

Personal statement, Cambridge:

Though the natural sciences are all fascinating, physics stands out to me as the most beautifully logical yet universally applicable. My experience researching and studying physics only consolidates this belief.

My ongoing research involving light scattering with physicists at Kansas State University has been such an exciting experience that I cannot wait to become a physicist myself. It taught me valuable lessons, like the importance of clear communication when presenting research to the group. The group's leader, Prof. Chris Sorensen, always prods us for physical explanations of our data. His advice pushed me in the right direction toward helpful findings, like how light reflection off small particles mimics light reflection off a steel ball—a much simpler problem. This wisdom about physical explanations permeates my daily life, for now I question the logic behind why things are the way they are, especially with “coincidences”. My research uses computational physics (using C++), which means I do not get to see the awesome lab equipment experimentalists use. However, other members of the group are experimentalists, meaning I learn about their work anyway. I may be the least qualified in the group by a long shot, but even my research can have applications to real problems—light scattering is very much at play in the greenhouse effect, for example. In fact, Chris's previous research led him to discover a method of mass-producing graphene, a material that could have countless uses but is limited by its slow production. That truly is inspiring and incredible. Given this research experience, I would love to do research for a living despite the difficulty of the journey there. To be honest, sheer curiosity first led me to study math and science in my own time. Thanks to my passion and inherent aptitude for these subjects, I quickly reached university-level math and physics using resources like MIT OpenCourseWare and edX. This allowed me to get so much out of my research experience. After a slow start in high school, I became a strong student in rigorous classes. I will graduate after three years of high school having taken college classes in each term. As a US student, my qualifications will include AP exams, which I will take in May. These certainly include Calculus BC and Physics C. In high school I earned a 34 ACT composite score and a 1500 SAT total. These exams taught me a wide range of reasoning skills as they include all core subjects. As part of my self-study of math and science, I studied for Physics Olympiad (USAPhO). Last year I bombed it tragically, but I am determined to succeed this year, putting to use the wisdom I have gained involving taking proper rest. This competition places emphasis on problem-solving skills, and while studying for it, I realised how much I enjoy tackling tough problems. I improved my problem-solving skills so much that I feel I wield a firm control over logic. These skills also improved my research experience.

I enjoy extracurriculars like Scholars' Bowl, a competitive team activity in which teams compete using their academic knowledge and speed. Scholars' Bowl taught me to trust my teammates and to take risks intelligently under pressure. Outside of school, I love lifting weights and find that I itch to go to the gym even on rest days. Intriguingly, the science of lifting ties together different natural sciences (physics, anatomy, and physiology make biomechanics, for example). Even more intriguingly, the principles and nuances of weight training can be recycled to train problem-solving skills. Not only is lifting fun, but it also keeps my physical and mental health in top condition.

Looking back on my experiences studying and researching physics, I know I have the passion, preparation, and aptitude to study the Natural Sciences at Cambridge. I am sure I have the tools

to succeed in physics whether or not I get accepted. However, as an international applicant, I would bring a novel worldview and set of experiences to the university and would learn of other worldviews that are novel to me.

Personal statement, common:

I enjoy studying pure math as well as all the sciences, but physics in particular stands out, unrivaled, as the most fascinating to me. Physics represents the intriguing fusion of my two favorite things: resolving the complexity and mystery of the real world--a characteristic of all sciences--and the aesthetic logic and precision of mathematics. For this reason, I love learning physics, solving problems in it, and researching it. I am certain of my goal to become a physicist in the future.

Physics has fascinated me ever since I was young, but I started seriously chasing this passion after middle school (which ended early due to COVID). Previously, I had excelled at math and science in school and done math enrichment outside of school, so I understood I had an aptitude for these subjects. When I began chasing my passion, I studied math and physics in my free time using resources like Khan Academy and MIT OpenCourseWare, quickly reaching the university level. Learning physics using these resources was exciting, but eventually I used up all the good resources. Afterwards, problem solving became the goal of my studying.

In my first two years of high school, I competed in Physics Olympiad (USAPhO), a nationwide competition that emphasizes problem-solving skills; I am still studying and will compete again this year. I was not super prepared the first time I competed, and I tragically bombed the qualifying exam ($F=ma$ exam) the second time despite being well-prepared. However, the problem-solving skills I developed while studying for it have been so astronomical that they completely rewired the way I think. I conceptualize everything with the causes behind it rather than a judgment about it. These problem-solving skills have helped me everywhere in life. And besides, the studying that went into developing these skills was fun by itself.

