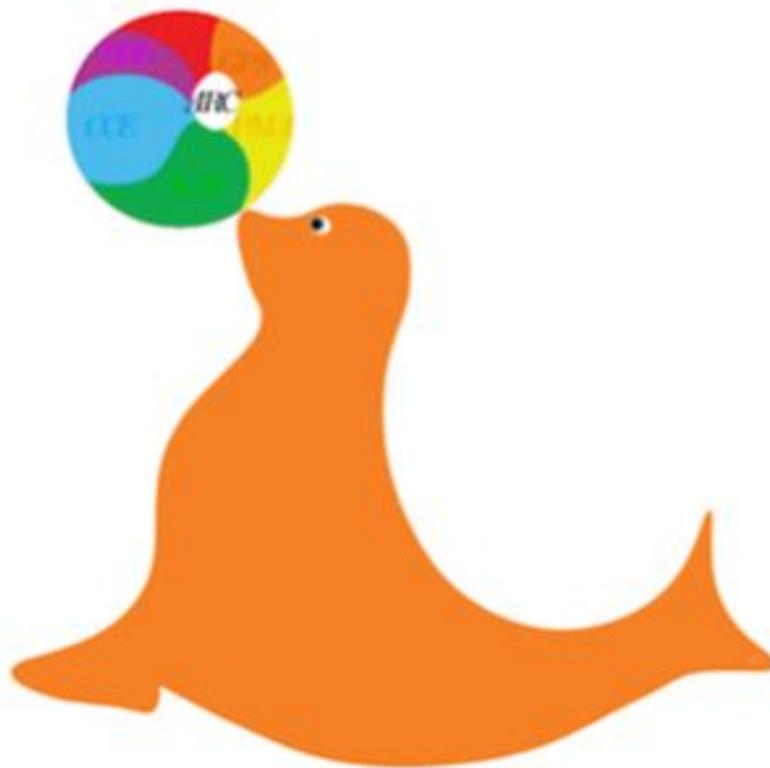


The ARC's Frosh Guide to Academics

Caltech 2017 - 2018

arc.caltech.edu



Caltech ARC

TABLE OF CONTENTS

[Introduction](#)

[The Basics](#)

[Lectures](#)

[Problem Sets](#)

[Units](#)

[Dropping/Adding Classes](#)

[Pass/Fail](#)

[Declaring a Major](#)

[More Complicated Stuff...](#)

[Practical vs Analytical Tracks of Mathematics and Physics 1B & 1C](#)

[Placement Tests](#)

[Math \(Ma\)](#)

[Physics \(Ph\)](#)

[Chemistry](#)

[Computer Science](#)

[Beyond That...](#)

[Super and Sub Sections/Math 1D/Math 8](#)

[Overloads / Underloads](#)

[Auditing](#)

[Academic Eligibility](#)

[Double Majoring/Minoring](#)

[Resources](#)

[Information on Graduation and Major Requirements](#)

[Registrar's Office \[http://registrar.caltech.edu/\]](http://registrar.caltech.edu/)

[Caltech catalog \[http://catalog.caltech.edu/\]](http://catalog.caltech.edu/)

[Regis \[https://access.caltech.edu/regis_resp/regisMenu.do\]](https://access.caltech.edu/regis_resp/regisMenu.do)

[Donut \[http://donut.caltech.edu\]](http://donut.caltech.edu)

[Academic Resources](#)

[Deans' office \[http://www.deans.caltech.edu/\]](http://www.deans.caltech.edu/) and [\[https://deans.caltech.edu/Resources\]](https://deans.caltech.edu/Resources)

[TQFRs \[https://access.caltech.edu/tqfr/reports/list_surveys\]](https://access.caltech.edu/tqfr/reports/list_surveys)

[Tutors \[http://deans.caltech.edu/Services/tutor\]](http://deans.caltech.edu/Services/tutor)

[HSS flow chart \[https://sites.google.com/site/arccaltech/resources-1 \]](https://sites.google.com/site/arccaltech/resources-1)

[Free Software \[www.software.caltech.edu\]](http://www.software.caltech.edu)

[CS 2 Tips \[https://sites.google.com/site/arccaltech/resources-1\]](https://sites.google.com/site/arccaltech/resources-1)

[People](#)

[Professors](#)

[TAs](#)

[Advisers \[http://registrar.caltech.edu/advising\]](http://registrar.caltech.edu/advising)

[ARC Reps](#)

[Ombudspeople](#)

[Upperclassmen](#)

[Classes You Could Consider Taking](#)

[General Classes](#)

[Pizza Classes](#)

[CS1](#)

[Freshman Labs](#)

[Freshman Seminars](#)

[Menu Classes](#)

[APh 9 vs CS 1 vs a Hum](#)

[FOR NON-EE MAJORS](#)

[FOR EE MAJORS](#)

[Ph 11](#)

[In Specific Majors](#)

[Applied and Computational Mathematics](#)

[Bioengineering](#)

[Biology](#)

[Chemical Engineering](#)

[Chemistry](#)

[Computer Science](#)

[Electrical Engineering](#)

[Math](#)

[Physics](#)

[New Changes This Academic Year](#)

[Research](#)

[Career Fair, interviews, and Internships](#)

[FAQ](#)

INTRODUCTION

Hello soon-to-be-Techer!

We hope you're enjoying your summer and hopefully, you're looking forward to the upcoming school year!

This fall, you will embark on a challenging academic journey that we hope you will also find to be fun and rewarding. Caltech is a different world from high school that you will have to adjust to: you'll be living in a new environment and also be trying to master a challenging core curriculum. This is a great place to learn and grow, but it is also a place that can overwhelm you if you're not careful. Luckily, you have resources to help you out and people looking out for you. You also have two terms of pass/fail where you can hone and refine your tactics without penalty.

So what's this? This frosh guide to academics contains academic information and tips to help you navigate through your first year in college. It contains basic information about Caltech's academic structure, resources to help you out, specific major related advice, thoughts on research + industry opportunities, and more! In particular, we focus more on first and second term advice, but we will also host house-related peer advising programs and the option fair to help you choose your major in third term :D

Please note that the Caltech Course Catalog is the authoritative guide on academics at Caltech. If there are any discrepancies between information you find here and that in the Catalog, the Catalog supersedes what is found here, and feel free to follow up with us as well.

Who are we? We're the ARC (Academics and Research Committee), the academic branch of ASCIT, Caltech's undergraduate student government body. We work to enhance and improve your academic experience at Caltech, and our hope is to make your time here awesome! Our official mission states that "The Academics and Research Committee serves as an objective liaison between students and faculty, to facilitate effective communication, and improve the quality of learning at Caltech." Our main goal is to create and maintain opportunities part of your academic and research experience, and you can learn more about the ARC's programs for students and what we do at arc.caltech.edu.

The ARC consists of one student elected from each house, 4 additional students, a secretary appointed by the committee, and a chair elected by the undergraduate student body. We're all resources for students and ARC reps can help you with academic advice and finding information for rules and procedures regarding various academic issues that might come up. At the very least, we can put you in touch with the right people :)

How to contact us? If you have questions after reading this guide or want to learn more about the ARC and are interested in getting involved, feel free to contact all of us at arc@caltech.edu or talk to the ARC chair, Kavya Sreedhar (ksreedha@caltech.edu). Additionally, all the current ARC reps are listed on the Roster on the last page of this guide and also on the [Roster page of our website](#). We also meet every Sunday in SAC B126 (formerly SAC 15) with time TBD (it will be updated on our website once the year

starts); our meetings are open to the public, so feel free to drop by!

If you have any feedback for the ARC about what programs you'd like to see or any issues with a class you're having, you can also submit a comment (anonymous or not depending on what you'd like) on [the ARC feedback form on donut](#).

Happy Reading!

Cheers,
The ARC

THE BASICS

LECTURES

For most of Core, you're going to be in a large classroom with at least half of your class. A professor will stand at the front of the class and lecture. Lectures are generally less interactive than your classes in high school were, but feel free to ask questions or to make requests of the professor. For example, if the writing on the board is too small or s/he is talking too softly, raise your hand and let the professor know. Professors are only human and don't always know what the students need.

Professors are aware of who regularly attends lecture, especially in smaller courses. Going to lecture is a great way to show the professor and TAs that you care about the class, and they're all there to help you understand the material. Many course concerns tend to come from students who don't often go to class.

