

**Physics A Level Transition Pack**

**To start the A level course September 2020**

At Teignmouth Community School we study the OCR A Specification qualification. From the birth and death of stars to the fleeting interactions of tiny particles, Physics studies how our world works. To do this it uses ideas ranging from Force and Energy, easily understood and every day, to Strangeness and Charm, rather more abstract and fanciful! It is a fascinating subject, driven by the desire to find out how and why matter behaves the way it does.

As you progress through the course you will build on your knowledge of the laws of Physics, applying your understanding to solve problems on topics ranging from sub-atomic particles to the entire universe. Physics is not only interesting, it is also highly marketable. With an A level in Physics you have proved that you possess a wide range of Key Skills, exactly what employers and universities are looking for today. Indeed there can be few subjects at A level that cover such a wide range of transferable skills – from the use of IT in data-logging experiments; to the numerical skills that are the bedrock of the subject, essential in problem-solving and in practical work; to skill in written expression needed to produce clear, concise explanations.

**Independent Learning Task:**

Over the summer holidays you are expected to complete the following independent learning task to show that you are committed to taking the course. This work will help your teachers to assess your prior knowledge and will help you and your teacher set personal targets for improvement. It will also contribute to the judgment made during the probation period in September.

**The work should be completed by your first Physics lesson in September.**



**Pre-Knowledge Topics**

Below are ten topics that are essential foundations for you study of A-Level Physics. Each topics has example questions and links where you can find our more information as you prepare for next year.

**Symbols and Prefixes**

|  |  |  |
| --- | --- | --- |
| **Prefix** | **Symbol** | **Power of ten** |
| Nano | n | x 10-9 |
| Micro | μ | x 10-6 |
| Milli | m | x 10-3 |
| Centi | c | x 10-2 |
| Kilo | k | x 103  |
| Mega | M | x 106 |
| Giga | G | x 109 |

At A level, unlike GCSE, you need to remember all symbols, units and prefixes. Below is a list of quantities you may have already come across and will be using during your A level course

|  |  |  |
| --- | --- | --- |
| **Quantity** | **Symbol** | **Unit** |
| Velocity | v | ms-1 |
| Acceleration | a | ms-2 |
| Time  | t | S |
| Force | F | N |
| Resistance | R | Ω |
| Potential difference | V | V |
| Current | I | A |
| Energy | E or W | J |
| Pressure | P | Pa |
| Momentum | p | kgms-1 |
| Power | P | W |
| Density | *ρ* | kgm-3 |
| Charge | Q | C |

Solve the following:

1. How many metres in 2.4 km?
2. How many joules in 8.1 MJ?
3. Convert 326 GW into W.
4. Convert 54 600 mm into m.
5. How many grams in 240 kg?
6. Convert 0.18 nm into m.
7. Convert 632 nm into m. Express in standard form.
8. Convert 1002 mV into V. Express in standard form.
9. How many eV in 0.511 MeV? Express in standard form.
10. How many m in 11 km? Express in standard form.

**Standard Form**

At A level quantity will be written in standard form, and it is expected that your answers will be too.

This means answers should be written as ….x 10y. E.g. for an answer of 1200kg we would write 1.2 x 103kg. For more information visit: <https://revisionmaths.com/gcse-maths-revision/number/standard-form>

1. Write 2530 in standard form.
2. Write 280 in standard form.
3. Write 0.77 in standard form.
4. Write 0.0091 in standard form.
5. Write 1 872 000 in standard form.
6. Write 12.2 in standard form.
7. Write 2.4 x 10 2 as a normal number.
8. Write 3.505 x 10 1 as a normal number.
9. Write 8.31 x 10 6 as a normal number.
10. Write 6.002 x 10 2 as a normal number.
11. Write 1.5 x 10-4 as a normal number.
12. Write 4.3 x 103 as a normal number.