This summer I was blessed to have the opportunity to see real research in physics and conduct some myself (still ongoing). Under a physicist in a group led by Prof. Chris Sorensen at Kansas State University, I learned about research in computational physics and did some research myself. It was even more fun than just learning or just problem solving since it represented the application of both. From this experience I expanded my problem-solving skills as we translated computational physics from scholarly articles to C++ programs and modified them to find insightful manipulations of data. The research covered light scattering by small particles like dust particles, and one such insightful manipulation of data of mine revealed that the light reflection component of light scattering by spherical particles matches precisely the light reflection by a spherical mirror. From this experience I also improved my communication skills by presenting my research in regular meetings with the group of physicists. This was particularly challenging since the physics I presented was rather abstract, and I needed to communicate my thought process clearly and effectively. As other members of the group presented, I also learned about how experimental research goes. Being the senior of the group, Chris provided advice to everyone to guide further research. From him I have acquired general wisdom--like how you should always tie your graphs and data to a physical explanation--for different types of research that will surely help me as a physicist and on my way there. In sum, this research experience has been engrossing to me, consolidating my goal to become a

physicist and do this for a living, and it has taught me advantageous skills, promoting my success.

As confirmed by these experiences ranging from studying to problem solving to researching, I have a passion for physics as well as an aptitude for it. Physics therefore is a captivating subject to me. I even do math or physics problems sometimes to escape from everyday stress. None of my friends or classmates have a passion like mine, so I hope to meet people like me in college.

Rice

Why academic area

Science is fascinating since it demystifies the mechanics of the real world. Math is fascinating since it's the purest form of logic, among other reasons. Put these two together, and you get physics. Because of that, and after engaging in real research in physics, I'm sure that I want to become a physicist and will major in physics along the way. That said, I'll explore other fields, like math and computer science. Not only are these interesting subjects, but they are also relevant to physics—in fact, in my current research we run computer programs to generate data and plot it. My goals for university are to gain a thorough and rigorous education, network with others with similar interests, and prepare myself the best I can for my future after undergrad—when I will go to graduate school and when I will become a physicist.

Why rice

Rice's rigorous classes and relatable community make it an attractive program.

Rice has a wide variety of challenging classes I'd like to take in my areas of interest. There's the option of taking honors lower-level classes. The wide selection of topics taught at the undergrad level, like plasma physics and computational physics, are an exciting opportunity to learn on multiple fronts. I'd also love to find out if one such topic fascinates me enough that I will specialize in it during graduate school. Rice offers research opportunities to further my education outside of the classroom.

In the sea of excellent students at Rice, I'll be sure to meet some amazing people. In the physics department, I heard there's a chapter of the Society of Physics Students (SPS). There, I could network with people like me and engage in things like outreach activities.

At Rice, I'd be honored to indulge in the challenging coursework and meet others like me.

Perspectives to contribute to rice

My upbringing gave me experience that will shape my perspective forever. My parents raised me uniquely thanks to a unique mix of cultures.

I experienced two significantly different styles of parenting instead of one. When I was younger, my parents held firm control over me. No video games on weekdays. Do homework or get grounded. The standard authoritative style. However, my parents gradually stopped enforcing these rules when I was in middle school, so I got to see the liberal style of parenting.

Neither style was overall better than the other. Under authoritative parenting, I got work done but felt restricted. Under liberal parenting, I felt free, but I often fell behind in schoolwork and had to make myself stop slacking.

This is why I don't think one side of an issue is better or more right than another. There may be some things I personally want that conflict with what someone else wants--and this is why we argue. This is how I see life; by default, I see two perspectives as equal, even if one of them is my own perspective. Historians and many writers support this worldview. For me, it's the secret to being open-minded.

Now, there are exceptions to every rule. Obviously, $1+1=2$; i.e., pure logic is objective. Also, my enthusiasm for certain things will cloud the perspective I just described. For example, I firmly believe that fitness *is* better than fatness.

My perspective doesn't come from a single culture or tradition. While both my parents were raised in Tunisia, my dad was American, so he was already familiar with the language and culture of America. Growing up, my family celebrated Eid and Christmas. We spoke in English and in Arabic. We loved eating pizza and couscous. My parents' shift from the cliché immigrant parenting style to a more laid-back one was facilitated by how our identities were more American than other immigrant households.

Seeing the world through two different cultural lenses therefore accompanies my "two equal sides" perspective on life. For example, I get why other people don't understand the significance of Ramadan, when Muslims fast from sunup to sundown for a month--in America, we love entertaining and indulging ourselves, myself included. But I simultaneously understand its significance--Ramadan requires discipline, and traditionally speaking, you need discipline to survive the day's hard labors. I sympathize with both views here; they make sense. In fact, this type of experience supports my "two equal sides" perspective.

By not judging opinions as right or wrong, I can better contribute to scientific discussion with an open mind. And by having grown up exposed to two cultures, I can better identify with more people.