RECITATION

Many large classes have smaller recitation sections with about 20 students each. Recitation sections are led by a teaching assistant (TA), who is typically either a graduate student or an undergraduate who excelled in the course, and some departments occasionally even have professors as TAs. Different classes utilize sections differently, but some typical uses for recitation include covering new material not taught in class, clarifying material, doing example problems, providing hints for homework, and going over quiz problems. In certain classes, sections are used to turn in and hand back problem sets and quizzes. The general format of many sections is similar to lecture, but certain classes have the option of "flipped" recitation sections -- meaning students work through problems while TAs walk around and assist. This can be a good option to try out if you have the chance, in order to see what type of recitation works best for you.

If scheduling allows for it, you're typically free to attend recitation sections aside from the one you are officially signed up for in your schedule. Many students will talk to their friends about the different sections and TAs and sometimes even sample a few different ones to see what works best for them. Additionally, if you miss your normal section one week, you usually can attend a different one. Most classes allow you to easily change your recitation section, so if you find that one section helps your understanding of the material more than your current section, definitely look into that.

OFFICE HOURS

Outside of recitation, each TA (and some professors) hold an office hour. This is a time they set aside specifically to work with small groups or students one on one to answer any questions. A student is usually allowed to attend any or all office hours for a class, and not just the one provided by their recitation TA. Office hours are usually announced at the beginning of a course and posted on the class website. It is a good idea to look at a problem set prior to attending office hours so that you know what questions to ask. Office hours are also a great time to go over old quiz material and to prepare for future quizzes. You should feel free to ask a TA to help with anything from reviewing concepts to walking you through practice problems.

PROBLEM SETS

Though professors are free to do what they like, classes at Caltech typically assign problem sets, which is what we call the assigned homework problems. At Caltech, many of the problem sets will have difficult questions designed for student discussion and collaboration. Seeking help when you are stuck on a problem by working with other students (see the paragraph below on collaboration policies) or visiting to the professor/TA is strongly encouraged. Often problem sets come out once every week and are due the next week. Typically a course will announce the location of a turn-in box for problem sets and the date and time they are due. It is definitely beneficial to start early on problem sets so that you have time to work on them independently and prepare questions for office hours or your peers. Realize that you are expected to utilize collaboration to help you thoroughly understand concepts, not just to know how to solve the problem.

Classes have collaboration policies that dictate which resources you can and cannot consult when working on a problem set/quiz/exam. For example, a class may allow students to consult the textbook or discuss a problem with a friend but forbid use of the internet or previous years' solutions. Many courses will cover these policies on the class website, in the syllabus, or during the first lecture. It is your duty as a student to know the collaboration policy for each course you're in and follow it appropriately throughout. If you're ever unsure about a resource, feel free to email the professor or a TA and ask! It's always better to check in and email than it is to deal with a situation in which a student consulted a resource they shouldn't have :)

UNITS

Uniting is an estimate of the amount of time you should spend on a course. Each unit is equivalent to one hour a week. When you sign up for a course, the units listed for the course, e.g. 3-0-6, are divided into: (# hours spent in class) - (# hours spent in lab) - (# hours spent on outside preparation). This leads unit numbers to typically be around three times the number of credits that classes are worth at other schools. Generally, you must register for a minimum of 36 units per term, and you may not take more than 48 units. For first and second term freshmen, only 45 of these units can be academic. Any additional units are for pizza classes, PE classes, performance arts classes, etc. Students are allowed to petition to take less than 36 or more than 48 units per term, as explained in the [Underloads and Overloads](#) sections below. For freshmen, underloading and overloading is slightly different; you must be granted an overload to take more than 48 units total or more than 45 academic units.

Keep in mind that units are not always accurate and schedules with the same number of units can have dramatically different workloads. As such, don't feel pressured to take classes just to be on a certain number of units and make sure to ask around to ascertain the difficulty of your class load. It's useful to ask people who have taken a class before what the workload will be like and check out the reviews for classes with their TQFRs (Teaching Quality Feedback Reports). Classes that require more time than the unit allocation are called "under-united" and those that generally take less time are called "over-united".

DROPPING/ADDING CLASSES

Adding and dropping classes is a fairly easy process, as long as you follow the steps. You can add up until

add day (usually on the 3rd Friday of term) and can drop classes up until drop day (usually the 8th Wednesday of term. Check the calendar on the [registrar's website](#) for the exact day each term.) You add and drop classes with a yellow "add/drop card". All the houses have them readily accessible, but you can also get them from the Registrar's office or from the Deans. To add a class, go to the professor and get them to sign your add card and then have your faculty adviser sign it. Turn this card into the registrar and you'll be added to the class. Dropping a class is very similar – you have to get the professor to sign the drop card (which is the same as the add card) and then get your adviser's signature. If you want to drop a class before Add Day, however, you do not need the professor's signature. If you urgently need your Add/Drop card signed (i.e. it's add/drop day) and you cannot reach your adviser, the Deans or the option representative can sign it for you instead.

If you want to introduce a time conflict in the meeting times (as posted online) for two classes or recitations, there is a separate orange "Add Conflict" card. You'll need both professors and your adviser to sign it. Since this is really a variant of adding classes, you also have to turn these in by Add Day at the end of the third week.

PASS/FAIL

As a first or second term frosh, all of your classes are automatically on pass/fail (P/F) and cannot be taken on grades. As a result, you will not have a GPA during your first two terms. After that, P/F (pronounced piff) becomes more complex. You have 90 units of P/F to use during your time at Caltech, not including your first two frosh terms or any classes that are labeled as always P/F. You aren't obliged to use all of your P/F (this phrase can be used as a noun, adjective, and verb :P) units, or even any of them, but you are allowed to P/F up to two classes a term so long as you have P/F that you can use. Some classes will be always P/F while others will be P/F only if you take it at a certain time. Your major will also have specific requirements as to what classes you are allowed to P/F. In most options, classes that fulfill option requirements cannot be Pass/Failed unless the class is always P/F, or unless you take the requirement first or second term frosh year. Likewise, core classes cannot be pass/failed starting with your 3rd term frosh year. However, classes that fulfill the non-writing intensive portion of the Humanities and Social Sciences requirement usually *can* be pass/fail, unless otherwise indicated by the catalog or the Professor.

DECLARING A MAJOR

Around the third week of third term you will be asked to declare a major. The registrar will email out a form in which you will indicate your selection of major as well as any specific focus in that field. The last few years, the form has been a Survey Monkey, so be aware that this is not spam and you should fill it out correctly :P The registrar will then try to assign you an adviser as close to your field of interest as possible. When you declare your major, don't worry! This will not be your only chance. You are allowed to switch majors or advisers later if you decide to change your field of interest, although the earlier you switch the easier it is. You can change advisers by filling out the form: "[Request a Change of Adviser](#)".

MORE COMPLICATED STUFF...

PRACTICAL VS ANALYTICAL TRACKS OF MATHEMATICS AND PHYSICS 1B & 1C

While the core curriculum is designed to provide both rigor and breadth, it also has to accommodate various interest levels in a subject across frosh of different intended majors. For this reason, during second and third term physics and math 1b and 1c, respectively, consist of two different 'tracks': a practical track and an analytical track. The track you take is not displayed on your transcript, but it does affect preparation for other classes, and some options require the analytical track. In general the analytical track of both subjects more rigorously teaches the fundamental principles of the subject, particularly aimed at students in the respective options, while the practical track teaches techniques and application, aimed at students in other sciences and engineering.

Asking upperclassmen can also be useful when deciding which track to take. It is possible to switch tracks during second and third term until drop day, and from second to third term. This is a particular case where pass-fail gives you some leeway to explore your interests second term. Note that most people who switch tend to do so from the analytical to the practical track. While we will not make broad claims about the relative difficulty of the tracks, the analytical classes demand more rigor and present material in a way students with less interest in the subject find esoteric. For this reason, most students will find the analytical track more demanding. On the other hand, students with a particular affinity for math or physics may find the respective practical track tedious in its emphasis on applied problems. That said, the analytical track is not intended to be taken only by students in those majors, and students in other options have successfully taken and enjoyed that track for both subjects as well.

