Contents

Introduction

Welcome to physics A level! A course which is both exciting and challenging and will enable you to find out more about how the physical world works in a far more detailed way than you learnt at GCSE. We'll be asking questions about why things behave as they do, from the tiniest particle to the entire Universe! We in the Woodhouse Physics Department are incredibly excited to be teaching you next year and we're sure you'll find the course fascinating and enjoyable.

What will I learn?

If you'd like some more information on what exactly the course covers, we encourage you to look at the AQA physics A level specification. We'll be referring to this specification throughout the course so do take a few minutes to familiarise yourself with it.

In brief, over the two years we'll be learning the following

Year 1	Year 2
1 Measurements and their errors 2 Particles and radiation 3 Waves 4 Mechanics and materials 5 Electricity	6 Further mechanics and thermal 7 Fields and their consequences physics 8 Nuclear physics
	One optional topic from: 9 Astrophysics 10 Medical physics 11 Engineering physics 12 Turning points in physics 13 Electronics

TASK 1: Click on the specification link and briefly skim through the topics on the specification. Are there any areas we'll be covering which surprise you? Make a quick note, including the topic(s) you're most looking forward to.

Optional: If you'd like to see the specification in more detail, we recommend the website A-level physics support where you'll be able to see, in detail, the material we'll be studying over the course.

Summer Preparation Work

Physics is the most mathematical science as it's the most precise; physicists focus on the aspects of nature where we *can* find equations which perfectly fit what happens. It's therefore important that you're confident with mathematical skills such as rearranging equations and manipulating large and small numbers. Some of the work below helps you improve these skills in a physics context but we would also like you start investigating some of the amazing ideas and concepts you will be meeting over the next two years. Being able to independently research your subject is an important aspect of studying at A level.

The activities below are expected to take **12-15 hours** in total and should put you in a strong position when you begin the course in September. We recommend you do the work in short bursts throughout the Summer rather than trying to cram it at the end – this will give you the best chance of remembering the material and save you from having to learn it all over again!

Preparation Work for Physics

To cover these skills you will be using these two websites:

Physics Online – a website that covers the content of our AQA syllabus through hundreds of videos. You can access all of the Year 12 content without a password. The creator of the site, Lewis Matheson, has also made a Youtube video with advice to those coming into Year 12 study physics, which is very informative.

Seneca Learning – you may already be familiar with this website. This is an interactive learning platform where you can learn at your own pace. This also has end of topic tests so you can assess how well you have understood the material.

TASK 2**:** Click the Seneca Learning link and create a login for yourself. Use your actual first and second names rather than an alias so your new teacher can identify your work. If the link doesn't take you there directly, you can use the class code: dh1fefgv63

The assignments for you to complete are on Seneca Learning and are as follows:

1. Units and Prefixes

Units are deceptively important and a key prerequisite for an understanding of how we measure phenomena and standardise our findings with scientists across the globe.

TASK 3: Watch this video and then work through the unit (Sections 1.1.1 and 1.1.2) and complete the end of topic test (Section 1.1.3) in Seneca.

Optional: when you're done, you can read this entertaining account of some of the weird and wonderful units which scientists have adopted over the years.

2. Measurements and Errors

A physicist is required not only to understand data and measurements taken from experiments, but also the limitations of the data. The limitations give us an idea of how well we can trust the data and any conclusions made from the experiments.

In addition, physicists and engineers become very good at making good approximations of quantities that might, at first, seem impossible to estimate. They do this using their knowledge of physics but also by making reasonable assumptions. The key is also to keep the calculations simple by working to one significant figure or even the nearest power of ten or order of magnitude. This is a skill that you may not have come across but one that you will find very useful and not just in your physics A level

TASK 4**:** Watch the video and then try out your estimation skills on the questions below**.**

Estimation

a. How long would it take to count to a billion?
b. How many hair follicles are there on a human head?
c. How hot does a brake disc get as the car comes to rest?
d. How many human lifetimes would pass on a journey to the nearest star to the Sun?

Optional: Create an estimation problem of your own and solve it! The reknowned physicist Enrico Fermi created a whole class of these estimation problems including his famous estimation of the number of piano tuners in New York.

3. Scalars and Vectors

You will have learned about scalars and vectors in GCSE, but in A-level you get to appreciate the explanatory power of these concepts and just how central they are to an understanding of a variety of physical phenomena.

TASK 5: Work through sections 1.1.4 to 1.1.7 (including the end of topic test) in Seneca.

Optional: Once you've completed the above, watch this video about how the use and estimation of measurement uncertainties have led to a so-called "crisis" in cosmology.

TASK 6: Watch this video and then attempt sections 4.1.1 to 4.1.3, including the end of topic test.

4. Motion in a Straight Line

Change is a property common to everything in the Universe, indeed the idea of time would be meaningless without it. These changes result from the motion of material, often sub-microscopic and beyond our senses. In order study the Universe, we therefore need to build up a picture of how things move, starting from motion in a straight line to more complex examples to projectiles thrown in the air.

TASK 7: Watch this video and then attempt sections 4.1.7 to 4.1.10 of the Seneca assignment, including the end of topic test.

Optional: Design and carry out an experiment to measure the value of g (the acceleration due to gravity) by dropping an object. Does the size of the object make a difference to the value? Suggest which factors affect your measure value for g and how accurate your value for g is.