Box: standard model lagrangian

Cornel

Science is fascinating since it demystifies the mechanics of the real world. Math is fascinating since it's the purest form of logic, among other reasons. Put these two together, and you get physics.

Because of that, and after engaging in real research in physics, I'm sure that I want to become a physicist and will major in physics along the way. That said, I'll explore other fields along the way, like math and computer science. Not only are these interesting subjects, but they are also relevant to physics--in fact, in my current research we run computer programs to generate data and plot it.

My background ensures my success in physics as well as math and computer science.

Preparation for the Physics Olympiad and AMC 12 exam has given me the backbone in problem-solving skills needed for the study of these subjects at Cornell. I'll also enter university with the scientific skills needed for this, having taken so many college-level science courses in high school.

On top of my background, my passion ensures my success. As indicated in my personal statement, I took it into my own hands to learn physics and enjoyed it along the way. Thanks to this, I'll have a head start since I learned undergrad physics up through second or third year physics. In sum, I won't simply burn out.

What I want to get out of undergrad is the best preparation possible for grad school and my later career in physics. For one, the rigor of Cornell's physics courses is a clear plus. Also, Cornell offers a plethora of research opportunities and even a couple teaching opportunities to add another dimension to the study of physics. In fact, it would be an honor to work with Cornell's world-class researchers in some of the world's most advanced labs. Knowing the value of my current research experience, I'll engage in as much research as I can at Cornell.

The way physics governs the physical world fascinates me. I'd like to explore more thoroughly this practical side of physics in lab classes since I haven't had the best opportunities to do so already. I'm drawn by the new lab classes Introduction to Experimental Physics and Exploring Experimental Physics. These would allow me to work with others to run student-driven experiments, gaining insight on experimental physics that could not be gained from robotically following lab procedures every week as in other schools' lab classes. Currently, I don't know what my specialization will be in graduate school. Who knows, maybe I'll be an experimentalist after taking Cornell's introductory lab classes. Or I might want to do astrophysics after taking Multiwavelength Astronomical Techniques and other ASTRO classes. I'm eager to see; after all, the unknown does make me excited.

Outside of the classroom, I'd like to join the Society of Physics Students (SPS) to contribute with my passion for physics. With the outreach programs like EYES that SPS engages in, I could spread the joy of physics to the next generation of aspiring scientists while simultaneously aiding them on their journey there. As someone who loves exercise, particularly lifting weights, I'd also want to join the Cornell Barbell Club to network with others like me and share our enthusiasm for lifting. It's actually a relief that Cornell has a club like this since many schools don't.

Cornell would give me excellent opportunities for growth, and I would contribute greatly to the community in return. With my background and passion for physics, it's all but assured that I'll succeed. In the future, I can make a change in the world with research in physics, whether it be in climate change, renewable fusion energy, the great cosmos, or many more. To reach this goal, I'd like to acquire an excellent, fitting education--a Cornell education.

Princeton

Interest

Science is fascinating since it demystifies the mechanics of the real world. Math is fascinating since it's the purest form of logic, among other reasons. Put these two together, and you get physics. With that, and after engaging in real research in physics, I'm sure that I want to become a physicist and will major in physics along the way. In studying for my own interest or for the Physics Olympiad, I gained the backbone in problem-solving needed to succeed in a Physics major at Princeton. I consolidated this backbone by learning math up through Differential Equations. Of course, the rigor of Princeton's Physics concentration makes it appealing. On top of that, I also plan to gain lots of research experience during undergrad, and the unique junior paper requirement would help me greatly. These projects give the opportunity to interact with

contributing physicists and get caught up with the literature. Both having connections and being informed are crucial to a physicist's work. The flexibility of the program of study would further help me achieve my career goal. I could pursue certificate programs involving math and computer science, both being important to physics. Math provides the necessary tools (and is fun). Computing is needed for research in physics, which I realized during my research experience since we run code to do calculations. I can't wait to take the next step on my journey to become a physicist, and Princeton offers the above unique ways to aid that goal.

Activity elaborate

Scholars' Bowl is an extracurricular activity in which teams compete to answer questions over school subjects the most accurately and rapidly. The fact that it's a team competition is incredibly important--it showed me that I don't know everything. For example, one person can't simply know all the subjects because that's way too much. Instead, we split the load so that each member has a couple specialty subjects to know. Scholars' Bowl has awarded me with the skills of collaboration and the awareness that collaboration is necessary--something I didn't even learn after playing team sports for most of my life. Many physics majors fall victim to their pride and try to do everything on their own; however, knowing the power of collaboration, I'll be sure not to fall victim myself. Scholars' Bowl thus showed me the importance of something that will be vital on the path to becoming a physicist.