Mathematics (Ma)

Ma 1b covers linear algebra, while Ma 1c covers multivariable calculus. The practical track of both 1b/1c covers more applications of the material, while the analytical track focuses on proofs and more abstract concepts. Depending on your option and interests, you may opt to do one or the other. Note however that the ACM option requires the analytical track. In general, the analytical track shows more similarity to Ma 1a. Both tracks cover the material in a similar logical order at roughly the same pace by topic, so switching tracks between second and third term is generally possible. The analytical track spends more time developing concepts and includes a deeper discussion of topics beyond the scope of the practical track (topology in 1c, for instance) at the beginning of each term. The practical track, on the other hand, spends more time teaching specific applications that the analytical track sometimes omits and better teaches useful problem solving techniques, for example in solving systems of equations (1b), optimization, and integration (1c). Some simpler proofs are presented in the practical track lectures, but are less common on problem sets than in the analytical track.

Physics (Ph)

Physics 1b/1c cover special relativity and Electromagnetism (E&M). Unlike for math, topics are not covered in the same order between tracks. The analytical track covers special relativity first in 1b as a prerequisite to later deriving magnetism analytically from electricity in 1c, which is quite interesting. The practical track covers E&M first and then covers relativity at the end. Both tracks continue to feature in-class demonstrations like those in Ph 1a. Students can take Ph1b analytical followed by Ph1c practical,

but generally it is not recommended to take Ph1c analytical after 1b practical. Note that in the former case, you would have to catch up on magnetism topics, as the practical track is ahead of analytical in magnetism at the start of third term, but that is usually not too bad for students. About half of students enroll in each track for physics.

If your major is physics-based, you should take the analytic track. Otherwise, you're free to take either track, and the analytical track can be quite interesting in its elegant derivations, even for non-physics majors. The analytical track is a better lead-in to Physics 12, which is required for the physics and applied physics options, while both the practical and analytical tracks have led well into Physics 2, sophomore physics classes required for a fair number of options. Both classes cover topics in similar depth, however the lectures on the analytical track focus on mathematical derivations and the problem sets tend to involve more analytical proof-style problems. The practical track focuses much more on numerical problems, which the analytical track does not completely omit.

MA 13

Beginning this academic year, Ma 13 will be offered during the winter term. Classes such as Ph 1b/1c, more so in the analytical track, assume previous knowledge of physics notation and multivariable concepts that students may not cover in high school. The current Ph 1b/1c class only offers a one-day bootcamp on these concepts, so Ma 13 has been added concurrently with these tracks for a deeper understanding. Ma 13 is best for those who want to learn or brush up on dot/cross products, line integrals, vector fields, divergence/gradient/curl, etc while taking Ph 1b. This class will run for five to six weeks, two hours a week.

PLACEMENT TESTS

Diagnostic tests for math and physics are mandatory for everyone. These tests are required to place you in appropriate recitation sections and/or supplemental classes based on your high school background. These are distinct from the exams needed to place out of core classes.

That said, you should also take placement exams if you can. Having the option to place out of classes doesn't hurt. That being said, if taking them doesn't work with your schedule, it really won't be a big deal. Feel free to brush up on material that you know but might have forgotten, but don't "study" for them to the point where you're skimming over material you never, at least at one point, thoroughly understood.

If you don't test out of a class, don't worry. You are not behind in any way -- the vast majority of students will not have tested out of that class either. You will still have plenty of room to take classes you want to on top of your major requirements.

So, say you've passed out of something. What do you do? Read on, friend...

MATH (MA)

In the past, Math 1a has been a proof-based course as much as it has been a calculus class. However, a new professor will be handling it this year, so it will be different from previous years and upperclassmen experiences of the class may differ greatly from your own.

That said, if you are very comfortable with proofs and you place out, there is likely no point in taking the course. If you are less comfortable or have never done a proof before, it's worth thinking about the classes you will take in the future. Students who take the more rigorous analytical track of Ma 1b/1c should be familiar with proofs before entering the class, as should students entering Ma 6, CS 21, or other popular courses. If you are unfamiliar with proofs and don't take Ma 1a, be sure you have a way to become comfortable with them.

If you place out of Ma 1b/1c, you definitely have the knowledge the practical track of the class would give you. If you haven't encountered some concepts in the analytical track and are considering taking the course, you could get some value out of it; however, there will be likely be other ways for you to learn that material and you could use those units to take other classes instead.

Just like Ma 1a, Ma 2 will also be taught by a different professor this year than previous years. In terms of preparation for future classes, however, if you place out of the class, you should be good to go and there should not be much reason to still take the class. If you place out of Ma 3, there is little point to still taking it as it doesn't have an analytical track and the placement test covers the course material well.

If you place out of some part of Ma 1, you should be mostly fine taking Ma 2/Ma 3. Ma 2 requires some knowledge from Ma 1b and Ma 1c. Ma 2 has a professor known for giving difficult proof-based problem sets this year, so taking it will likely place a relatively large burden on your course load. If you take it now, you will have pass-fail as a buffer in case it proves more difficult than you expected. If you take it next year, you will likely be more ready, your peers will be taking it with you, and the class will hopefully have been streamlined a bit (classes could be a bit rough the first year a professor teaches them). With all this information, the choice is yours :)

PHYSICS (PH)

If you place out of Ph 1a, there's no point taking the class as the placement test is very thorough in asking you what is covered in the class. Take something else instead!

Ph 1bc teaches concepts not covered in the vast majority of highschool E & M -- relativity, for instance. Deriving E & M principles from relativity is an extremely cool experience. That being said, if physics is truly not your cup of tea and you place out of Ph 1, unless your major requires Ph 2, there's not much point taking Ph 1. And, if you are a physics major or plan on taking more physics classes and are comfortable with E & M/multivariable calculus, you might as well take Ph 2/12. This will enable you to take physics electives and classes building on physics earlier, and you'll likely encounter relativity and such later.

HOWEVER -- DO NOT take Ph 2/12 unless you have a **solid understanding** of multivariable calculus and E & M. Otherwise, you will be very sad.

CHEMISTRY

The chemistry placement test is challenging and goes significantly beyond the material of AP Chem. If

you pass the test, you're fine to skip Ch 1ab. See Chemistry and ChemE under "Classes You Should Consider Taking" for what to take in place of Ch 1ab in more detail, though Ch 41abc is always a good choice.

COMPUTER SCIENCE

CS 1 goes over the basics of programming, in Python. Memory management, data structures, algorithms, etc, are not covered. While it is an excellent class for learning programming, someone with the knowledge to place out will probably benefit more from taking a CS 11 track. If you have taken AP Computer Science in high school or have other significant programming experience, taking the CS 1 Placement exam is highly recommended.

If you place out of CS 1, there are several alternative higher level CS classes available first term. CS 11 Language tracks are 3 unit classes intended to help you learn a new language including but not limited to C, C++, and Javascript. In particular, the CS 11 C Track is a great class, and is most commonly taken after CS 1. Furthermore, if you want to take CS 2 in the winter, knowledge of C will be incredibly, incredibly helpful. If you have prior knowledge in C, consider taking any of the other CS 11 Language tracks or the CS 11 project track where you can work on an individual project. All CS 11 tracks are 3 units, but the classes can be over or under-united depending on your prior programming experience, and CS 1 or equivalent programming experience at Caltech is a prerequisite for any of the tracks. If you are interested in taking CS 21 in the winter, Ma/CS 6a can be helpful in developing proof-based thinking.

BEYOND THAT...

If you place out of classes more advanced than covered here, there's not a whole lot of standard advice to give. Feel free to reach out to the ARC and we can try and find people to who have been in similar situations. At that point, you probably went to a school which taught you these things at a very advanced level and will probably be fine skipping these classes. At this level much of placement is at department discretion, and they generally have a good idea of the rigor required.

SUPER AND SUB SECTIONS/MATH 1D/MATH 8

Since core classes tend to involve students with a wide range of knowledge, there are sometimes super sections and sub sections. For Chemistry, the last numbered section (usually 12) is the super section, where more advanced material is taught and the TA spends little time on the week's concepts. Physics follows in a similar fashion, except the supersection is usually the last two sections. In addition, physics has flipped sections, where once a week instead of a usual lecture style recitation, students work in small groups, with the TAs' guidance, on problems related to that week's set. For some classes, the first sections (usually 1-2) are the sub-sections, for students who would benefit from a deeper foundation on the week's material. For Math and Physics, the section placement is based on your performance on the diagnostic tests, while students are randomly assigned to the supersection in Chemistry. **You are free to change into any section you want, including advanced sections, with a Add/Drop card, provided it is turned in before Drop Day. The exception to this is Math 1a Section 1.**

Math 1a Section 1 is basically a class "in parallel" to Math 1a, which covers the same material with the exception of series and sequences. It is designed for students who would benefit from a stronger foundation in calculus and proof-based calculus. Math 1d is a class taught during winter term, which

goes over series and sequences. If you are placed into Math 1a Section 1, you will be automatically enrolled in Math 1d.