**Rearranging formulae**

This is something you will have done at GCSE and it is crucial you master it for success at A level. For a recap of GCSE watch the following links:

[https://portal.uea.ac.uk/documents/6207125/8194887/steps+into+algebra+rearranging+equations.pdf](https://portal.uea.ac.uk/documents/6207125/8194887/steps%2Binto%2Balgebra%2Brearranging%2Bequations.pdf)

<https://www.youtube.com/watch?v=YbzRXkZS_Eg>

Rearrange the following:

1. E=m x g x h to find h
2. Q= I x t to find I
3. E = ½ m v2 to find m
4. E = ½ m v2 to find v
5. v = u + at to find u
6. v = u + at to find a
7. v2 = u2 +2as to find s
8. v2 = u2 +2as to find u

**Significant figures**

At A level you will be expected to use an appropriate number of significant figures in your answers. The number of significant figures you should use is the same as the number of significant figures in the data you are given. You can never be more precise than the data you are given so if that is given to 3 significant your answer should be too. E.g. Distance = 8.24m, time = 1.23s therefore speed = 6.75m/s

The website below summarises the rules and how to round correctly.

<http://www.purplemath.com/modules/rounding2.htm>

Give the following to 3 significant figures:

1. 3.4527
2. 40.691
3. 0.838991
4. 1.0247
5. 59.972

Calculate the following to a suitable number of significant figures:

1. 63.2/78.1
2. 39+78+120
3. (3.4+3.7+3.2)/3
4. 0.0256 x 0.129
5. 592.3/0.1772

**Atomic Structure**

You will study nuclear decay in more detail at A level covering the topics of radioactivity and particle physics. In order to explain what happens you need to have a good understanding of the model of the atom. You need to know what the atom is made up of, relative charges and masses and how sub atomic particles are arranged.

The following video explains how the current model was discovered [www.youtube.com/watch?v=wzALbzTdnc8](http://www.youtube.com/watch?v=wzALbzTdnc8)

Describe the model used for the structure of an atom including details of the individual particles that make up an atom and the relative charges and masses of these particles. You may wish to include a diagram and explain how this model was discovered by Rutherford

**Recording Data**

Whilst carrying out a practical activity you need to write all your raw results into a table. Don’t wait until the end, discard anomalies and then write it up in neat.

Tables should have column heading and units in this format quantity/unit e.g. length /mm

All results in a column should have the same precision and if you have repeated the experiment you should calculate a mean to the same precision as the data.

Below are link to practical handbooks so you can familiarise yourself with expectations.

<http://filestore.aqa.org.uk/resources/physics/AQA-7407-7408-PHBK.PDF>

<http://www.ocr.org.uk/Images/295483-practical-skills-handbook.pdf>

<http://www.ocr.org.uk/Images/295483-practical-skills-handbook.pdf>

Below is a table of results from an experiment where a ball was rolled down a ramp of different lengths. A ruler and stop clock were used.

**1)** Identify the errors the student has made.

|  |  |
| --- | --- |
|  | **Time** |
| **Length/cm** | **Trial 1** | **Trial 2** | **Trial 3** | **Mean** |
| 10 | 1.45 | 1.48 | 1.46 | 1.463 |
| 22 | 2.78 | 2.72 | 2.74 | 2.747 |
| 30 | 4.05 | 4.01 | 4.03 | 4.03 |
| 41 | 5.46 | 5.47 | 5.46 | 5.463 |
| 51 | 7.02 | 6.96 | 6.98 | 6.98 |
| 65 | 8.24 | 9.68 | 8.24 | 8.72 |
| 70 | 9.01 | 9.02 | 9.0 | 9.01 |

**Graphs**

After a practical activity the next step is to draw a graph that will be useful to you. Drawing a graph is a skill you should be familiar with already but you need to be extremely vigilant at A level. Before you draw your graph to need to identify a suitable scale to draw taking the following into consideration:

* the maximum and minimum values of each variable
* whether 0.0 should be included as a data point; graphs don’t need to show the origin, a false origin can be used if your data doesn’t start near zero.
* the plots should cover at least half of the grid supplied for the graph.
* the axes should use a sensible scale e.g. multiples of 1,2, 5 etc)

Identify how the following graphs could be improved

**Graph 1 Graph 2**



**Forces and Motion**

At GCSE you studied forces and motion and at A level you will explore this topic in more detail so it is essential you have a good understanding of the content covered at GCSE. You will be expected to describe, explain and carry calculations concerning the motion of objects. The websites below cover Newton’s laws of motion and have links to these in action.