Difficult topic

Some time ago, I was practicing for college interviews with a teacher--for whom I'm grateful since few teachers will go this far to help a student. She likes philosophy, so we were in fact bound to end up talking about a difficult topic. Indeed, she brought up the niche interview question about what my weaknesses are and how I overcome them. It was difficult to admit that an addictive personality is a weakness of mine and how it made me struggle. The struggle is why I know how to handle addictions so well now. The teacher's weakness was anxiety, and it hurt to hear how much she struggled with it. The struggle is why she knows how to handle anxiety so well now. There's something we can learn from this. I sometimes struggle with my own anxiety, so in fact I could learn from my teacher how to handle it. Likewise, she has addictions herself, so she could learn from me how to handle them. I therefore believe we can learn from other people how to handle certain struggles, and we can conversely teach others how to handle our worst struggles. You should learn from someone who had it worse than you. This message must be spread. The world would be much happier if we could handle all our struggles, not just the worst one.

Civic engagement

This spring, a tornado touched down in Andover. It flattened several homes and buildings. My family's small rental home (vacant at the time) was by the touchdown point, so the day after the tornado hit, we went to the rental to check it out. It survived, but the shack didn't, and many neighboring homes suffered damage as well. The next day, we brought buckets to pick up the debris, which was trashed everywhere. Thankfully, a neighbor had rented a dumpster and let us dump our debris in it. It was a lot of work just to clean up our property; however, this stimulated my sense of community. I therefore convinced my family to go back the next week

to help out the neighbors. Meeting new people and working with them, we actually had fun. They were great people, but they revealed to me a novel style of living--the lower/working class lifestyle, to which I had little exposure. They had to work hard to get by, and they did not get to buy expensive computers or go on vacations like we do. Some had bitter family relationships or spent little time with family. I haven't ever been ungrateful, but this enlightenment sits at the back of my mind, making me aware of the nice things I have that many don't.

Harvard

Gap year what do

Everyone knows that time is invaluable. That said, I will have purchased myself an extra year by graduating high school early. The possibility is thus very real that I will take a gap year or a year off during college. I would take advantage of this opportunity to take great steps toward my goal of becoming a physicist by expanding my skillset and gaining experience. I could also use this time to contribute to the community or pursue other interests.

During a gap year or long break, I would first and foremost further my interest in research with a research internship abroad if possible (I may or may not satisfy the eligibility requirements depending on when I take this time off). This way, I could gain more practical experience in the career I will do in the future—as a physicist. Of course, this type of experience is vital for becoming the best physicist I can be. A research internship abroad would also help me improve skills like communication and problem-solving. That the internship be abroad is a personal preference; I am a curious person, so I love exploring the wonderful world, learning new languages, and immersing myself in exotic cultures. In addition, the life abroad would only help and not hinder me in that I would certainly improve the relevant skills. All these benefits make the research internship abroad an undeniably desirable experience if I took time off during college.

A research internship abroad may not be possible, however, so in that case I would stay home and get a job in tutoring. Tutoring is a meaningful job and a valuable experience. As a tutor, I could contribute to the community by aiding younger students in their success. The way I see it, if people are spending their hard-earned money for their kids' improvement, then I cannot be the one to let it go to waste. With this motivation, I will be sure to improve skills like communication and interpersonal skills in order to be a tutor of service to the community and worthy of the price. The wage is obviously another benefit. Just to brag, I am not much of a materialist, so I would simply invest the profits for my later benefit unless I have a pressing need for money. In sum, tutoring would be a great option for what to do during a long break given that it is meaningful, beneficial, and profitable.

During a gap year or long break, I would also have time to further my interests in learning. I would continue my ongoing research experience with K-State physicists, which is something I can do remotely. Also, 2023 will be the last year I compete in the Physics Olympiad, but in college I want to try my hand in the Putnam math competition. A gap year or long break would be the perfect time to prepare for it as I will have more free time. As with the Physics Olympiad, preparation for the Putnam will greatly improve my problem-solving skills, which are irreplaceable as a physicist and on the way there. Well, I really enjoy solving problems, so the above is just an excuse to continue doing it. Moving on, I would also practice my writing skills since they are a vital component to communicating research. I have an aptitude in writing that

may rival my aptitude in math; however, I have not truly cultivated it since it has never been my priority and since the composition classes I took were not challenging enough. Therefore, I believe some practice would yield improvement well worth the effort. It would do me well to spend some time to continue my research and do some enrichment.

While I would like to gain practical experience and study during a year off, I also have other interests that I would like to pursue. For example, my main (not career-related) hobby is exercise. Currently, I only have time for resistance training and some cardio, but during a year off I might have time to branch out and do other activities, like swimming. In fact, if tutoring does not work out and I am not abroad, then I could be a trainer—which yields many of the same benefits. Also, unless I am busy with a research internship abroad, I could go on vacation at any convenient time of the year.