Math 8 is first term, and is a 3 unit class which gives students enrolled in Math 1a extra practice with problem solving. It is somewhat like a more in-depth additional recitation.

It is important to realize that being placed into a super or sub section says *nothing* about your ability to do well at Caltech. Don't feel pressured to join a super section, for instance. Part of the reason first and second terms are on pass-fail is that students come from vastly different high schools, some of which have a much stronger science/math culture and curriculum than others.

OVERLOADS / UNDERLOADS

Overload

Anyone wishing to take more than 48 units must have his or her schedule approved by his or her adviser. Schedules with more than 51 units must also be approved by the deans. Additionally, no more than 45 units during the first two terms of freshman year can be classroom courses (academic units). The additional units should come from courses such as PEs, PAs, pizza classes, or independent research. An overload petition must include a description of the student's schedule and must explain why that student needs an overload. The deans are particularly open to approving overloads for students wishing to participate in a performing arts group chamber music, (band, orchestra, etc.) or research.

Although there are a lot of tempting classes and a seemingly daunting number of requirements to be fulfilled, it is *not* necessary to overload to graduate, especially during freshman year. In most cases, even those doing two options are able to complete their requirements without overloading. It is never necessary to overload freshman year, but if you decide to try, be sure you are fully prepared for it. Also, it is wise to get the advice of upperclassmen, your adviser, and the Dean's office.

Keep in mind that you have 12 terms to earn the 486 total units needed to graduate. This works out to an average of 40.5 units per term, or between 4 and 5 classes per term.

Underload

Underloading is defined by taking fewer than 36 units a term (you must register for at least 36 units to remain a full-time student), though to be academically eligible to register, you must have passed at least 27 units of coursework. This is explained in more detail in the next section.

There are many reasons that someone might end up underloading. Sometimes a class can be severely underunited, so a 33 unit course load feels like a 42 unit course load. Other times, health issues can complicate completing coursework or extensions on sets start building up, so dropping a class in order to finish the rest may be a better course of action. Sometimes a plan to overload by taking an additional class can lead to an underload due to an overall heavier workload.

If you're planning on taking fewer than 36 units a term, you'll need to get an underload petition approved by the Deans before add day, which is the third week of term. Underload petitions can be found on the [registrar's website](#).

AUDITING

Students also have the option of auditing classes, which is equivalent to showing up to class and having access to the coursework but not formally taking the class. This means that you have the choice of doing the homework or not, and, depending on the class, whether you want to take the tests or not. Students audit for several reasons. Maybe you want to figure out if you're interested in the class before you eventually commit and add the class. Maybe there's not space in your current term and you want to prepare for the coursework in a later term. Maybe you love learning and want to make the most of your Caltech academic experience! Regardless, auditing is a great way to see if you're interested in a course without having to add it to your schedule. Different classes will have different auditing policies; depending on the class size and TA demand, some classes may grade homework turned in by auditors, and some classes may not, along with other minute differences. If you audit a class, you will not receive credit for it and it will not show up on your transcript. However, you're free to later (officially!) take the class for credit, with the professor's permission.

ACADEMIC ELIGIBILITY

After the first two terms, students must pass at least 27 units in the previous term to remain eligible for registration for the next term. Once you are off of pass-fail, you need a GPA of at least 1.9 to remain eligible for registration. Additionally, you must earn an average of 36 units per term over each academic year (or three trailing terms) for a total of 108 units over the course of three terms. You can be excused from the 27-unit requirement if you file a petition to the Dean or Associate Dean before Add Day. Under extraordinary circumstances, the *Deans can waive the 27-unit requirement after add day*, but only once during a student's time at Caltech. Note that you must still maintain a total of 108 units over three terms to remain eligible, even if you have approval to take under 27-units for a term.

If you become ineligible for the first time, you'll meet with one of the Deans, and they'll either reinstate you and let you register for classes normally, or have you petition the Undergraduate Academic Standards and Honors Committee (UASH). UASH will then either choose to reinstate you (on academic probation), or may require you to withdraw from Caltech for two terms. Students who fail a core course or fail to complete 36 units will also need to meet with a Dean before being allowed to register for classes, although they are not necessarily academically ineligible.

For more information on academic eligibility and UASH, visit the UASH website at: <http://www.registrar.caltech.edu/uash/>. You can also talk to one of the UASH undergraduate representatives if you have any questions. Any information you disclose to these representatives is completely confidential. For the 2017 - 2018 school year, the UASH representatives are Anne Dorsey, Karen Pham, and Olivia Hinder, with Stephanie Huard, Erik Herrera, and Nikita Poole serving as alternate reps.

DOUBLE MAJORING/MINORING

Caltech is a challenging place for those attempting to complete even one option. There are many students, however, who opt to do more, adding a minor, a second option, or in rare cases both. If you are interested in doing this, be sure to prepare and complete requirements in a timely and efficient manner to avoid overly large or stressful course loads. You do not want to find yourself writing two

theses while taking three labs and Advanced Quantum Mechanics in your senior year. Also, be aware that second options are typically not granted within the same division, and elective courses are usually not double-counted.

Those wishing to add a minor or a second option may do so as early as the beginning of their sophomore or as late as the beginning of their senior year. They will be required to submit a petition for approval which includes their reasons for requesting a second option and a plan to complete all requirements for both options by the end of their fourth year. This petition must be approved by both option representatives and a faculty adviser in each option.

RESOURCES

INFORMATION ON GRADUATION AND MAJOR REQUIREMENTS

REGISTRAR'S OFFICE [[HTTP://REGISTRAR.CALTECH.EDU/](http://REGISTRAR.CALTECH.EDU/)]

The registrar is in charge of student records. She keeps a record of your grades, registers you for classes, and prepares the course schedules. On the registrar's website you can find class schedules, textbook lists, the academic calendar, the course catalog, and an option to order transcripts.

CALTECH CATALOG [[HTTP://CATALOG.CALTECH.EDU/](http://CATALOG.CALTECH.EDU/)]

The Caltech catalog holds the academic "rules" at Caltech. Though there may be some exceptions, for the most part it is the authoritative guide on all things academic. You can find core requirements, graduation requirements, as well as a [listing of all the courses](#), when they're offered, their units, and their prerequisites.

REGIS [[HTTPS://ACCESS.CALTECH.EDU/REGIS_RESP/REGISMENU.DO](https://ACCESS.CALTECH.EDU/REGIS_RESP/REGISMENU.DO)]

REGIS, the Registrar's Information System, is the online system that students log into from access.caltech to perform tasks such as registering for classes and checking grades. This is also where you can see your unofficial transcript, view your degree audit, order an official transcript, and see any other personal academic information. All undergraduates will use REGIS to enroll in courses during the registration period and advisers will approve schedules using REGIS.

DONUT [[HTTP://DONUT.CALTECH.EDU](http://DONUT.CALTECH.EDU)]

Think of donut as the universal directory and course planner for Caltech undergraduates. Most people use donut as a undergraduate directory as well as a course scheduler for each term and all four years. There are additional resources and information available on donut (SAC room reservations, clubs, etc.), but that deserves a guide on its own. Please check out the entire website if you can make the time!

ACADEMIC RESOURCES

DEANS' OFFICE [[HTTP://WWW.DEANS.CALTECH.EDU/](http://WWW.DEANS.CALTECH.EDU/)] AND [[HTTPS://DEANS.CALTECH.EDU/RESOURCES](https://DEANS.CALTECH.EDU/RESOURCES)]

While many students only visit the deans to get their drop cards signed when their adviser is missing, the deans can be very useful to you during your time at Caltech. You can talk to the deans about any concerns or problems you may be having, personal or academic. The deans have a lot of experience in helping students find their way through Caltech and can give you great advice or refer you to other

people who may be better suited to help you. For instance, if you become sick or if a family issue arises the deans can help you obtain extensions in your classes. Note that, if the reason for an extension is significant, the deans are usually very accommodating in approving these requests. In the past, if student have become injured or otherwise incapacitated, the deans have done things like hire others to take notes for them.

