

Hello Year 11's!

If you are receiving this, then you have applied to do the best A-Level: Physics.

You may be wondering what you can do to prepare, or are eager to get stuck in so I've compiled some things to over the coming weeks – not homework, just activities to get you thinking in the way required to tackle A-Level physics.



Week 1: The most expensive substance ever created – Research Task (Easy)

Week 2: 'What even is physics'? – Research Task (Hard)

Week 3: Dimensions, flatlanders and tesseracts – Theatre of the mind challenge

Week 4: 'What is something' - Video and Question Task

Week 5: 'Head start to A-Level Physics' – free kindle book and Self-reflection Task

- 1) Easy research task to start you off here – there's something in the universe which is valued at hundreds of trillions of pounds per gram (approx. $\pounds 1 \sim 10^{15}$ /gram for fans of standard form). It's created in the coldest place in the known universe and it could instantly vapourise anything that comes into contact with it. I would like you to email me a sentence for each of the 5 W's – Who, What, Why, When, how.
- 2) This one's not so easy...I want you to research something. There are 7 of them. They are French. You've known some of them for a while now, others you've never heard of. They are fundamental to physics. Once you think you've found them drop me an email with a list of them and a little (sentence or two) background information about each one.
- 3) Bit maths-y this one: we are going to try and imagine 4 dimensions (why stop there, though?). 4 Spatial dimensions, let's not even get into temporal dimensions...
Let's build up a set of rules for visualising dimensions, imagining we have the World's most sharpened pencil and a large piece of paper in front of us. Feel free to follow along in your head or actually sketch out what is going on, for bonus points. A light tap down on the pencil would yield, in theory, a 0-dimensional object. No width or height in this theoretical scenario. How do we get to 1 dimension? Well we need a connector (technically a line segment) joining 2 copies of our original 0-dimensional objects. Voila! 1 dimension. Let's carry on: now take 2 copies of our 1-dimensional objects (lines) and connect them at each vertex (corner) with another 1-dimensional object. Boom: a square! Can you see where this is going? Carry on the same pattern to get to 3-dimensions and then take a leap into 4 dimensions after that! (a 4 dimensional cube is called a tesseract)
Brain hurt? Good – with physics you have to sometimes stretch your imagination in new ways to understand new concepts, e.g. in string theory there are 10+1 dimensions. <https://www.youtube.com/watch?v=Da-2h2B4faU>
From the right perspective a line is the shadow of a square; a square the shadow of a cube and therefore a cube is just part of the shadow of a tesseract, a tesseract could look like this, therefore: <https://en.wikipedia.org/wiki/File:Tesseract.gif> maybe that's enough shape talk for the moment...
- 4) Hopefully you have a better picture of the scope of physics – it encompasses EVERYTHING and it constantly pushing the boundaries of humanity's knowledge. But surely there must be some accepted facts within physics which are just true? Nope, we've only just scratched the surface and things are about to get real weird. Strap in and have a watch of this: <https://www.youtube.com/watch?v=X9otDixAtFw>. We are not in GCSE land anymore! Research the four fundamental forces and write a one sentence explanation that a Year 8 student could understand.
- 5) A book we give out to students 'Head start to A-Level Physics' is now free for the Kindle app – this is usually part of the 'summer assignment' given to Year 11's. It's very dry and is just drilling home the fundamentals of GCSE Physics. I would like you to have a look at the book email me one topic you think you are strong at

and one topic you want to get even better at, I will give you some general strategies for that area.

<https://www.amazon.co.uk/Head-Start-level-Physics-Level-ebook/dp/B00VE2NII4>

Let's see how we go with those tasks, try to stick to the week by week outline, if you are craving more physics see the appendix at the end of this document.

I've included a few common Q&A's about A-Level Physics – feel free to get in touch if you have questions or queries.

Warmest regards,

Mr Whitaker & Mr McLean, the Physics Team

Jan.whi@sns.hackney.sch.uk

Q&A's

Q: Is A-level physics difficult/hard?

