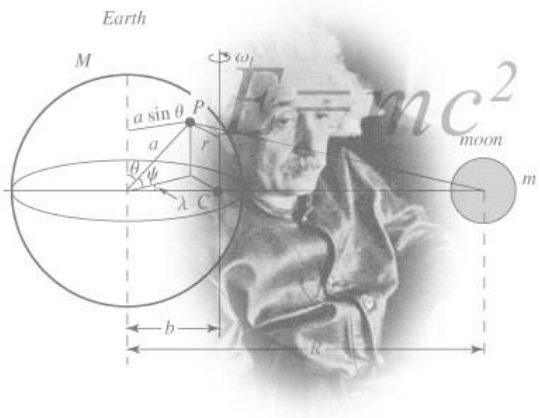
A Level Physics

We follow the OCR "Physics A" specification; there is nothing to stop you from going to OCR's website, looking at the Physics A specification document and over the summer, teaching yourself everything in the whole two-year course before you start in September! That will work if you are a super-genius however, for everyone else, I have a few more realistic tasks for you, in order to prepare you for the transition from GCSE to A-level physics.



Some pupils find the transition from GCSE to A level difficult and can become overwhelmed by the new subject knowledge they meet and the level of understanding required. Some of you would have completed a triple science course while others would have completed a core and additional science course, using different GCSE specifications. As a result, every one of you will have different starting points.

The tasks in the transition pack aim to support the transition. They are intended to give you practice at the sorts of skills that you need on the AS physics course. You are required to complete the tasks before the start of term in order to prepare yourself for your A level physics journey and also to prepare you for your baseline assessment which will take place in your first week in college. Have your answers to the tasks ready to submit in your first lesson.

The transition pack contains web links to access resources which will help you understand the concepts. At the end of the pack, there are some suggestions of books you could read and films you could watch to deepen your interest in Physics.

I look forward to seeing you in September.

Mrs A Daniels

Pre-Knowledge Topics and tasks to be completed (Compulsory)

Below are ten topics that are essential foundations for you study of A-Level Physics. Each topic has example questions and links where you can find our more information as you prepare for next year. You also have some research to carry out and write about.

1. Symbols and Prefixes

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

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 10^{3}
Mega	M	x 10^{6}
Giga	G	x 10^{9}

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

TASK 1:

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.
8. Convert 1002 mV into V.
9. How many eV in 0.511 MeV?
10. How many m in 11 km?

2. Standard Form

At A level quantity will be written in standard form, and it is expected that your answers will be too. In standard form, the number is written with one digit in front of the decimal point and multiplied by the appropriate power of 10. This means answers should be written as ….x 10^{y}.

E.g. for an answer of 1200kg we would write 1.2 x 10^{3}kg. The diameter of the Earth, for example, is 13 000 km. 13 000 km = 1.3 × 10 000 km = 1.3×104 km. The distance to the Andromeda galaxy is 2 200 000 light years = 2.2 × 1 000 000 ly = 2.2×106 ly.

For more information visit: www.bbc.co.uk/education/guides/zc2hsbk/revision

TASK 2:

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 2.4×10^{2} as a normal number.
8. Write 8.31×10^{6} as a normal number.
9. Write 3.505×10^{1} as a normal number.
10. Write 6.002×10^{2} as a normal number.
11. Write 1.5×10^{-4} as a normal number.
12. Write 4.3×10^{-3} as a normal number.

3. 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:www.khanacademy.org/math/algebra/one-variable-linear-equations/old-school-equations/v/solving-for-ahttp://www.khanacademy.org/math/algebra/one-variable-linear-equations/old-school-equations/v/solving-for-a-variablevariable www.youtube.com/watch?v=_WWgc3ABSj4

TASK 3: 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 v^2 to find m
4. E = ½ m v^2 to find v
5. v = u + at to find u
6. v = u + at to find a
7. $v^2 = u^2 + 2as$ to find s
8. $v^2 = u^2 + 2as$ to find u

4. 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

TASK 4a: Give the following to 3 significant figures:

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

TASK 4b: Calculate the following to a suitable number of significant figures:

6. 63.2 ÷ 78.1
7. 39 + 78 + 120
8. (3.4+3.7+3.2) ÷ 3
9. 592.3 ÷ 0.1772
10. 0.0256 x 0.129

5. 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 subatomic particles are arranged.

The following video explains how the current model was discovered
www.youtube.com/watch?v=wzALbzTdnc8

TASK 5:

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 by

a. Drawing a labelled diagram

b. explaining how this model was discovered by Rutherford

c. producing a table showing the constituents of an atom, their relative charges and masses.