TQFRs [[HTTPS://ACCESS.CALTECH.EDU/TQFR/REPORTS/LIST_SURVEYS](https://access.caltech.edu/tqfr/reports/list_surveys)]

Teaching Quality Feedback Reports are reports of course feedback from students over the years. A link can be found from access.caltech. TQFRs can be used to see the average time spent on homework and the average grade for classes, as well as the quality of teaching and course material, etc. TQFRs also have a section containing comments from students who have taken the course, which are often quite helpful.

TUTORS [[HTTP://DEANS.CALTECH.EDU/SERVICES/TUTOR](http://deans.caltech.edu/services/tutor)]

One notable service that the deans provide is student tutors, free of charge. These are undergraduates who have met certain requirements for performance in the class, and who can give you one-on-one attention. While tutoring is free for you, the Deans Office pays these students for their time, so it's a win-win! For certain core and large classes, study sessions in Millikan with tutors present are also available, times TBD.

HSS FLOW CHART [[HTTPS://SITES.GOOGLE.COM/SITE/ARCCALTECH/RESOURCES](https://sites.google.com/site/arcacaltech/resources)]

Oh the humanities! The humanity requirements for core can be rather confusing. This is a helpful chart on the ARC website that diagrams out exactly what you need to take.

FREE SOFTWARE [[WWW.SOFTWARE.CALTECH.EDU](http://www.software.caltech.edu)]

If you go to www.software.caltech.edu, you can use your access caltech credentials to download software like Mathematica and Matlab for free. The site also includes anti-virus software and tools like ChemDraw and Adobe Acrobat. Chances are that if you need some software, this site's got it, so be sure to check it out before buying something yourself!

CS 2 TIPS [[HTTPS://SITES.GOOGLE.COM/SITE/ARCCALTECH/RESOURCES-1](https://sites.google.com/site/arcacaltech/resources-1)]

CS2 is a challenging class that some frosh take second term. The class is considerably more difficult than CS1, and frosh with a weaker programming background sometimes struggle with the class. This page lists some tips for succeeding in the class.

PEOPLE

PROFESSORS

While professors are very busy people and may be more difficult to get a hold of than TAs, they are very worthwhile people to get to know. Most professors are more than happy to have students come talk to them, whether about a class or about research. Typically professors have office hours for their classes or will allow you to schedule an appointment with them.

The 3:1 student-to-faculty ratio is more than just a number! There are plenty of opportunities to get to

know your professors outside of class and office hours. The ARC runs several [student faculty interaction programs](#) throughout the academic year.

In addition to ARC programs, many options also have clubs or organizations dedicated to increasing student-faculty interaction. Option clubs may host socials, seminars, or other events to help you get to know your professors or identify possible research mentors.

TAs

Teaching assistants can be graduate students, undergraduate students, or even Emeritus professors. TAs are in charge of recitation sections and also typically write (and grade) problem sets, quizzes and finals. If you are struggling in a class, feel free to attend their office hours (usually posted on the course website). If you can't attend the scheduled office hours because of a conflict, feel free to email your TA (or any TA you feel comfortable talking to) to set up another meeting time.

ADVISERS [[HTTP://REGISTRAR.CALTECH.EDU/ADVISING](http://REGISTRAR.CALTECH.EDU/ADVISING)]

Entering freshmen are all assigned a freshman adviser independent of intended major. Your freshman adviser is probably the first faculty member you will have the opportunity to forge a personal bond with. The administrative things an adviser does include approving your schedule and signing add/drop/overload cards. You are required to meet with your adviser at least once a year to avoid getting your spring registration put on hold. You should also take advantage of your adviser as a knowledgeable resource who can help guide you in any decisions you may be making. For more details on the roles and responsibilities of an adviser, visit the registrar's advising arena. Keep in mind that after your freshman year, you will later be assigned (or you can request) an option specific adviser for your next three years at Caltech. Finally, don't forget that your academic adviser can be one of your best networking tools. Aside from delivering sound academic advice, your adviser can suggest who among his or her colleagues might be the best research adviser or SURF mentor for you.

ARC REPS

Each house has at least one -- ask around if you are unable to find yours. You should also feel free to reach out to any member of the ARC! Our [full roster](#), along with contact information, is at the end of this guide. Additionally, you can check out our [snazzy website!](#)

OMBUDSPEOPLE

The majority of core classes and other large classes will assign ombudspeople. Often, one person is assigned from each house. Ombuds meet with the professor and TAs a few times a term to go over how people are responding to the class. Becoming an ombudsperson is a great way to get involved early on! These people are often your easiest point of contact for classes.

UPPERCLASSMEN

They've been through all this and can advise you pretty well! For the most part, upperclassmen love helping frosh :)

CLASSES YOU COULD CONSIDER TAKING

GENERAL CLASSES

PIZZA CLASSES

These classes are low-unit classes (typically 1-3 units) that meet once a week, usually during lunch, and are intended to introduce you to current research in a particular field. They are a great way to learn about the current research done by professors and find a field of interest. There is also an [online guide](#) on pizza classes on the ARC website. The pizza classes for the fall term are:

- Bi2 - biology
- Ma20 - math
- E2 - broad range of engineering topics
- Ch10a - chemistry (3 units)
- Ph10 - physics (3 units)
- CS9 - computer science (in the evening, serves cookies instead of pizza)

CS1

CS 1 - Introduction to Computer Programming is a popular computer science class only offered first term. This class teaches the basics of computer programming and is taught using Python. Over 200 students take it each year, and it is designed for students with a wide range of past CS experience (though students with significant CS experience can take a placement test to place out of the class). As of the 2015-2016 course catalog, the following options require CS1:

- ACM
- Bioengineering (requires either CS1, CS2, or CS3)
- Biology (recommended, but not required)
- Computer Science
- Engineering Applied Science (or “approved alternative course”)
- Computation and Neural Systems track of EAS
- Planetary Science (not required, but fulfills an advanced science requirement)
- Mechanical Engineering (requires either CS1, CS2, CS11, ACM11, or EE/CS 51)

Note that many majors that don't explicitly require CS1 require more advanced CS classes that are very challenging without a solid programming background. For example, the electrical engineering option does not require CS1, but a good programming background will definitely help with other software-related option requirements. This class is a good choice, both for CS majors and for non-CS majors, as most SURFs and internships look for a basic programming background.

FRESHMAN LABS

As part of Core, students must take 12 units of laboratory classes, 6 units of which must be Ch3a or Ch3x. The additional 6 units must be chosen from one of the following: APh/EE 9 (6 units), APh 24 (6 units), Bi 10 (6 units), Ch 3b (8 units), Ch 4ab (9 units per term), Ge 116 (6 units), Ph 3 (6 units), Ph 5 (9 units), Ph 8bc (6 units), or a more advanced laboratory. It is recommended that students take the introductory chemistry classes during their freshmen year and complete the lab requirement by their second year. Note that Ch3a and Ch3x are automatically on pass/fail for non-seniors only. For a quick guide on frosh labs, see the Course Catalog.

FRESHMAN SEMINARS

These seminars are a great opportunity to take a class where the professor teaches whatever s/he thinks is really cool. They provide an intimate setting to interact with professors, and you get to know a professor outside of a large lecture hall setting.

MENU CLASSES

These are third term. You are required to take one menu class during your time at Caltech, in a field outside of the field of study you had declared at the time. These are fun, interesting classes in fields like Geology (Ge 1), Astronomy (Ay 1) and Information Science (IST 4) which students generally have not been exposed to in high school. These are extremely interesting and a good way to learn about something different.

APH 9 vs CS 1 vs A Hum

FOR NON-EE MAJORS:

For other majors, the question is usually CS 1 vs a hum, and the short answer is:

if (you haven't coded much before or at all):

return 'TAKE CS 1!!!!'

else:

return 'Taking CS 1 is not a bad idea, but if you are fairly comfortable with programming, you could take a hum and not get behind on hums :P'

The “FOR EE MAJORS” section below has more information the advantages and disadvantages of taking CS 1 vs a hum.

