

SUCCESSING IN THE SCIENCES

**“I never teach my pupils.
I only attempt to provide
the conditions to learn.”**

Albert Einstein



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Know the difference between HSC and real science and what it takes to really do really well in HSC Science courses.

Nikhil came 7th in the state in HSC Physics with a mark of 97, and scored an ATAR of 99.95. He is a graduate of James Ruse Agricultural High School, and the University of Sydney where he completed a double degree (Advanced Science/Doctor of Medicine) on a scholarship for Outstanding Achievement. Nikhil currently works as a junior doctor at Westmead Hospital and was a key contributor in developing our new HSC science courses.

Succeeding in the HSC Sciences.

By Nikhil Vasan

When choosing subjects for the HSC at the end of Year 10, many students discount Mathematics and the Sciences immediately because they perceive these subjects as requiring a much higher level of academic ability than what they are capable of. This is a self-limiting belief. The vast majority of students are capable of succeeding in these subjects, in the HSC and beyond, but the key is understanding *how*.

What does the HSC want?

To succeed in HSC sciences, it is important to understand the purpose and expectations of the HSC. The Board of Studies does not need high school students to be experts in General Relativity, nor be able to synthesise complex organic compounds in catalytic reactions. Rather, the BOS wants you to be able to understand and communicate information, interpret and manipulate data, and critically analyse information presented to you. Why is this important to know? Because these skills are not specific to science. These are the skills required for you to succeed in any

field you choose to go into. Choosing a subject like Physics simply makes physics-related concepts the vehicle through which you demonstrate your mastery of these skills. The concepts themselves are reasonable for most students to grasp, but getting the top marks requires something very different. This is why it is very common that the state's top performers in HSC sciences may not end up pursuing careers in science, and those that do may have underperformed in their HSC exams.

So what is the key to doing well in the sciences?

Understanding the fundamental concepts is the key starting point but the real differentiator is exam technique.

Essentially, having good exam technique refers to how well you can communicate a concise response which directly addresses the key concerns of the question. This is an art – but it can be learnt and improved.

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The Board of Studies wants you to be able to understand and communicate information, interpret and manipulate data, and critically analyse information presented to you. These skills are not specific to science. They are required for you to succeed in any field. Choosing a science subject simply makes it the vehicle through which you demonstrate your mastery of these skills.

Here are my five tips to help you ace HSC sciences.

1. Understand the Syllabus

The syllabus is the medium through which you demonstrate your comprehension and communication skills. Although it may look daunting, the syllabus is relatively basic compared to how vast the realm of science really is. This means that with effective teaching and studying, the syllabus can be conquered. Whilst exam technique may be the key differentiator in the HSC, all learning starts with the syllabus. Put it this way, if you know the syllabus well, but have very poor exam technique, i.e. you know the concepts but can't really explain them well, you're likely to get 50-60% in the exam. If you don't know the syllabus at all, you aren't going to get any marks no matter how good your exam technique is.

So what's the best way to learn the syllabus?

Firstly, it's about understanding the structure of the syllabus. The science courses consist of four topics in the HSC, each divided

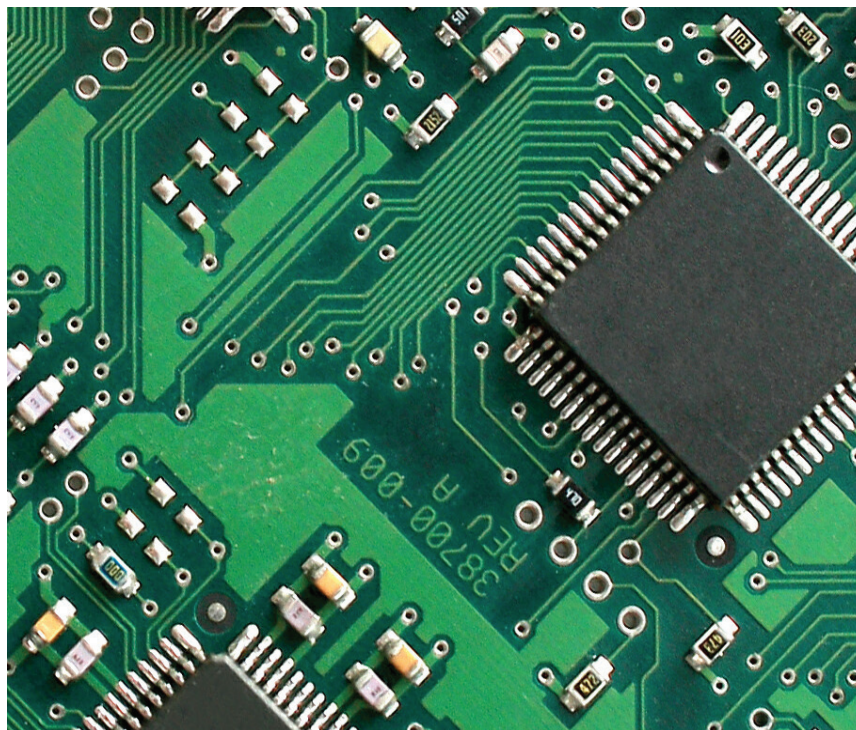
into roughly 4 sub-topics. Each sub-topic will have a set of dot points, corresponding to some theoretical points you need to understand, and some research and practical components that you may be asked to draw upon in the exam. It prescribes the outer limits of what you need to know, and hence study.

