems)? If I spend between 12-15 hours a day studying, is it possible to cover all of this material in 10 weeks? What will I have to do to be able to study faster, yet being able to know, understand, and retain the information at a deep level? How much time should I spend on each subject (i.e. how many hours of the 12-15 should I allot to, say, mechanics)?

Appendix A: List of Questions from OP (Original Poster)

- 1) I'm not sure if I do use five weeks to cover mechanics, electrodynamics (and enough multivariable), anatomy, physiology, and general chemistry that I'll have enough time to cover the remaining subjects - real and complex analysis, ordinary and partial differential equations, linear algebra, and organic chemistry. For more information as to what level I want to cover these courses, see the "Textbook" section. (*see* "Introduction")
- 2) My concern is how to do this method in an efficient way, since it seems like this would take a long time. (*see* "Mathematics and Physics" under "Techniques")
- 3) However, I'm not sure if approaching molecular and cell biology, general chemistry, organic chemistry, and physiology in the same way would be effective. Could I have some advice? Keep in mind that I am very detail-oriented but still want to see the big picture. A fast and effective note-taking method (or using the Anki decks) may be desired. However, you all know more, so I would like to hear what you have to say. (*see* "Biology and Qualitative Chemistry" under "Techniques")
- 4) Real Analysis (book recommendations)
 - a. I'm not sure... I'd like some recommendations. I've considered Rudin, Zorich (vol. 1 and vol. 2), Thompson - Bruckner, Loomis/Sternberg (for multiple variables)
 - b. Other suggestions would be appreciated
- 5) Ordinary Differential Equations (book recommendations)
 - a. I'm in a similar situation here as with real analysis; which book(s) should I use? I've considered Hirsch/Smale (if I use this, it would be desirable to use editions 1 and 2), Ross, Miess, Perko, Coddington (the Theoretical one), possibly Arnol'd
- 6) Is there a magic number of how long a problem should take before I give in (note that I don't readily give up on some problems)? If I spend between 12-15 hours a day studying, is it possible to cover all of this material in 10 weeks? What will I have to do to be able to study faster, yet being able to know, understand, and retain the information at a deep level? How much time should I spend on each subject (i.e. how many hours of the 12-15 should I allot to, say, mechanics)?

Thank you all *so* much for taking the time to read this long post. I appreciate your help and your tolerance to my obnoxious questions. I don't know if I will follow through with this plan, but I hope that I really do go through with it.