

Developing maths skills for A level physics

As part of this online self-study course, you will be focusing on developing your maths skills for use with Physics A level, in areas such as: significant figures, standard form, units and prefixes, interpreting data from graphs and handling vectors.

Most of these skills you will already be familiar with, as you have been developing them throughout your GCSEs. It is helpful now to spend some time practising and improving these skills, to ensure a strong and confident start to your A level work in September.

Resources:

<https://isaacphysics.org/>

Isaac Physics has lots of example questions – you can practice skills or move onto to more conceptual problem solving. Many of the problems include “hints” with links to notes on the various concepts or explanatory videos.

<https://www.alevelphysicsonline.com/>

Lots of useful resources here that you can use now and throughout your A level course. You can log in with the CHG account to access more resources. Use the email address physics@kechg.org.uk as user ID and the password *Ogden*.

Help and support:

If you have any questions about the work outlined here, please email r.nicholson@kechg.org.uk for help and support.

Lesson 1: Units, dimensions, standard form and orders of magnitude

- Read the notes in the attached files *Units and dimensions.pdf* and *Scale of the Universe.pdf* and try the practice questions. This should be a re-cap of information that you already know but it is good to practice, as you will need to be confident working with very large and very small numbers at A level, using standard form and manipulating units.
- If you are not confident using standard form, take a look at these videos on the topic: <https://www.youtube.com/playlist?list=PL3F89F1E677F1C1D0>
- For more information on quantities, units and prefixes look at:
- <https://www.alevelphysicsonline.com/quantities-and-units>
- Isaac Physics for extra practice on standard form: https://isaacphysics.org/gameboards#phys19_a3

Lesson 2: Uncertainties and significant figures

- Read the file *Uncertainties and significant figures.pdf* and try the practice questions.
- For more practice on significant figures go to Isaac Physics: https://isaacphysics.org/questions/sig_fig_prac?board=sig_fig_prac_mastery (these questions have been set as an assignment).
- Watch the video on Accuracy, Precision, Error and Uncertainty at: <https://www.alevelphysicsonline.com/practical-skills> and write down definitions for these terms.

- On the same page, watch the videos on absolute uncertainty and percentage uncertainty and make sure you are clear on the difference. Try, for example, measuring the length and diameter with a 15cm ruler. The absolute uncertainty is the same for each value (1mm) but the percentage uncertainty is very different - why?
- Watch the video about finding the percentage uncertainty for multiple (repeated) measurements and write down a definition of how to do this. Try this out yourself - hold a sheet of A4 paper over your head and use your phone to time how long it takes for it to fall to the floor. Repeat 3 times and find the mean, the range and the uncertainty.

Lesson 3: Distance-time and speed-time graphs

Building on your GCSE knowledge, you will need to be able to understand and interpret distance-time and speed-time graphs, using the gradient of the distance-time graph to calculate speed, the gradient of the speed-time graph to calculate acceleration and the area under the speed-time graph to calculate distance travelled.

- Read through the notes, *Motion.pdf*, and have a go at all the practice questions.

Lesson 4: More practice with graphs

As part of A level physics, you will need to be able to interpret graphs, calculating gradients and areas under a graph and linking these to physical quantities.

- On Isaac Physics, try the following practice questions:
https://isaacphysics.org/gameboards#phys19_a5
It's worth having a go with these - one of the things that Isaac emphasises is thinking about units. Remember that a gradient always has a unit (which depends on the units on the y-axis and the units on the x-axis) and it is a good habit to get into to always think about what the units on a gradient will be.
- On Isaac Physics, try: https://isaacphysics.org/gameboards#phys19_a7 for practice on finding the area under a graph. Again, you will need to think about significant figures and units - for the units on an area you need to multiply the units on the x and y axes.

Lesson 5: Resultant forces

Building on our GCSE knowledge, the mechanics topic in A level looks in detail at static forces. You will need to be able to manipulate vectors: adding vectors to calculate resultant forces and also be able to resolving vectors into two perpendicular components. We'll start with this lesson, looking at resultant forces.

- Read the notes *Resultant forces.pdf* and have a go at the practice questions.
- If you have a printer, then print out the file *Parallelogram of forces examples.pdf* and have a go at the examples. There is one sheet with forces drawn on graph paper and to scale (make sure you print sized 100% so you don't change the scale) - and another version of this with completed answers so you can check your work.
- If you don't have a printer, you can have a go at drawing your own scale diagrams - shown in *force diagrams - video example sheet.pdf* - on plain or lined paper (you'll need a ruler and a protractor). The video here:

<https://www.youtube.com/watch?v=UQfNF-i8R7sFoc> shows you how to do this step-by-step if you are not sure how.

Lesson 6: Resolving forces

- First, have a go at the examples in *Resolving Forces.doc*. There are some notes included to explain the theory, but you can also use the video here <https://www.youtube.com/watch?v=rbtliGSsE1A> to help you work through the examples if you are not sure how to do this.
- Then, try the questions in *Resolving Forces Further Practice.doc* - you can check your answers with the mark scheme included in the document.
- Read the notes *Resolving forces.pdf* and have a go at the practice questions.