In total, I could spend a gap year or year off in an advantageous manner given my goal of becoming a physicist. Now, it is true that there would be some benefit to simply taking the whole year off, doing nothing, and clearing fatigue. But where is the fun in that? I found a career I like, so I will not willingly hold myself back.

UC

#6 academic subject

I enjoy studying math and all the sciences, but physics in particular stands out, unrivaled, as the most fascinating to me. Physics represents the intriguing fusion of my two favorite things: resolving the complexity and mystery of the real world--a characteristic of all sciences--and the aesthetic logic and precision of mathematics. For this reason, I love learning physics, solving problems in it, and researching it.

Due to COVID shutdowns, my summer of 2020 was extra long. During this time, I hunkered down for several hours a day, learning physics and math and loving every minute of it. Thanks to previous mathematical enrichment, I reached college-level math and physics very quickly. At some point, my purpose became concrete: Physics Olympiad. Preparing for it was and still is extremely difficult. Indeed, I've given up and burnt out many times while studying for the Olympiad. But I always come back--I feel like I'm slowly deteriorating when I could study but choose not to. On the $F=ma$ exam, I scored a 7 in 2021 and a 12 in 2022, not enough to pass. This shows improvement, but on the latter test I was extremely dissatisfied since I had been scoring 17+ on practice tests. I'm still studying for Physics Olympiad, and of course, I will try again this year.

My ongoing research experience, which started this summer, has been just as satisfying as studying physics. It isn't a real internship, but I still do quite a bit. Early on, I spent lots of time each week getting up to speed with the research. Thankfully, it's about light scattering, which is rather easy to conceptualize compared to other topics of research like nuclear physics. After that, I began doing real research in computational physics, expanding on code written by Dr. Justin Maughan in C++. In weekly meetings with Justin's group, I see others' research and get feedback on mine.

Based on these experiences outside the classroom, I've furthered my interest in physics to a substantial degree. I've used this advantage to help my classmates in physics succeed.

#4 opportunity/obstacle

A couple such opportunities and obstacles showed themselves to me early in high school. In fact, one was both a blessing and a curse.

Due to the pandemic, middle school was cut short for me by over two months. The start of high school was also delayed by about a month. Therefore, I had a super long summer of 2020, which proved to be an educational opportunity for me. At the very beginning of this was when I began chasing my passion for physics--studying physics and math in my own time, unconstrained by school so that I could spend several hours each day on this. Fueled by my insatiable curiosity, I made astronomical progress, going from Algebra 2 to Physics 3 and Differential Equations in that extended summer. I thus consider the pair of COVID and online resources like edX to be a significant educational opportunity for me.

During that same summer, I found out that "Gifted" students could take dual enrollment college classes as soon as freshman year (I'm a "Gifted" student). I immediately arranged for that starting in the fall. This was a huge educational opportunity--it added rigor to my course schedule and would allow me to graduate early by virtue of the 5 credit hour classes. Case in point: I took Calculus 1 that fall and got two semesters of high school credit while the class was one semester long.

COVID turned out to be a challenge, unfortunately. That same fall (2020), my school used a messy hybrid system. My willpower crumbled under the pressure of schoolwork, and addictions took me over. I thus got little done on online days. My grades suffered, to some degree. Now, I obviously can't blame COVID for that semester's grades, but other than myself, COVID was the biggest factor. In any case, this challenge overcame me instead of vice versa. However, it made me learn from the experience and gather the motivation to end my bad habits--hard times create strong men, as they say. Part of the next semester was hybrid, but I didn't repeat my mistake.

Without the opportunities of COVID and dual enrollment early on, I would not be so brilliant today. Even the hardships were meaningful.

#2 creative side--food

Like many STEM freaks, I used to tell myself I had no creativity. That's just not true; in fact, it *can't* be true since what I do often requires creativity.

Problem-solving is a significant part of my life--Olympiad studying, research, and school subjects constantly need it. For example in my research, I find creative ways to use coding to make my research less tedious or to look at it through a new lens. By consistently exhausting my creativity I can improve my problem-solving skills. When I first learned this, I began to embrace creativity as a powerful virtue.

Next, in cooking, I like to innovate, striving to improve my dishes. I take simple recipes and slowly transform them into irresistible dishes based on my knowledge of what each ingredient does. For example, I have been meal-prepping omelets to eat every morning, and they're so good now that I don't get tired of them, even after a year. I like having total control over my food, so I can satisfy my taste buds as well as my calorie and protein goals at the same time. I also express my creativity in planning. An example of this would be writing myself a lifting program--I have all the knowledge I need and a gym to execute my program at, but it's a real test of the imagination to figure out how to follow every lifting principle in a way that won't have me bothering or being bothered by people at the gym. It also took creativity to develop a

system to track my progress and my training variables. Planning also includes managing my time so I can handle my schoolwork, extracurriculars, and lifting. The way I study was also structured carefully in a way like the way I structure my lifting.