<http://www.physicsclassroom.com/Physics-Tutorial/Newton-s-Laws>

Sketch a velocity-time graph showing the journey of a skydiver after leaving the plane to reaching the ground.

Mark on terminal velocity.

**Electricity**

At A level you will learn more about how current and voltage behave in different circuits containing different components. You should be familiar with current and voltage rules in a series and parallel circuit as well as calculating the resistance of a device.

<http://www.allaboutcircuits.com/textbook/direct-current/chpt-1/electric-circuits/>

<http://www.physicsclassroom.com/class/circuits>

**1a)**  Add the missing ammeter readings on the circuits below.

**b)** Explain why the second circuit has more current flowing than the first.

**2)** Add the missing potential differences to the following circuits



**Waves**

You have studied different types of waves and used the wave equation to calculate speed, frequency and wavelength. You will also have studied reflection and refraction.

Use the following links to review this topic.

<https://www.khanacademy.org/science/physics/mechanical-waves-and-sound/mechanical-waves/v/introduction-to-waves>

<https://www.khanacademy.org/science/physics/mechanical-waves-and-sound/mechanical-waves/v/introduction-to-waves>

**1)** Draw a diagram showing the refraction of a wave through a rectangular glass block. Explain why the ray of light takes this path.

**2)** Describe the difference between a longitudinal and transverse waves and give an example of each

**3)** Draw a wave and label the wavelength and amplitude

**Book Recommendations**

Below is a selection of books that should appeal to a physicist – someone with an enquiring mind who wants to understand the universe around us. None of the selections are textbooks full of equation work (there will be plenty of time for that!) instead each provides insight to either an application of physics or a new area of study that you will be meeting at A Level for the first time.

1. **Surely You're Joking Mr Feynman: Adventures of a Curious Character**



**ISBN - 009917331X -** Richard Feynman was a Nobel Prize winning Physicist. In my opinion he epitomises what a Physicist is. By reading this books you will get insight into his life’s work including the creation of the first atomic bomb and his bongo playing adventures and his work in the field of particle physics.

(Also available on Audio book). [https://www.waterstones.com/books/search/term/surely+youre+joking+mr+feynman++adventures+of+a+curious+character](https://www.waterstones.com/books/search/term/surely%2Byoure%2Bjoking%2Bmr%2Bfeynman%2B%2Badventures%2Bof%2Ba%2Bcurious%2Bcharacter)

# Moondust: In Search of the Men Who Fell to Earth

# ISBN – 1408802384 - One of the greatest scientific achievements of all time was putting mankind on the surface of the moon. Only 12 men made the trip to the surface, at the time of writing the book only 9 are still with us. The book does an excellent job of using the personal accounts of the 9 remaining astronauts and many others involved in the space program at looking at the whole space-race era, with hopefully a new era of space flight about to begin as we push on to put mankind on Mars in the next couple of decades.

# [https://www.waterstones.com/books/search/term/moondust++in+search+of+the+men+who+fell+to+earth](https://www.waterstones.com/books/search/term/moondust%2B%2Bin%2Bsearch%2Bof%2Bthe%2Bmen%2Bwho%2Bfell%2Bto%2Bearth)

# Quantum Theory Cannot Hurt You: Understanding the Mind-Blowing Building Blocks of the Universe

# ISBN - 057131502X - Any Physics book by Marcus Chown is an excellent insight into some of the more exotic areas of Physics that require no prior knowledge. In your first year of A-Level study you will meet the quantum world for the first time. This book will fill you with interesting facts and handy analogies to whip out to impress your peers!