So don't worry about knowing optical birefringences of crystals, nor the synthesis of fluoroantimonic superacid, because that's not in the syllabus. Studying efficiently involves structuring your study around the syllabus.

Secondly, it's about designing your study. Each subtopic will have some points which cover the basics, e.g. how magnets interact, or how a cell is structured. You must start with these. Don't move on to the other dot points until you are certain you have a thorough understanding of the basics.

Science is like a pyramid, you need to have a strong foundation first before you attack the more complex concepts that lie on top. You will find that when you invest that bit of extra time in understanding the fundamentals of a topic, the rest will flow much more easily.

Finally, the syllabus is a great framework for revision. Towards the end of your HSC year, as you are preparing for the final exams,



it is important to perform a full audit of your course knowledge. A great way to do this is to dissect every dot point in the syllabus, and type up succinct summaries of your understanding of these dot points, and answer the common question types that relate to them.

At Talent 100, we've brought together some of the best educators and communicators in the state to do just that. Our meticulously crafted notes cover the syllabus accessibly and thoroughly.

2. Do past papers.

Once you understand the theory, repetition is the key to success. For this reason, past or sample papers are one of the best ways to develop exam technique because they force you to synthesize your knowledge into a set of cohesive and logical answers. This is no easy task. Past papers should only be attempted after you have a solid understanding of the relevant syllabus dot points; you need to know what you are communicating, before you practice how to communicate it.

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Doing past papers helps you sharpen your exam technique in three ways:

- **Forces you to synthesise your knowledge and respond to the question.** An annoying but important, part of answering HSC style questions is to pitch your answer according to the key verbs, e.g. Discuss, Evaluate, Explain. These have specific meanings in the HSC. For example, “discuss” requires you to provide arguments for and against, whilst “evaluate” and “assess” also require you to provide a judgement. Doing past papers forces you to shape your knowledge to what the examiner is asking.
- **Exposes you to the variety of probable question types.** If you’ve encountered the most common question types in your studies, you’re less likely to get thrown off during your exam. There are ‘common’ question types as well as ‘left-field’ question types. By doing past papers, you should be able to master all of these common question types, and you may

even see enough of the unusual or unique types that you can answer them much more proficiently than those who are seeing it for the first time.

- **Timed practice will help you deal with the stress of exams.**

There is no better form of practice than doing a past paper under exam timing and conditions. This is the final stage in preparing for your exam. It not only tests your knowledge, but also your time management abilities, which can also be a key differentiator in HSC exams.

Doing past papers sharpens your exam technique, especially if you sit them under exam conditions. By doing this, you can turn a 3 or 4 out of 5 into full marks. That’s ultimately what discriminates top performers in the HSC

3. Predict the marking criteria.

When your answers are marked, they are checked off against pre-determined criteria. By pre-empting that criteria, you can write much more concise answers that are likely to get full marks. For e.g.,

a question about electromagnetic braking in trains may be worth 5 marks. The marking guideline may stipulate that one mark is given for: a definition, a diagram, the use of Faraday’s Law, the use of Lenz’s Law and an advantage of this method of braking.

Although each school and the Board itself, may have slightly different marking guidelines, by pre-empting what those guidelines are, you can write better answers that maximise your chance of scoring full marks.