FOR EE MAJORS:

Such is the struggle of many a frosh EE, and the answer to this question really depends on your background :P

For most freshman SURFs and internships, especially for EE, at least some knowledge of CS is a must-have. Furthermore, some programming background is definitely recommended before you go on to take upper level EE classes. As such, it is strongly recommended that you try to take CS 1, which will teach you the fundamentals of programming.

That said, if you've coded before, it's worth it to consider taking a humanities course (“hum”) or APH 9. It's very helpful to have finished your two freshman hums (core requirements) by the end of your freshmen year as you have to take 12 humanities / social science classes total as part of core which evens out to one of these classes per term. Waiting a term to finish your freshman humanities will make it harder to stay on track with this 1 hum/SS class per term schedule because scheduling with your other classes might not work out, hum classes are typically capped, and you can't take advanced hums until you've completed both your frosh hums. However, it is not the end of the world if you are not able to take your two hums “on schedule” and especially with the expanded humanities offerings for your class, it will most likely work out even if you delay taking your hums.

APh 9 is not only an option requirement, but also counts towards the frosh lab core requirement, so you get to kill two birds with one stone if you take this class. Taking the lab first term freshman year is convenient because you don't have to worry about fitting it in your schedule later on, but not taking it first term won't put you behind in any of your future EE classes. Whether or not to take APh 9 depends on whether or not you want to have to find room for it in later years.

So, to recap -- take CS1 if you don't have much coding experience, but if you have programmed before, consider APh 9 or a hum. Of the latter two, it's just a question of whether you'd rather be taking a freshman lab or a freshman humanities course later and in the long run, it won't really make a difference whichever way you decide :)

PH 11

In the fall, 5 to 9 freshman will be selected for this admission-based class based on their solutions to two "hurdles". Hurdles are open-ended, challenging problems with no "right" answer that will be released during first term for all freshman to try. Regardless of what major you're thinking of, you should attempt the hurdles!! This class is not just meant for physics majors: students in computer science, biology, and everything in between will benefit from thinking about such problems and learning from the class.

Throughout the year, the class meets once a week to discuss real-world questions and develop interesting models to answer them. In addition, Ph11 students are offered automatic research support for the summer after their freshman year, similar to a SURF, without having to write a SURF proposal or fill out the application to get a SURF approved. Ph11 students are paired up with a professor in any subject they are interested in to work on a project for the summer.

Ph11 is a 6-unit class, part of your non-academic unit allocation. It meets for 3 terms, the winter and spring terms of freshman year and the fall term of sophomore year, and the Deans are generally flexible in allowing students to fit the class in their schedules with their regular workload. The class is truly a rewarding experience, and it is highly recommended among Ph11 alums for frosh to just try the hurdles because for such unconventional problems, your background and test scores don't really matter. If you have any questions, feel free to reach out to the ARC Chair, Kavya Sreedhar, at ksreedha@caltech.edu or any other Ph11 alums. More information about the hurdles will come in fall term around early October.

IN SPECIFIC MAJORS

This section discusses classes in specific majors that frosh may consider taking. In some cases, these classes are officially recommended or required by the Caltech course catalog. In other cases, you should only consider taking the class if you've placed out of a core or prerequisite class.

APPLIED AND COMPUTATIONAL MATHEMATICS

The ACM major requires students to take the analytic track of both Ma1b and Ma1c. Students who take the practical tracks for these classes and later decide to switch into the ACM major should discuss whether they have fulfilled this requirement with their option rep.

Ma6 - All 3 terms of Ma6 are required for the ACM major. Ma6a provides an introduction to discrete math. Ma6b is focused on graph theory, and Ma6c is an introduction to mathematical logic. These

topics do not require Ma1abc, though some experience with proof writing is probably recommended. If you're interested in pursuing the ACM option, this is a good class to take.

Ma5 -- See the "Math" section.

BIOENGINEERING

Bi1x - This is an introductory lab course offered in the Spring that teaches techniques used in biology and bioengineering research. This class satisfies the Core biology requirement. In addition, the Bioengineering option requires Bi1x, so if you are thinking about majoring in that, it is good to take Bi1x in the Spring to see if you'll want to continue the path down the Bioengineering option.

Bi8/Bi9 - Both of these classes are required for the Bioengineering option. Many students take Bi8 freshman year second term and Bi1x or Bi9 third term. See the Biology section for more details.

BIOLOGY

Bi8/Bi9 - Freshmen planning on majoring in biology are recommended to take Bi8 (winter term) and Bi9 (spring term) their freshman year. This is advantageous for anyone planning to take advanced biology courses as Bi8 and Bi9 are common prerequisites. Keep in mind that Bi8 is a very important introductory biology course, especially if you are planning on majoring in Biology. Some students make the mistake of not taking the material as seriously, since Bi8 is a second-term class and therefore taught while freshmen are still on pass/fail.

Bi10 - This is a 6 unit cell biology lab meant to be taken alongside Bi9 in the spring term.

Bi23 - This is a three unit class that is offered second term. Different sections are focused on different topics in biology, ranging from DNA nanotechnology to human birth defects. Sign up for whichever section interests you most. This class can count towards your total biology units if you are a biology major.

CHEMICAL ENGINEERING

ChE 15 - Introduction to Matlab, first term, 9 units. Should you pass out of a core class/have room in your schedule fall term, this may be a useful class to take. Some SURFs prefer students with knowledge of Matlab, and there are no prerequisites.

ChE 62 - Separation Processes, second term, 9 units. This course is a good introduction to the bread and butter of chemical engineering and it is offered concurrently with ChE 63a. If you have room in your schedule, feel free to take both, but be sure to talk to an upperclass chemical engineering major before deciding whether this is a good idea for you. Otherwise, choose between ChE 62 or ChE 63ab.

ChE 10 - Introduction to Chemical Engineering, second term, 1 unit. This is the chemical engineering pizza course, where you can hear directly from the ChemE profs about the latest in their research. The ChemE faculty are pretty close-knit, and this is a great way to see if you would like to join any of their labs.

ChE 63ab - Chemical Engineering Thermodynamics, second and third term, 9 units. Taking this series freshman year will lower your course load sophomore year, and there are no prerequisites. Generally, taking one of ChE 62 or ChE 63ab would give you a good perspective of the ChemE curriculum and give you more flexibility in choosing courses in later years.

If you tested out of Ch1...

Ch 41abc - Organic Chemistry, first, second, third terms, 9 units. This is usually a sophomore chemistry course, but should you have the opportunity to take this freshman year, it is a useful requirement to fulfill. Note that the series, unlike Ph 2abc, must be taken in order.

CHEMISTRY

Ch 10_{ABC} - Ch 10ab (first and second term - 3 units) is a pizza class with talks at lunch each week by a different chemist, and lab tours later each week. After taking both Ch 10a and Ch 10b, students have the option of taking Ch 10c and working in a chemistry lab (almost always starting work for a SURF) third term. The class Ch 10c (third term - 8 units) consists of spending some time in the lab each week, and giving a presentation of the research you are starting on. If Ch 10c is taken freshman or sophomore year, the class counts towards one of the (currently 5) terms of chemistry lab required for chemistry majors.

If you tested out of Ch 1...

Ch 41 - The chemistry department allows you the option of taking Ch 41 (organic chemistry) or Ch 21 (physical chemistry). Almost all students deciding between the two should take Ch 41. If you're not a chemist and have exposure to quantum mechanics, Ch 21 might work, but most freshmen are not prepared for Ch 21. Even for chemists, Ch 41 is usually a sophomore year class and Ch 21 is a junior year class.

Ch 3_A/Ch 4_{AB} - If you are enrolled in Ch 41 *and* take Ch 3a first term, you have the option of taking Ch 4ab, the first chemistry lab for chemistry majors, freshman year. Ch 4a is offered in the winter and Ch 4b is offered in the spring, so you have to take Ch 3a first term in order to take Ch 4ab.

COMPUTER SCIENCE

CS 1 - Introduction to Computer Programming (9 units) is a popular computer science class offered first term. This class is required for the computer science major, and is typically taken freshman year. For more details, see the description of [CS1](#).

Ma 6 - See ACM and Ma. This class is also good preparation for CS 21, if you are interested in taking that winter term, and fulfills a requirement for the CS option.