Creativity is a priceless skill to have, and I have expressed mine in problem-solving, cooking, and planning, to name a few ways. Writing, humor, art, and more are other creative outlets of mine. I have, in sum, uncovered the hidden relevance and versatility of creativity to exploit it in my life.

#5 challenge

In middle school, I was a bit of a miscreant. Bad habits and a crippling porn addiction followed me to high school, where I could no longer dodge the consequences.

In my first semester of high school (Fall 2020), when I was learning from home most of the time, I uncontrollably wasted time on things like video games or porn. My grades suffered as a result, and this was a major motivating factor for me to change my lot. Porn was by far my strongest and most dangerous addiction, so in the next semester I decided I would quit it. I tried and failed again and again, using every known method and connecting with others online with my same problem. Ramadan turned out to be my salvation since that was when I had my first good streak—about 3 weeks clean. I had made significant progress, and that summer of 2021 was my best, with abstinence from not just porn but also video games and bad food. I relapsed before school restarted. And alas, the journey goes on today; it's like addictions develop a resistance the way mosquitoes adapt to become immune to an insecticide.

This challenge hurt my academic achievement initially. However, it's not all bad. For example, I learned that thanks to my addictive personality, I should never relax before doing homework because I'll just neglect the homework if I do. Also, I've freed myself from the brain fog that comes with a hefty porn addiction, meaning I can focus better and feel more emotion. I've gained the confidence of someone who has (nearly) beaten an addiction that plagues the masses. By overcoming this addiction, I'm now able to handle my academics better and focus on my passions and hobbies.

In sum, persistence was key in breaking a parasitical porn addiction. By fighting this addiction, I learned about myself and changed myself psychologically and emotionally, making me a better and more successful person today.

Caltech

Why

I have explained pretty thoroughly in my personal statement how I have a passion for physics. Now, Physics at Caltech is a perfect match for my interests and my background. The program places emphasis on all the sciences, which is fine with me since I enjoy them all. It also encourages research, so I can add to my ongoing research experience. The claim that Caltech's problem sets are "harder than anything you've ever seen before" does not scare but excites me. In fact, I believe expanding my problem-solving or creativity skills on many fronts—like math, chemistry, engineering, and writing—will improve my problem-solving skills in my specialization—physics. As for my interest in math, I would say I am better at math than at

physics. However, this interest remains secondary since my passion for physics is much stronger than my love of math.

Stem 1

A beam of light shined on a particle will scatter in all directions. In my current research over this phenomenon, we use computational methods to generate data and plots to describe this interaction of light and small particles. By playing around with the data and plots, we see how the scattering and absorption depend on parameters like particle size and refractive index. For example, when the imaginary component of the refractive index gets large, the light undergoes simple reflection and diffraction off the particle and doesn't enter it. What's really interesting about this research is its tangibility. Plots often involve scattered light intensity, which is pretty easy to visualize--it's just brightness. The plots often have a close connection to the real world. For example, the plot of scattered light intensity versus scattering angle (angle measured from the direction of the initial beam of light) for a water particle has a peak at around 120 degrees that is responsible for rainbows--the peak shifts slightly depending on light wavelength thus the separation of colors. Learning the mechanics explaining the real world in real research has been exciting and has stimulated my curiosity. I'll explore this interest further once I'm a physicist.

Stem 2

I began learning physics in my own time even before high school. In 8th grade, I had a backbone in Algebra 2 and Geometry, so I was prepared to try algebra-based physics. Using Khan Academy, I finished Physics 1 in four days. It felt amazing newly to understand gravity and all that. That's when I got greedy. I wanted to learn everything, so I learned calculus, then moved on to college-level math and physics. Classical Mechanics was hard, so I simply re-learned it. I thus reached quantum physics within a year. My curiosity could have carried me much further, but after bombing the $F=ma$ exam I began focusing on honing my problem-solving skills and mastering lower-level physics. I loved that I was constantly stuck learning. For example, when I learned the concept of electric monopoles, I wondered if magnets were the same. When I learned magnets aren't the same, I wondered how they work. As a result of all this, I'm ahead of my peers in physics. It has been a joy tutoring them at school and sharing my favorite insights with them. In indulging my curiosity, I in fact stimulated my curiosity. This is why I'll become a physicist.

Innovator - 250

Innovation is a nice skill to have.