How you approach each question is very important. First, read the stem of the question very carefully. Look for and underline key words. Before writing your response, brainstorm how you are going to get each and every mark. This will be heavily influenced by the question verb. For example, in an ‘assess’ question, you know your marks will come from positives and negatives, as well as a dedicated mark for a judgment. For an ‘explain’ question, you know that relevant fundamental phenomena and a logical progression of your answer will draw marks. Do not

start writing your answer until you have a fairly strong idea of what you need to include in your answer to get every mark, how these points fit together, and in what order you will discuss them to give your answer the best flow. If you just start writing a rapid-fire response after reading the question, you may find that you get lost in your writing, you forget to add points, or your answer loses a logical flow, which makes it harder for the examiner to interpret.

To become better at predicting marking criteria, you need exposure. Again, past papers - particularly if they have marking guides - are a great way to do this. You can start to gauge how examiners allocate marks. If you encounter a similar question type in the exam, you'll have a good idea of what you need to say. Pre-empting marking criteria is an inexact science, but with enough

exposure, you'll start to get a good sense of how to pitch and structure your answer.

At Talent 100, the in-class questions, homework and exam preparation are all accompanied by well-reasoned marking criteria and sample answers, so by the end of the teaching year you will be well equipped to hit the 'full mark bullseye' in your exam questions.

4. Teach others.

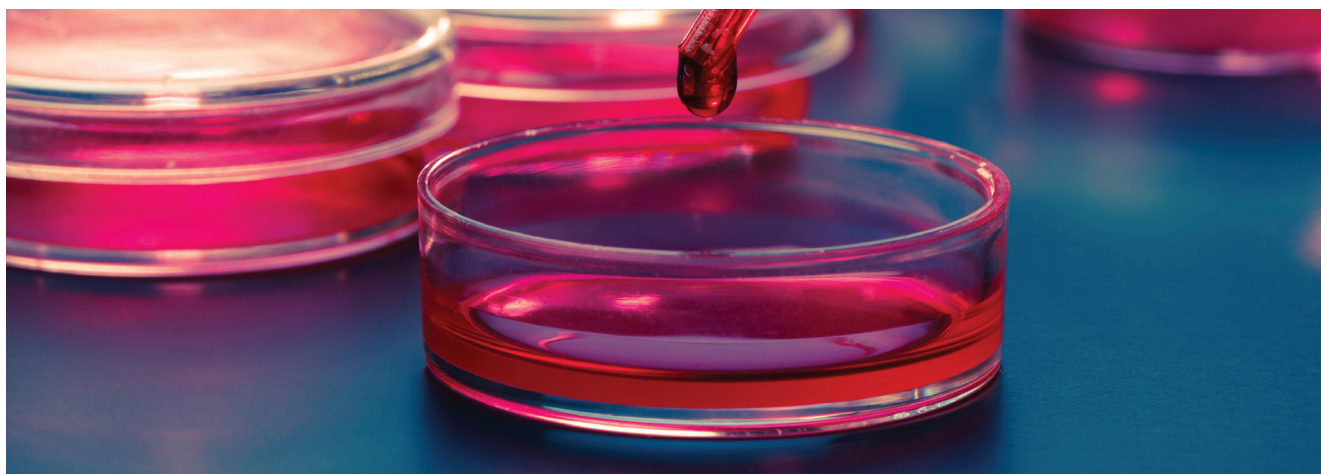
SODOTO is a common learning adage in the medical community, but the principles are useful in any type of learning. It stands for 'see one, do one, teach one'. Teaching is the best way of learning, and there is no substitute for it. By gauging how well your 'student' understands what you've explained, you can see how clearly you communicate the logical flow of

your ideas, which is exactly what an exam is testing you on.

So how do you apply SODOTO?

The first step is obvious. Turn up to class, listen to your teachers explaining a concept to you for the first time. This is the 'seeing', the first exposure, or the laying of the cornerstone in the scientific pyramid. By the nature of memory, it is highly unlikely you will fully understand or retain a concept on first exposure. At the very least, you can pick up on key words and related laws that will allow you to research the concept later on. This is why it is crucial to apply yourself in class, and why the quality of your teachers is of utmost importance. If step one doesn't work out, the next two steps are compromised.