CS 2 - Introduction to Programming Methods (9 units) is offered second term, and is a requirement for CS majors. This class is always offered pass-fail and covers data structures, algorithms, and the basics of numerical computation. It is considerably more demanding than CS 1, and students must take CS 1 first as a prerequisite. This class is also a prerequisite for additional CS classes, such as CS 21. While CS 2 is traditionally taught in C++, in the 2016 - 2017 academic year, a Python track of CS 2 was offered and taught by a visiting professor. There is no confirmation as to whether it will be offered in the upcoming year, but it may be an option.

CS 11 - Computer Language Shop (3 units) teaches students a specific computer language. This class is offered every term, and there are multiple tracks that each teach a different computer language. Popular tracks include C, C++, and Java. Taking or placing out of CS 1 is a prerequisite for CS 11.

For Students with an Extensive Programming and Mathematics Background

Prospective CS majors with extra space in their schedule and an *extensive* background in advanced mathematics may wish to consider taking CS 21 or CS 38 during their freshman year. CS 21 (Decidability and Tractability) is a *very* rigorous class offered second term that covers the formal foundations of computer programming. CS 38 is offered third term and covers algorithms. Students with a very extensive coding background may wish to consider taking CS 24, a computing systems course offered third term. Please note that CS 21, CS 24, and CS 38 are all sophomore/junior level classes, and there is no need to take these courses freshman year to graduate on time. Only students with a *rigorous, extensive* background should consider taking these courses their freshman year and be warned that these classes can be very challenging and time-consuming.

ELECTRICAL ENGINEERING

APh/EE 9ab - This two term class satisfies the freshman lab requirement and explores solid state electronics for integrated circuits. Only the first term is required for the EE option. It is a good idea to take APh 9a first term frosh year if you are interested in majoring in electrical engineering. Also see the APh9 vs CS1 vs a Hum section above.

EE 1 - While E2 first term is the general engineering pizza class, EE 1 second term is a pizza class which specifically focuses on EE. This is a fun way to learn about current research in the field and is required for the EE option.

EE 10ab - This sequence of classes will be offered for the first time this coming school year and will be required for the EE option for students following the catalog for the Class of 2020 and below (so all of you!) EE 10ab will be offered second and third term. These classes are intended to be introductory classes and since no one has taken them before, it's hard to know whether or not they will be suitable for freshmen, but just keep in mind these exist when the time comes. For more information about this EE option requirement change, see the [New Changes This Academic Year](#) section.

MATH

If you tested out of Ma 1a, see the "placement tests" section above.

MA 5 - If (and, for the most part, only if) you have solid experience with proof-based mathematics (e.g. you took a college-level Number Theory, Analysis, or rigorous Linear Algebra course, or participated in proof-based math competitions like the USAMO and USAMTS), you may wish to consider taking the Ma 5 sequence. This is a year-long course on Abstract Algebra (each term is a prerequisite for the subsequent terms). It is a requirement for the math and ACM majors, an elective for physics majors, and very interesting if you enjoy proof-based math. You sometimes need to obtain the instructor's approval to begin taking the class first term.

MA/CS 6 - The first and third terms of Ma 6 are requirements for the math major (but can be exchanged for higher level classes on the same topic). Of the math major required classes (Ma 5, Ma 6, Ma 108, Ma

109), the Ma 6 sequence is usually considered the easiest. Ma 6a also fulfills one of the requirements for the CS and ACM majors, along with the CS minor.

PHYSICS

PH 11 HURDLES - See the “general classes” section above.

PH 10 - the pizza class for physics. It is offered first term and meets weekly for two hours during lunch, generally with an hour of reading to prepare outside of class. Presentation topics range from theoretical astrophysics to the physics of banjos.

PH 20/21/22 - The physics 2x sequence is a track of classes that teach computational skills from a physics perspective. Starting with Ph 20, students learn various techniques and tools that are commonly used in physics research: Linux environments, numerical techniques of solving differential equations, integral approximations, etc. After Ph 20, students can go on to take Ph 21 or 22, or even both. As of the 2015-16 catalog, CS 1 is required as a prerequisite for Ph20. Currently, the entire sequence is 6 units per class. Ph 21 fulfills a requirement for the physics option and Ph 22 counts as physics elective credit. Ph 20 is offered first and second term, Ph 21 is offered second and third term, and Ph 22 is offered third term.

NEW CHANGES THIS ACADEMIC YEAR

This section is here to highlight some changes to the curriculum that are new for your year and that upperclassmen did not experience, just so that you can be aware of these differences when talking to people about classes and options.

Ma 13 - See the description of Ma 13 in the More Complicated Stuff section above. In one sentence, this is a new course that will be offered winter term to cover concepts students are required to know but are only briefly covered in Ph1bc.

New Materials Science Option

Materials Science is a new option being introduced in the 2017-2018 catalog that is modeled on the previously offered EAS option with a concentration in materials science. Apart from core and some introductory materials science and thermodynamics courses, this option has relatively flexible requirements and will provide more freedom in course selection than other similar options (e.g. the materials track of the ChemE option). The EAS option will remain available to those interested in Computation and Neural Systems (CNS) or designing their own major, but the materials concentration has now been formalized as an option.

Electrical Engineering Option Requirements

The EE option requirements have changed significantly for students starting from the Class of 2020 and so for this option in particular, upperclassmen experiences may differ a lot from what you'll go through. The biggest change is that previously, EE majors were required to take the 5x track (EE 51 and EE 52ab) sophomore year, but that requirement has been replaced by a new set of classes, EE 10ab, which are explained further in the Catalog. There were a few more small changes to the requirements which can also be found in the Catalog, and feel free to reach out to the ARC or the EE department if you have any

further questions.

Ma 1a, Ma 2

In the previous few years, Ma 1a had a reputation as a difficult class with a professor who often approached topics in an unconventional way. Ma 2, on the other hand, was typically considered easy, with most problems being very similar to those in the textbook. This fall, the previous Ma 1a professor will now teach Ma 2, so upperclassmen comments on Ma 1a and Ma 2 may not apply. A different professor (Prof. Vafae for Section 1 and Prof. Ramakrishnan for the other sections) will cover Ma 1a this year.

Pass / Fail Update

Earlier this past school year, there was a proposal to change the current freshman pass/fail policy. However, there will be **no change** to pass/fail for your year. This is just to let you know that the Class of 2021 will have the same pass/fail policy as previous years, where all classes freshmen take their first two terms are on pass/fail.

RESEARCH

Caltech is widely known for its world-class research, and there are many ways for undergraduates to get involved. You can do research during the academic year, sometimes for credit or for pay. Some options like Chemistry and Chemical Engineering let you use research units towards your option requirements, so check the catalog to see how your option treats research units. Otherwise, you can ask your PI (principal investigator) for pay, which is a cool way to do work study if you have it. A great way to get started is to check out [research seminars](#) that happen throughout the year. Also, you can look up any Caltech professor to find their field of research; if something catches your interest, feel free to reach out to them! The best way to get involved in research at Caltech is to take initiative. The ARC also compiles a list of professors who are interested in taking on undergrads, so keep an eye out for that! The Little T also has some suggestions for approaching profs, along with a myriad of other advice. You should get a hard copy of this student-compiled handbook sometime during your first week on campus, but here is a link to the electronic 2015-16 version:

http://donut.caltech.edu/static/15_16_LittleT_Content_FINAL-1.pdf.

Of course, if you don't have time to do research during the academic year, you can always join a lab for the summer. SURFs (Summer Undergraduate Research Fellowship) are a popular way to get involved and the SFP (Student-Faculty Programs) office has many resources for [summer research](#), including [how to contact a potential mentor](#). Perks of doing research over the summer include spending more time in the lab and experiencing what it's like to be a grad student. Academic year research often continues into summer research and vice versa, so research at Caltech can be year round.

CAREER FAIR, INTERVIEWS, AND INTERNSHIPS

Caltech's Career Development Center (CDC) can help you with your job or internship search. The CDC provides walk-in and scheduled one-on-one appointments for general and pre-health advising. The CDC helps with finding opportunities and work-study positions, mock interviews, and workshops on a wide range of topics from resume building to LinkedIn profiles! Definitely check out the [CDC](#). Additionally, be sure to explore [the Handshake portal](#), which helps you schedule appointments and

apply for positions.