A: It is one of the most challenging and rewarding A-levels. It has the biggest difference between GCSE and A-Level grades (how likely a student with a certain grade at GCSE will maintain or improve that grade at A-Level) don't expect to get an A just because you got a 9/8/7 at GCSE! It has the hardest exams and the most conceptually difficult ideas. To succeed within A-Level physics requires determination, hard work and imagination. That is the reason it is so valued later on, aside from the actual content and learning process, an A-Level in physics shows you are not afraid of a challenge and that you can do well under difficult circumstances.

Q: I'm not going to be doing Further Maths at A-Level, is this an issue?

A: No, there is no direct overlap in content between the two courses. However, you are training the same set of skills and will develop better habits more quickly. Most of our students that achieve A's do Further Maths, but correlation does not mean causation.*

Q: I'm not going to be doing Maths at A-level, is this an issue?

A: There is a large overlap between the two courses. Not only are you training a similar set of skills but you are learning the same content from different perspectives. You will have to be doing additional work if you don't take A-Level Maths to keep pace with some parts of the course. In other 6th Forms Maths A-Level is compulsory for Physics A-Level.

Q: How much is A-Level Physics like GCSE (but harder)?

A: They share some similar ideas but GCSE is focused on memorising equations, covering lots of things in very little detail and not linking together different topics. With A-Level there are some huge, new topics such as Quantum Physics, Particle Physics, Astrophysics, gravitational fields, etc. Every topic starts to link and blend into each other beautifully.

Q: I only did combined science for GCSE; will this be an issue?

A: Me too! No as long you have a keen interest and are willing to put hard work in this won't be an issue – you missed a 'Space Science' module and a few things about magnetism that are difficult to get first time round anyway. If you want to do well and are determined to give it your all – you can succeed at A-Level.

Q: Are there any trips?

A: We go to University College London to experience university lecturers from some of the leading scientists around the World. I have built a partnership with Highgate school who offer a range of activities and events throughout the year. There is a trip to Geneva, Switzerland to visit the World's largest machine – the Large Hadron Collider at CERN.

Q: What support is available if I'm struggling?

A: We are with you every step of the way and know that there are some very difficult concepts within the course and at times it can feel overwhelming. I offer one-on-one sessions that work around your (and my!) timetable. We receive

excellent student feedback across all aspects of the A-Level course but in particular our availability for questions or even just to talk through a concept you are finding difficult is often mentioned.

Appendix - bonus extra awesome Physics stuff:

Books (order increasing levels of intensity):

- *A Short History of Nearly Everything* by Bill Bryson - A modern classic. Popular science writing at its best.
- *Surely You're Joking Mr Feynman: Adventures of a Curious Character* by Ralph Leighton and Richard Feynman – Physics personified, explores his work on particle physics, atomic bombs and playing the bongos.
- *Why don't penguins' feet freeze?* By NewScientist – speaking of which Mr Hershkowitz has wangled a log in that students can use to access the entire archive of New Scientists online, the annual compilations are a good place to start as the volume of content can be overwhelming at first (Login: jes.her@sns.hackney.sch.uk Password: stokey123)
- *Just Six Numbers* by Martin Rees – Astronomer Royal explores the impossibility of our existence and the 6 fundamental universal constants – a classic UCAS statement book!
- *The Feynman Lectures in Physics* – there will never be a better explanation of physics in its entirety in our lifetime: <https://www.feynmanlectures.caltech.edu/> (Free)

Online Lectures

- Lectures from Walter Lewin (e.g. <https://www.youtube.com/playlist?list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e>) and Richard Feynman (e.g. <https://www.youtube.com/watch?v=QRE0GxT6Zbw&list=PLlom0wCJILFyHHvTAAUwbaRUv72jz8mjT>) are things of beauty.

Thoroughly excellent YouTube Channels:

- Veritasium – everyday phenomena explained through physics
- In a nutshell (Kurzgesagt) – excellent explanations of the coolest parts of physics
- Minutephysics – simple explanations of complicated concepts
- PhysicsGirl – excellent interviews, tours of famous physics places and engaging physics

Thoroughly excellent Physics Simulation Games

- Kerbal Space Program – developed in partnership with NASA, comprehensive and hyper-realistic
- Universe Sandbox – educational space gravity simulator