Step two involves you doing the hard yards at home. Go on the



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internet, open your textbook, and read up on the concept again. Try answering some practice questions and homework to get used to applying the ideas, and to get feedback on your understanding. As mentioned earlier, learn from the bottom up. Start with the most fundamental aspect of the concept, and slowly work your way up to the tip of the pyramid. You may need to fall back on step one a few times here, but by going back to your teachers or textbooks you will fine tune your understanding. At Talent

100, this is what your tutors are for – they are dedicated to answering your specific questions in a personalized way to fill in the missing stones in the pyramid.

Once your pyramid is standing, you now need to test its strength, and this is step three. Try explaining the concept to someone else. This could be your best friend, someone in a study group, a peer who may be falling behind in the subject, or simply a member of your family. Test how coherently your logic

flows. See if you can answer questions thrown at you, by deepening one part of your explanation or by drawing on a related aspect of the syllabus. You will soon find out which areas you don't know too well, or if you need to work on how you convey your ideas, and this is where you fall back to step two again. Eventually, your ability to verbally communicate the concept will be so strong, that writing it down in an exam will be second nature.

5. Attitude is everything.

This may very well be the most important point, and the one which is most pertinent to your life after the HSC. Get used to embracing failure. Get used to saying "I don't know", and more than that, start enjoying saying it. Don't be scared of having a go, or of being wrong. Failure is potentially the best motivator, and the most objective way of being shown what you need to work on.

Succeeding in the HSC requires tenacity. When you are studying and encounter a dot point you don't fully understand, it is tempting to skip over it and tell



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yourself “I kind of get this, I should be fine”. Don’t. Who is this helping? It’s helping every other person that is competing with you. Don’t be complacent. Follow up on your mistakes and things you don’t know in order to understand them better. Everyone has shortcomings, they don’t disappear simply because you ignore them.

During your HSC, you are bound to encounter failure at some point. A common demotivating thought is “how can I recover from such a huge setback?” Although it may be difficult, avoid self-pity. Pitying yourself and doing less than you were before are not methods of recovery. You cannot control what has happened in the past, but you can control what you do from this point forward. Reflect on why you got a question wrong, or why you did poorly in an exam, identify the causative factors, and try to fix them in the lead up to your next try. I think this is one of the reasons why it is also important to have some extra-curricular activities and hobbies during Year 12, as they are great ways to divert your negative energy when it starts creeping up on you, allowing

you to refresh your mind and preventing you from burning out.

The great stoic philosopher Epictetus is quoted as saying “it is not what happens to you, but how you react to it that matters.” There may be no truer words than these ever uttered. Approach every aspect of your life, including learning and exams, with enthusiasm, or at least curiosity. Accept things that are outside your control, and capitalise on things that are within your control. Try to remember every little success, and try to view all the bad things as objectively and constructively as possible, no matter how large. Don’t define yourself by the HSC, keep up your social and extra-curricular activities, otherwise you will find it difficult to reset your thoughts and focus.

And above all, always have something to look forward to.

The 2019 HSC

From 2018 onwards, the HSC science syllabuses will change after a long 18 years with relatively

little modification. Here are the top four changes:

1. Concepts, not context: The new syllabus sees a return to a more rigorous teaching of science, focusing more on the core scientific concepts, rather than the historical context of the previous syllabus. In the past, a focus on the social context of science ironically meant that the top students were actually be distinguished by their ability to recall historical facts, rather than on their understanding of underlying sciences.

Consequently, there will be a stronger focus on learning scientific principles, theories and laws, with a greater emphasis on the mathematical content, particularly for Physics and Chemistry. This is actually a good thing for most students: if you understand the concepts and formulae properly, it will be easier to score top marks.

2. Depth Studies: A new component of the HSC are depth studies, which require students to investigate and research concepts

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in greater detail. Up to 15 hours of class time plus any additional time for independent study is provisioned for these depth studies, which will be mandatory for Year 11 and 12.

3. A greater focus on skills and understanding through practicals:

Although the syllabus does not prescribe any particular practical as mandatory, there will be more practical investigations and second hand data interpretations. Students are required to understand the concepts that the investigations demonstrate, rather than simply focus on methodology.

4. Removal of Option topics:

Previously, students (or schools) were free to choose one of four option topics in the final term. The new syllabus does away with this; all students will study the same course for the entirety of their final year.