In cooking, I innovate to take simple recipes and slowly transform them into irresistible dishes based on my knowledge of what each ingredient does. For example, I meal-prep omelets to eat every morning, and they're so good now that I don't get tired of them, even after a year. I accidentally invented avocado aioli before I knew it already existed.

The skill of innovation comes in real handy. When cooking for others, you can use it to improvise a recipe when someone dislikes a certain ingredient. When ingredient selection is

low, as is often the case at my house, you can just create something new. Today, there was no cheese, so I instead scrambled some eggs and packed them into the sandwich I was making (this was no ordinary sandwich in the first place).

Also, my studying setup is engineered. For example, I cleared out the guest room to have the best, quietest spot for the setup. I made a mini toilet in Ceramics class to hold pencil shavings. I jerry-rigged a headphone stand. The microwave attached to the underside of my desk (a folding table) heats up water so that I can make tea, and it doubles as a storage space. A picture frame conveniently holds up a Trig Identities sheet.

There are still more things I've created, like systems for studying and for tracking workouts. Innovation is handy everywhere in life, making it a valuable skill in my opinion.

How i use past/present experience and perspective to navigate the world - 250

My upbringing gave me experience that will shape my perspective forever.

I experienced two significantly different styles of parenting instead of one. When I was younger, my parents held firm control over me. No video games on weekdays. Do homework or get grounded. The standard authoritative style. However, my parents gradually stopped enforcing these rules when I was in middle school, so I got to see the liberal style of parenting.

Neither style was overall better than the other. Under authoritative parenting, I got work done but felt restricted. Under liberal parenting, I felt free, but I often fell behind in schoolwork and had to make myself stop slacking.

This is why I don't think one side of an issue is better or more right than another. There may be some things I personally want that conflict with what someone else wants--and this is why we argue. This is how I see life; by default, I see two perspectives as equal, even if one of them is my own perspective. Historians and many writers support this worldview. For me, it's the secret to being open-minded.

Now, there are exceptions to every rule. Obviously, $1+1=2$; i.e., pure logic is objective. Also, my enthusiasm for certain things will cloud the perspective I just described. For example, I firmly believe that fitness *is* better than fatness.

By not judging opinions as right or wrong, I can better contribute to scientific discussion with an open mind.

Favorite hobby 100+50

- Lifting
- cooking

Identity 150

- immigrant

UMich

Second-generation immigrants are usually defined as the children of immigrants. As a member of the second-generation immigrant community, I believe our mix of cultures makes us unique. I take my place in this community by spreading my culture and absorbing others.

Second-generation immigrants are plentiful in the US. People move here from all over the world, especially Asia. My family comes from Tunisia, an Islamic country in North Africa. No second-generation immigrant has a well-defined culture; we are typically immersed in two cultures at once. For example, at school I am a part of the American identity, but at home I am more Tunisian and Muslim. We also typically speak two native languages. I believe this cultural and vernacular hybridization makes second-generation immigrants unique and serves as a defining factor for this community. We all share ground as Americans but differ because of our familial backgrounds.

At school, many of my friends are members of the second-generation immigrant community. Most immigrants in my area are Vietnamese. However, I still see plenty of diversity, including people from the Middle East, who share a similar culture with me. I have learned a lot about other cultures as my friends and I like talking about topics like visits to our families' former countries. We may not have started clubs for this but that is not to say we do not engage in each other's cultures; for example, I occasionally go out with friends at restaurants involving our culture like Vietnamese restaurants. I contribute to this "spread" of culture as basically the only North African around.

Thanks to its diversity, UMich would be a great place to continue contributing thus as an active member of the second-generation immigrant community, offering culture and learning culture.

Studying here would support not just my career interests but also many personal interests.

UMich's College of LSA has a great reputation for physics as one of the best schools in the country for it. As someone who has already worked hard for my passion, I would appreciate the opportunity to get the best education I can. The curriculum looks advanced, and the option of taking the Honors route would let me demonstrate my motivation to study physics. This advanced curriculum with advanced laboratory classes would help me greatly expand my technical skills, which are a weak point for me since I do not have much lab experience in science. Also, the UMich physics program allows undergraduate research opportunities, of which I will definitely take part. While this is not unique to UMich, I will consider studying abroad. The research abroad at CERN, however, is an attractive opportunity that I could not have at practically any other school. Since I plan to become a physicist in the future, UMich's curriculum and research would let me become an outstanding prospect for this field.

