

How to get into Cambridge or other top UK (Russell Group) Universities: *The inside story*

The take home message is “there is *no* inside¹ story”; there is no mystery. Top universities (Russell Group, including Oxbridge) make public² (for free) what they value in students, what students need in order to flourish at university, how students should prepare for admissions (tests and interviews), how to make the transition from school, and do well in HE. See below how you should inform and prepare yourself for Cambridge! But it is the same for STEM³ in all universities.

Outreach & inspiration: find out what is great about Physics, Engineering, Maths, Chemistry, . . . Read, follow popular lectures (most famously by Brian Cox, but by many others), speak to

professionals. Get an idea of how these subjects are applied and what they lead to.

Enormously inspiring, and with particularly deep insights into physical and other phenomena, are the subjects that **Steve Mould** turns to:

<http://stevemould.com/>

and see also his YouTube films:

<https://www.youtube.com/user/steventhebrave>

There is much available in this quite inspirational sphere, but be clear about what you then also need:

Empowerment: to realise your aspirations in physics, you need to get into a good university and then succeed there. Universities are interested in the skills with which you can express your insights and understanding of science and maths. Universities are urged to admit on *intrinsic* potential (ability and creativity). If it does exist, it is hard to assess in the absence of clear self-expression. If you do have such potential subject skills, then fluency in maths, analytic ability in problems, drawing diagrams, good work habits, . . . are all also vital to realise this potential. You need to cultivate all these abilities to empower yourself.

Top Tips

1. Don't pay for expensive courses – these are NOT run by the University. You can find much advice and help for free.
2. Take care to choose the right combination of subjects at A-level (or equivalent)
3. Practise maths and physics **every** day as if it were the piano or football: see below.
4. Use ALL information that is available – example online tests, example videos on the University website (<https://www.youtube.com/watch?v=dUwN6GI-OEQ>)

¹ I am a professor of theoretical physics in the University of Cambridge, a fellow of a college (Corpus Christi), have lectured many of the major courses in physics and have taught them at college level (supervisions – tutorials in Oxford). With others in 1992, I revised the 3-year physics syllabus to become the 4-year course that we have today. I have done admissions in my College since 1986. I am seriously concerned about the process and equitability of admissions, so much so that I co-direct a large government project to increase the physics skills and knowledge, and therefore university opportunities, of school students in STEM. One might say that I am an insider!

² I am frequently contradicted by teachers and told what “the real secret is”, “what dons are actually looking for”! Given there is no mystery, I conclude there are some powerful (mis)beliefs out there in the face of the simple facts revealed here.

³ STEM = science, technology, engineering, mathematics.

The good news is that there are clear steps that you can follow:

1. During your lower 6th year, visit classes that are run by universities to give you a flavour of what a subject is like at university level. For example, for Cambridge see: <http://www.undergraduate.study.cam.ac.uk/events/masterclasses>
Events by the Central Admissions Office (CAO) of the University, or run by the constituent colleges, are usually free, or have at most a nominal fee for covering essential expenses. A web search quickly reveals the large range of UK universities that run masterclasses of various character.
2. Make sure you are studying the right subjects at school! A-level Maths is compulsory for all physical natural sciences in Cambridge, and strongly advised for any science. For some clear advice, given by a college admissions tutor (who happens to be a physicist himself), see: <https://www.corpus.cam.ac.uk/subjects/natural-sciences-physical>
3. Skills, fluency and confidence in your key subject areas and mathematics are built up *slowly*: Start *early* in the lower 6th doing regular problem solving. Do it regularly as you would do piano or football practice. It is the only way to learn, and it is how you will be assessed, not only at admissions, but also at university. You will find the physics, chemistry and maths problems needed for physics, engineering and higher maths itself (with unlimited practice, hints and concepts), on Isaac – a Government STEM empowerment project based in the University of Cambridge. See the OPALs⁴ isaacphysics.org and isaacchemistry.org for physics and chemistry respectively; both also have maths sections. Usage is free. Register, and your activities are accumulated for you as a portfolio. It is private to you, unless you choose to share specific work with teachers (e.g. homework). Declare your school, and you will be told of events in your area. Register your DoB and gender⁵, and Isaac will notify you of events just for you. There are questions to select from a question filter (more to stretch you), and also from accompanying course books⁶ coupled to the Isaac OPAL (these will do your A-level results a lot of good). Marking and help is automatic and tailored to you. You can submit your portfolio to attend extra courses – see below the “SPC”. Maximally, 100,000 problems a day are currently being attempted by students. Levels span late GCSE to early university, levels 1 – 6. A GCSE physics book was released September, 2017. All its problems are answerable on-line. The Isaac Maths book presents all the Isaac Maths that is available to answer on-line – go to isaacphysics.org and click the questions tab, then select only the maths hexagon and then choose field below it.
4. The period mid-August to mid-December (of your upper 6th year) is vital for detailed preparation for admissions tests and interviews. An admissions test was adopted by

General rule of thumb:

If you find a class that appears to be from the University but is **very expensive**, then it is **not** from the University, (or it is a University summer school directed at adult learners). **Look again!**

⁴ OPAL = **O**pen **P**latform for **A**ctive Learning

⁵ See below, “Women in STEM” opportunities.