Hint: the camera app on your phone will be useful here!

Optional: If you're unfamiliar with standard form, use the following videos to make notes

Significant figures

When you calculate an answer in physics you cannot express that answer to more significant figures than the data you have used to calculate it.

Use of significant figures

Standard form

The nearest star to the Earth (ignoring the Sun) is Alpha-Centauri which is about 40000000000000000m distant. The diameter of an atomic nucleus is about 0.0000000000000015 m. Physics concerns itself with the very large as well as the very small and expressing numbers in this way is extremely impractical! But there is a better way.

Standard form and significant figures

Independent Research

Curiosity is usually the primary reason for studying physics and as part of your summer work you can research a question from physics that interests you. Having come up with an answer (or at least a little bit more understanding!) we'd like you to report back your findings to your teacher and class in the form of a poster or a PowerPoint presentation. Impress us!

TASK 8: **Prepare a PowerPoint presentation (no more than 6 slides) or a poster of your research on your chosen topic**

This will be presented in your first few physics lessons in college. You can either choose from the list of suggestions below or come up with your own question.

- What are gravitational waves and how will they change astronomy?
- Why do hot liquids freeze more quickly than cold?
- How close are we to using nuclear fusion as a power source?
- How does a quantum computer work?
- How can physics solve global warming?
- Why is it impossible to travel faster than light?
- What are muons and why are they so useful?
- What is superconductivity?
- What is the shape of the Universe?

...or choose your own!

Poster guidance

Scientific posters are usually presented at conferences as the first way of sharing research. They would normally be A0 or A1 size but try to fit your research onto an A3 size poster. Below is a link to some advice. You can format your poster as a PowerPoint slide (there is no need to print it).

Tips for making scientific posters

The best posters will be proudly displayed on our walls!

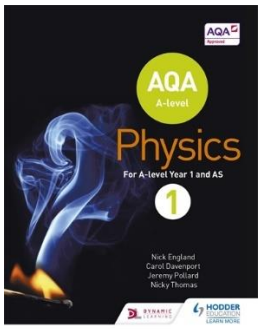
Presentation guidance

The presentation should explain your question and summarise your research to give the answer. It should be aimed at a scientific non-expert – your classmates. You can use software such as PowerPoint but **do not copy and paste lots of text from the internet!**

Other Recommended Resources

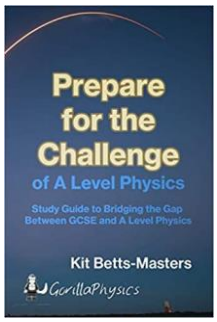
Books

We'll supply you with a copy of a year 1 textbook (shown below), so there's no need to go out and buy one.



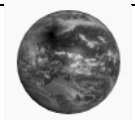
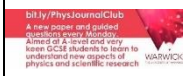
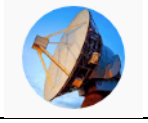
However, for more reading material, there are several suggestions on this page. New popular physics books are coming out all the time so there are plenty of others to choose from as well – search around!

If you're looking for a book to help you transition from GCSE to A-level then we recommend a book by Kit Betts Masters, currently available for £4.95 and can be read in a day. It also gives suggestions for experiments you can try at home over summer! Here's a link to the book.



Websites

There are many brilliant websites/channels/podcasts where you can research your topic and learn about the physics you'll be covering in more depth:

minutephysics		The Royal Institution		Physics World	
Veritasium		Dr Becky		The Life Scientific	
Sixty Symbols		Warwick Physics Journal Club		The Physics Hypertextbook	
Backstage Science		The Infinite Monkey Cage		In Our Time	

Summary checklist

Here's a summary checklist of all the tasks above:

Task	To do	Optional	Tick when complete
PREPARATION			
1	Click on the specification link and briefly skim through the topics on the specification. Are there any areas we'll be covering which surprise you? Make a quick note, including the topic(s) you're most looking forward to.	If you'd like to see the specification in more detail, we recommend the website A-level physics support where you'll be able to see, in detail, the material we'll be studying over the course.	
2	Click the Seneca Learning link and create a login for yourself. Use your actual first and second names rather than an alias so your new teacher can identify your work.	Extension work can be found here	
3	Watch this video and then work through the unit (Sections 1.1.1 and 1.1.2) and complete the end of topic test (Section 1.1.3) in Seneca.	Read this entertaining account of some of the weird and wonderful units which scientists have adopted over the years.	
4	Watch the video and then try out your estimation skills on the questions a-d as described in the text in the Task box. Estimation	Create an estimation problem of your own and solve it!	
5	Work through sections 1.1.4 to 1.1.7 (including the end of topic test) in Seneca.	Watch this video about how the use and estimation of measurement uncertainties have led to a so-called "crisis" in cosmology	
6	Watch this video and then attempt sections 4.1.1 to 4.1.3, including the end of topic test.		
7	Watch this video and then attempt sections 4.1.7 to 4.1.10 of the Seneca assignment, including the end of topic test.	Design and carry out an experiment to measure the value of g (the acceleration due to gravity) by dropping an object. Does the size of the object make a difference to the value? Suggest which factors affect your measure value for g and how accurate your value for g is.	
INDEPENDENT RESEARCH			
8	Prepare a PowerPoint presentation (no more than 6 slides) or a poster of your research on your chosen topic		