# <https://www.waterstones.com/book/quantum-theory-cannot-hurt-you/marcus-chown/9780571315024>

# A Short History of Nearly Everything

# ISBN – 0552997048 - A modern classic. Popular science writing at its best. A Short History of Nearly Everything Bill Bryson’s quest to find out everything that has happened from the Big Bang to the rise of civilization - how we got from there, being nothing at all, to here, being us. Hopefully by reading it you will gain an awe-inspiring feeling of how everything in the universe is connected by some fundamental laws.

[https://www.waterstones.com/books/search/term/a+short+history+of+nearly+everything](https://www.waterstones.com/books/search/term/a%2Bshort%2Bhistory%2Bof%2Bnearly%2Beverything)

# Thing Explainer: Complicated Stuff in Simple Words

# ISBN – 1408802384 - This final recommendation is a bit of a wild-card – a book of illustrated cartoon diagrams that should appeal to the scientific side of everyone. Written by the creator of online comic XTCD (a great source of science humour) is a book of blueprints from everyday objects such as a biro to the Saturn V rocket and an atom bomb, each one meticulously explained BUT only with the most common 1000 words in the English Language. This would be an excellent coffee table book in the home of every scientist.

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# <https://www.waterstones.com/book/thing-explainer/randall-munroe/9781473620919>

# Movie / Video Clip Recommendations

# Hopefully you’ll get the opportunity to soak up some of the Sun’s rays over the summer – synthesising some important Vitamin-D – but if you do get a few rainy days where you’re stuck indoors here are some ideas for films to watch or clips to find online.

# Science Fictions Films

# Moon (2009)

# Gravity (2013)

# Interstellar (2014)

# The Imitation Game (2015)

# The Prestige (2006)

# Online Clips / Series

# Minute Physics – Variety of Physics questions explained simply (in felt tip) in a couple of minutes. Addictive viewing that will have you watching clip after clip – a particular favourite of mine is “Why is the Sky Dark at Night?”

# <https://www.youtube.com/user/minutephysics>

# Wonders of the Universe / Wonders of the Solar System – Both available of Netflix as of 17/4/16 – Brian Cox explains the Cosmos using some excellent analogies and wonderful imagery.

# Shock and Awe, The Story of Electricity – A 3 part BBC documentary that is essential viewing if you want to see how our lives have been transformed by the ideas of a few great scientists a little over 100 years ago. The link below takes you to a stream of all three parts joined together but it is best watched in hourly instalments. Don’t forget to boo when you see Edison. (alternatively watch any Horizon documentary – loads of choice on Netflix and the I-Player)

# <https://www.youtube.com/watch?v=Gtp51eZkwoI>

# NASA TV – Online coverage of launches, missions, testing and the ISS. Plenty of clips and links to explore to find out more about applications of Physics in Space technology.

# <http://www.nasa.gov/multimedia/nasatv/>

# The Fantastic Mr. Feynman – I recommended the book earlier, I also cannot recommend this 1 hour documentary highly enough. See the life’s work of the “great explainer”, a fantastic mind that created mischief in all areas of modern Physics.

# <https://www.youtube.com/watch?v=LyqleIxXTpw>

# Both Mrs Housecroft and Mr Grainger-Allen are looking forward to working with you in September

Physics A content and Assessment Overview

|  |  |
| --- | --- |
| **Content Overview** | **Assessment Overview** |
| Content is split into six teaching modules: Module 1 – Development of practical skills in physics Module 2 – Foundations of physics Module 3 – Forces and motion Module 4 – Electrons, waves and photons Module 5 – Newtonian world and astrophysics Module 6 – Particles and medical physics Component 01 assesses content from modules 1, 2, 3 and 5. Component 02 assesses content from modules 1, 2, 4 and 6. Component 03 assesses content from all modules (1 to 6).  | Modelling physics (01) 100 marks 2 hours 15 minutes written paper |

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| **37%** of total A level  |

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| Exploring physics (02) 100 marks 2 hours 15 minutes written paper  |

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| **37%** of total A level  |

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| Unified physics (03) 70 marks 1 hour 30 minutes written paper  |

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| --- |
| **26%** of total A level  |

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| Practical endorsement in physics (04) (non exam assessment)  |

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| --- |
| Reported separately  |

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