Twice a year, the CDC will host career fairs, one in October and one in February. The fairs are open to all undergraduate students, and there is generally pre-registration for the fairs. Hundreds of companies set up booths at the fair, recruiting students for full-time positions and summer internships in a wide variety of fields. If you are interested in working in industry or just looking for experiences in your field outside of academia, the career fair is the definitely the place to go. As an added incentive, companies also hand out free swag at their booths!

At a career fair, students talk to recruiters and hand out resumes. Even if you're a freshman and might not have as much experience, most recruiters are happy to talk to freshmen and often even accept their resumes. Local companies are willing to take students with less experience and larger ones have freshman targeted internships. Even showing interest this early can go a long way when you apply to the company in the future. Some tips for preparation include a good resume and having a 1 minute elevator tip showing your prior experience and interest. Leaving recruiters with a good impression will definitely help in getting contacted by companies. After that, most companies will have interviews potentially involving coding questions (many CS positions), logic puzzles (common for finance), questions about your research and classes (some Biotech companies), and general behavioral questions. Good luck with the job search and feel free to reach out to upperclassmen, recruiters, alumni, and the CDC to prepare!

FAQ

There are pizza classes, menu classes, and freshman seminars. I'm confused!

All three of these are designed to be fun ways to learn about various different fields, but menu classes are a core requirement while the other two are not. Pizza classes are 1 to 3 unit, low workload classes which generally meet during lunch and are offered throughout the year, although departmental pizza classes are usually offered during specific terms. (Their official name is "frontier classes", but they are referred to as pizza classes because many come with free pizza). They generally meet once a week, and every week, different speakers (usually professors) come and talk about their research. Freshman seminars, on the other hand, are first and second term and are generally six units. They are generally laid back when compared to other classes and since they are very small, they can be a fun way to get to know a professor. The goal of freshman seminars is to learn about a professor's research and/or new developments in a field in a thorough yet understandable manner for freshmen. Lastly, menu classes are third term and are all nine units. They often require a good amount of time, but they are very unique and designed to expose students to fields they may not have considered. In fact, the menu class you take to fulfill the core requirement has to be outside of your option.

Does it matter what section I am assigned to?

In most cases, no. You are free to attend any section you would like. While you may initially be assigned to a particular section, you can usually switch sections. Notably, Ch1a and Ph1a have assigned students to super sections and sub sections, but you should in no way feel obligated to remain in them. Some departments, such as math, will not let you officially switch sections for grading reasons, but students can attend another section if it is more convenient or if they like the teaching style of a particular TA more. The exception to this is Math 1a Section 1 and for more information on that, see the section on [super/sub sections](#).

What is core? What courses do I need to take to graduate?

Core is the name we give to the general education requirements that all students must take to graduate from Caltech. The best resource for figuring out what classes you need to take is the catalog. Also, if you are confused, you can consult your adviser, talk to upperclassmen, or ask the ARC.

If the catalog changes, do I need to meet the new requirements?

The requirements for your core classes will be the requirements from the catalog you entered with. So, don't put off taking core because it won't change for you! For your option requirements, you may use any catalog requirements released during your four years at Caltech. This means that if option requirements change you don't need to worry, as the catalog year you entered under is sufficient. And, if the option requirements change, you can choose to follow either the old set or the new set of requirements. However you cannot "mix and match" requirements in your option.

How do prerequisites work?

Prerequisites for all courses can be found in the course catalog. If you do not meet the prerequisite requirements but still want to take a class, be sure to talk to the instructor and get approval. Prerequisites for most classes are well thought out and students should be confident that they have the skills/knowledge that the prereqs give before side-stepping them. Even though professors will grant permission in most cases, you should seriously consider whether you will be adequately prepared. Furthermore, be sure to read the TQFRs (explained above) for a class to see whether students who have previously taken it recommend helpful prior classes that are not official prerequisites.

What is an elective?

There are several types of elective requirements at Caltech. Generally, an "elective requirement" is a requirement that can be satisfied by many different courses. "General elective credit" refers to credit that does not satisfy any requirements other than the institute requirement of 486 credits for graduation. "Departmental elective credit" refers to classes taken in a department which are not used to satisfy another requirement in a particular option for graduation. In the case of double-majors, sometimes credit satisfying a specific requirement of one major can be used to satisfy an elective requirement of another. However, sometimes this is not permitted. Be sure to check with both option representatives in order to determine what will happen.

Which classes are good?

One way to evaluate the quality of a class is by looking at TQFR ratings (please see the TQFR section above for more information). *However, the easiest way to find out about classes is to talk to upperclassmen.* When registering for classes, don't be afraid to ask around as you will find students have a lot to say about the quality of the classes they have been in. As always, feel free to check in with the ARC about any questions you might have.

Which classes have the heaviest and lightest workloads?

You can find this information yourself on the TQFR website (once again, please refer to the TQFR section in the guide for more info). Generally, you should be able to estimate how much time each course takes by the units. However, some classes give more work than the units predict (we call this under-united) and others less (over-united). While you need to look up each course individually, the general trend is that HSS (humanities, social science) courses tend to be over-united and lab classes tend to be under-united.

Are you required to take at least one humanities class for all three terms of freshman year?

While no one enforces when you take them, it is highly recommended you take your two frosh hums during your freshman year as you will not be able to register for advanced humanities classes until you have finished. Keep in mind that you will have to take 12 humanities/social science classes to graduate, which averages to one a term during your four years at Caltech. If you put off your frosh hums you will have to double up on humanities / social science courses in subsequent years. (See HSS flow chart in the Academic Resources section).

Do language classes count toward your Advanced Humanities requirement?

No, they do not. However, you also need 36 units of general Humanities and Social Science classes. Language classes can fulfill this part of the HSS requirements.

Is it easy to change classes once term starts? Would you get behind if you switch into a class?

It is advantageous to add the course sooner rather than later to avoid getting behind. If you're unsure about a class, you can audit the class and then add the class before add day, and you still have until drop day to drop the class (see the [Dropping/Adding Classes](#) section for more information about add/drop days).

What is the Housner fund? What sorts of things will they fund?

The George W. Housner fund [<http://www.deans.caltech.edu/gwhfund.htm>] is a program run by the Dean's office which funds student proposals for scholarly activities. "Scholarly activities" can include research (either independently or with an adviser), travelling to conferences (for example, students often apply for funding to attend the AAAS Annual Meeting), and independent study. To receive funding, students must write a proposal in time for one of the fund's four annual consideration deadlines. The proposal will then be considered by a student-faculty committee. Some recently funded proposals include "Presenting in American Physical Society 2010 March Meeting," "Mobile Phone-Based Automated Cardiac Auscultation for the Developing World," and "Independent Study of Law at UCLA."

2017 - 2018 ARC ROSTER

ARC Chair

Kavya Sreedhar
Electrical Engineering
Class of 2019 (Avery)
ksreedha

Secretary

Allison Tang
Chemical Engineering
Class of 2019 (Blacker)
allison

Avery Rep

Adrian Huang
Chemistry / CS
Class of 2020
ajhuang

Blacker Rep

Sara Adams
Mechanical Engineering
Class of 2020
sadams

Dabney Rep

Amrita Rhoads
Bioengineering
Class of 2020
arhoads

Fleming Rep

Anuj Chadha
Mechanical Engineering
Class of 2020
achadha

Lloyd Rep

Shreya Ramachandran
Electrical Engineering
Class of 2019
sramacha

Page Rep

Michelle Zhao
Computer Science
Class of 2020
mzhao

Ricketts Rep

Alejandro López
Chemical Engineering
Class of 2020
allopez

Ruddock Rep

Maggie Anderson
Physics / History
Class of 2020
maanders

At-Large Rep

Erika Salzman
Materials Science
Class of 2020 (Ruddock)
esalzman

At-Large Rep

Vibha Vijayakumar
Electrical Engineering
Class of 2020 (Ruddock)
vvijayak

At-Large Rep

Camilla Ora
Physics / Philosophy
Class of 2020 (Blacker)
clora

At-Large Rep

Asta Wu
Mechanical Engineering
Class of 2020 (Page)
acwu

Emeritus

Timothy Liu
Electrical Engineering
Class of 2018 (Ruddock)
tliu

Emeritus

Anusha Nathan
Bioengineering
Class of 2018 (Blacker)
anathan

Emeritus

Vaishnavi Shrivastava
Computer Science / BEM
Class of 2019 (Ruddock)
vshrivas

*To email any rep, add
@caltech.edu to their
email username given on
the last row for every
person.*