⁶ These are available at cost price (£1). See: www.isaacbooks.org

Cambridge in 2016. A sample test and 2016 and 2017's past papers, along with other information, is available on the web.

<http://www.undergraduate.study.cam.ac.uk/courses/natural-sciences#entry-requirements>

Oxford has had such a test for several years: See past Oxford Physics Aptitude Test papers for excellent practice and an idea of level:

<https://www2.physics.ox.ac.uk/study-here/undergraduates/applications/physics-aptitude-test-pat/pat-past-papers>

They are half physics, half mathematics and are for entry to both Physics and to Engineering.

5. For the critical weeks before interview, Isaac provides advice, and also questions specifically to practise fluency and confidence in physics and mathematics at the appropriate level for interview. See:

https://isaacphysics.org/exam_uni_help

https://isaacphysics.org/pages/fast_track_as

See part 1 and part 2 of this latter page. It is essential that you *do* the material⁷. You should also be practising maths and physics questions, at least at levels 4 & 5 from the Isaac question filter, as further preparation.

6. You should look at various college web sites for interview guidance and past college tests, if applicable. If the college you are applying for does not have another test at interview, it will still be good practice to do sample tests to get to the right level. It is a bit like training for a race. Colleges will look at your past performance, but you will be judged on what you are able to do in the November/December that you apply. See for instance examples of physics and maths problems discussed at interview:

http://www.tcm.phy.cam.ac.uk/~mw141/Corpus/sample_questions.pdf

and also a sample test paper from earlier years when Corpus had a college test:

http://www.tcm.phy.cam.ac.uk/~mw141/Corpus/Dec_09.pdf

For admissions practice and advice specifically in the engineering context, but of course building on and beyond school physics and maths, see:

<http://i-want-to-study-engineering.org/>

But do look more widely than these sites! See especially “Professor Povey’s Perplexing Problems: Pre-University Physics and Maths Puzzles with Solutions”, an outstanding book from Oxford Engineering professor, Thomas Povey.

7. **Look for additional activities** that will build your skills and confidence. For instance, the Maths, Physics, Chemistry and other Olympiads are an excellent source of problems, competition and resources of past papers. The Cambridge Chemistry Challenge also has written papers, and additionally monthly challenges, for Lower 6th students: <http://www.c3l6.org/>

Each year in late June, there is the Senior Physics Challenge; this residential lasts 4 days and has about 45 lower 6th students doing advanced theory and experiment. Students are accommodated in a college. Attendance is free and is on the basis of

⁷ If you want further information as to why the “doing” is so important, see my comments about a lecture on this subject: <http://www.cambridgeassessment.org.uk/blog/reflections-on-curricular-illusions/>

problem solving history. See <http://www-spc.phy.cam.ac.uk/> where additional resources and information is available.

Women in STEM masterclasses are very valuable – not just for the teaching you will receive, but you will meet other talented young women and discover they have the same interests and aspirations as you do. It is cool to be good at science! A past example can be found at

<http://www.corpus.cam.ac.uk/news/stem-women-summer-school-27-29-june-2016/> and more are planned in this and other universities.

Colleges offer masterclasses themselves, with residential accommodation and at notional cost, where there is a specialist component, including tuition at laboratories. Look for college offerings, for instance “CCPE” (Cambridge College Physics Experience).

8. Cambridge and Oxford interview candidates in December as a way of assessing their academic abilities and potential. In STEM subject interviews, the emphasis will be almost entirely on problem solving, and you are often asked to work through mathematics or scientific problems with guidance from the interviewers. These are modelled on 'supervisions' or 'tutorials', the small group teaching session that form an important part of the learning process at these universities. Interviewers are simply looking for how well a student can think about the problem at hand, how they take on board hints, and whether they can apply what they have learned in their studies to challenging problems. The best way to prepare is to practise problems in your own time, for instance by using the *isaacphysics* and *isaacchemistry* websites, or other resources mentioned above.

If you are selected for an interview, these videos produced by Cambridge give a very realistic account of how the interviews are conducted:

<https://www.youtube.com/watch?v=dUwN6GI-0EQ>

<http://www.emma.cam.ac.uk/admissions/video/interviews/>

Other top universities, for instance Imperial College, also interview candidates on technical aspects of the subject for exactly the same reasons. Furthermore, scholarships and other support are available on the basis of technical accomplishment; see for instance

[Imperial College-presidents-scholarships](#)

Very substantial help, on the basis of entry exams, is also available to students at [Southampton-scholarships](#)

(where sample papers are also available), to name but two further examples.

Professor Mark Warner

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