Conclusion

Choosing a science in your HSC year will be a rewarding experience. It's more than understanding concepts in physics, chemistry or biology; it is about the pursuit of knowledge and the discovery of the unknown. Studying a science

subject is an effective way to develop a range of skills that will aid whatever career you choose. It develops effective communication, lateral thinking, critical appraisal, and research methods. And of course, if that isn't enough, remember that the sciences are amongst the highest scaling subjects and should positively impact your ATAR.

I hope this has convinced you that the sciences are conquerable subjects, and at Talent 100, we would love to be a part of your learning journey.



BREAKING DOWN THE PHYSICS & CHEMISTRY

Question Type	Calculations	Practicals
What it involves	<p>A Science exam will invariably involve some level of calculations. For example, calculate the final velocity of a ball dropped from a height of 10m under constant acceleration.</p> <p>The key is to hone your algebra skills in order to calculate the answer flawlessly, and even when you don't know how to, 'scab' as many marks as possible.</p> <p>You should really attempt to memorise all the formulae that are needed. Better students will take the further step of 'understanding' the formulae and develop a mistake-free process of performing calculations.</p>	<p>Above-average students have some idea of what goes on during these labs, but do not commit themselves to memorising the scientific method (Aim, Method, Results, Discussion, Conclusion).</p> <p>Top students understand how theory is applied in practicals and even know how to analyse their results in terms of reliability, accuracy and validity.</p> <p>Physics and Chemistry are experimental sciences, and as such, it is important that you are able to construct and understand experimental methods and discussion.</p>
Level of Achievement	<p>memorisation</p> <p><i>In 2019, there is less of a focus on memorisation...</i></p>	

NEW 2019 HSC EXAMS

Concepts & Explanations

Likewise, you should all know that a Science exam is going to ask you to explain, describe or apply some key theory. For instance, explain the difference between covalent and ionic bonding.

Most students know the general principles, but better students will understand the finer distinctions, exceptions, and how to explain concepts clearly and concisely.

Curve Balls

Curve-ball questions are designed to distinguish between those truly gifted (or prepared) students and those who are rote-learners.

The best students understand that examiners are asking you for application of reasoning to concisely relate the theory to the demands of the question. You need a strong understanding of concepts and good writing skills to answer these questions.

understanding of concept

...and more on understanding the concepts.

MEET THE MENTOR



MICHAEL LIU

School - Knox Grammar School

ATAR - 99.95

University - USYD Bachelor of
Science (Advanced) /
Doctor of Medicine

ACHIEVEMENTS

3rd in State for Chemistry, Dux of the School (Knox Grammar School), Academic Scholarship recipient, Outstanding Service to the School (Senior) Award, Da Vinci Decathlon National Champion 2013, International Runners-up 2013.

QUESTIONS

What were your secrets of success in Science?

To succeed in the Sciences, you need a thorough understanding of the content and skill in applying your knowledge. This takes lots of practice! The HSC is very much a test of endurance and you should consistently test yourself on exam-style questions. Practice explaining concepts to friends, family or in your own head as this will consolidate the content, help with memorisation and your ability to communicate effectively.

How did you deal with stress and challenges?

The first step was to accept that stress and challenges are completely normal for every student. I found it helpful to stop and just write down everything that was causing me stress. Then, systematically work through

each and identify what was in my control. I would try to break something confronting into more manageable goals to achieve and it was incredibly satisfying to gradually tick them off. Never be afraid to turn to your peers, teachers, family or mentors for support.

What is your advice for HSC students?

Do not be discouraged by a bad mark! I often have students losing motivation after getting a disappointing result, but bad marks happen to everyone. I certainly had a lot of trip-ups during my HSC...The important thing is to learn from these experiences and take the opportunity to receive feedback. Keep applying yourself and make sure you do not make the same mistakes again. Make use of your teachers, mentors and all the resources available to help you succeed.

Why do you like teaching at Talent 100?

I love the environment that Talent 100 builds in its learning centres which really facilitates collaboration and bonding. Students form friendships with one another and establish a great rapport with the mentors. Its great seeing students so eager to learn, constantly asking advice from their peers and staff. I have been fortunate to witness staggering improvements and outstanding results in my time here. It is a great atmosphere to work in.

TALENT'S HSC SUBJECT GUIDE

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At Talent 100, we've helped thousands of students achieve exceptional HSC results. We're so confident we have the most effective system of tutoring, we're offering you **FREE TRIALS for any of our courses.**

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