The possibility of studying at the Residential College also piques my interest. As someone planning to enter academia or at least a career in research, I value "intellectual" beliefs like being well-rounded (though I dislike the inflated ego stereotype associated with "intellectuals"). The RC's emphasis on humanities would present me a new front to learn on, and improving my writing skills would benefit my career in physics. While my creativity will be put to work solving tough physics problems, I would enjoy putting it to use in a different way. Creativity is after all an important skill and not my biggest strength. An old hobby of mine is learning languages,

particularly French since it relates to my family's background. Recently I have not been able to pursue this hobby outside of school, but studying at the RC would help me do so again. Another interest of mine is fitness, specifically lifting weights. I have been consistently lifting for years now and enjoying it thoroughly. I am sure UMich has top-quality fitness centers, being a D1 football school. For this reason, I can rest assured that I will be able to further this interest without struggle.

UMich's social life also looks great. I am thankful to have so many smart friends at my high school, and I would love to continue meeting smart people, by whom I would be surrounded at UMich. In addition, D1 football games provide great opportunities to socialize.

For the above reasons, I believe UMich would uniquely suit my interests very well--not just my career interests, but also personal and social interests. Having a passion for physics, I would do my best to contribute to UMich as a shining student with a diverse background and varied interests.

MIT

Weightlifting. While I typically do many things for pleasure, like watching YouTube, I can never hang on to one of those activities for longer than a few months as they simply become boring--but this does not apply to weightlifting, in which I have been engaging regularly for more than 2 years now. The results of lifting (strength and physique) appeal to most people, and in fact I started lifting to build strength for football, but I found that I truly enjoy the process. It was hard at first, but it became quite satisfying to me to push myself to the limits to pump some iron, especially when it gets hard. Grinding out an extremely tough rep and succeeding is particularly satisfying as it gives a feeling like crushing an opponent despite them being stronger than you. While the process is pleasing, so are the results, and I think that goes without saying. Moving on, this year is my toughest yet in school, and going to the gym to lift provides me with a great way to relieve my stress. I would much prefer to continue going to the gym even though my time may be better spent studying or doing homework. I enjoy weightlifting very much and will certainly continue to lift after high school, no matter where I end up.

I come from an immigrant family in a community with numerous such families. My family and many of my friends' families confirm in some way the stereotype that foreign parents only care about school and grades. Stereotypically, these children of immigrants I know at school often want to become doctors, engineers, programmers, etc. When I was younger, these stereotypes described my family and me as I vaguely wanted to become a NASA physicist and needed good grades. My path diverged from the other immigrant kids' by 8th grade, when I no longer felt pressured for good grades. That likely represented American culture finally assimilating my parents as American parents usually are more lax and leave more freedom with the child. I could use my new freedom to laze around and forget about performing well in school, or I could continue doing the minimum to become a physicist. Instead, I chose to do the maximum to become the best physicist I could. Meanwhile, the other immigrant kids continued doing only what was required by their parents to lead them to successful careers. I must note that my inherent curiosity in physics was vital--so I primarily chose to chase a passion, not just glory. In

the end, the well-timed transition from immigrant culture to American culture most directly amplified my long-held dream of becoming a physicist.

This spring, a tornado touched down in Andover. It flattened several homes and buildings. My family's small rental home (vacant at the time) was by the touchdown point, so the day after the tornado hit, we went to the rental to check it out. It survived, but the shack didn't, and many neighboring homes suffered damage as well. The next day, we brought buckets to pick up the debris, which was trashed everywhere. Thankfully, a neighbor had rented a dumpster and let us dump our debris in it. It was a lot of work just to clean up our property; however, this stimulated my sense of community. I therefore convinced my family to go back the next week to help out the neighbors. Meeting new people and working with them, we actually had fun. They were great people, but they revealed to me a novel style of living--the lower/working class lifestyle, to which I had little exposure. They had to work hard to get by, and they did not get to buy expensive computers or go on vacations like we do. Some had bitter family relationships or spent little time with family. I haven't ever been ungrateful, but this enlightenment sits at the back of my mind, making me aware of the nice things I have that many don't.

Under "Activities" I reported that I competed in the USAPhO and did not make it past the $F=ma$ exam, though you may have noticed how much time I spent studying. I was not well-prepared for my first $F=ma$, but by the time my second $F=ma$ came around, I was very ready, scoring 17+ on all of the previous exams posted online. But on test day, I scored a 12, which was unfortunately below the cutoff score of 15. This was a devastating failure to me. I really wanted "USAPhO finalist" to be on my MIT application. Discouraged, I took a rather long break from physics after receiving the result. I think the main reason for my flunk was that I burned myself out. This time I am determined not to make that mistake again. After my break, I began again to study--while "USAPhO" will not show up on my MIT application, I want to prove to myself I am capable of the achievement (also, I enjoy studying physics). I am spreading out my study time over the 8 months leading up to it and taking breaks to clear out fatigue, like in weightlifting. I will also fix test day mistakes so that during the test I do not feel like my bladder will explode. In sum, this failure forced me to mature.