6. 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

TASK 6: Here 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. Identify **five (5)** errors the student has made in the space below.

Length/cm	Time			
	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

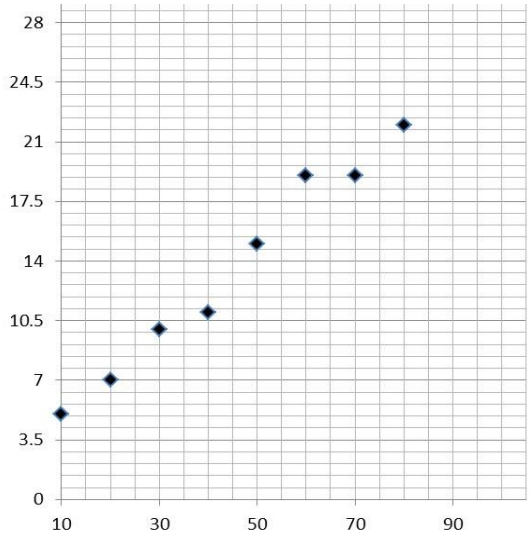
7. Graphs

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:

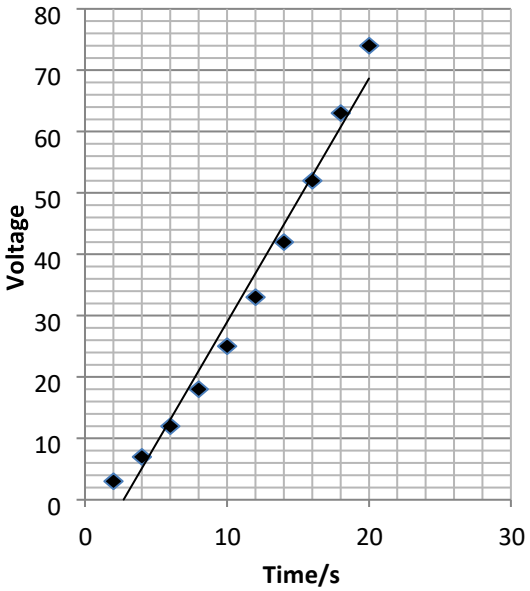
- the maximum and minimum values of each variable
- whether 0.0 should be included as a data point; graphs don't need to show the origin, a false origin can be used if your data doesn't start near zero.
- the plots should cover at least half of the grid supplied for the graph.
- the axes should use a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

TASK 7: Identify how each of the following graphs could be improved

Graph 1



Graph 2



8. 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
http://www.sciencechannel.com/games-and-interactives/newtons-laws-of-motion-interactive/

TASK 8: Sketch neatly a velocity-time graph showing the journey of a skydiver from leaving the plane to reaching the ground. Annotate terminal velocity on the sketch.

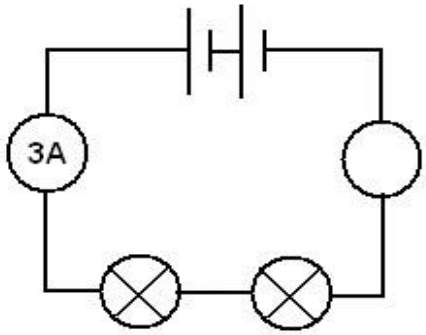
9. Electricity

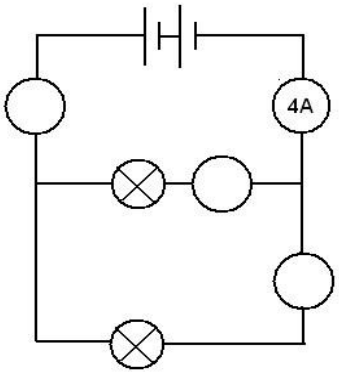
At A level you will learn more about how current and voltage behave in different circuits containing different components. You should be familiar with current and voltage rules in a series and parallel circuit as well as calculating the resistance of a device.

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

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

TASK 9a: Add the missing ammeter readings on the circuits below.





9b) Explain why the second circuit has more current flowing than the first.

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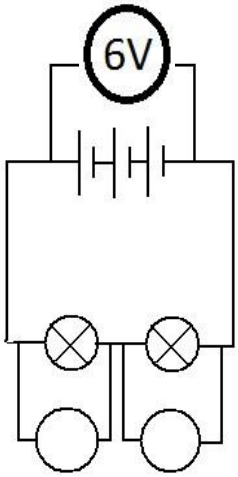
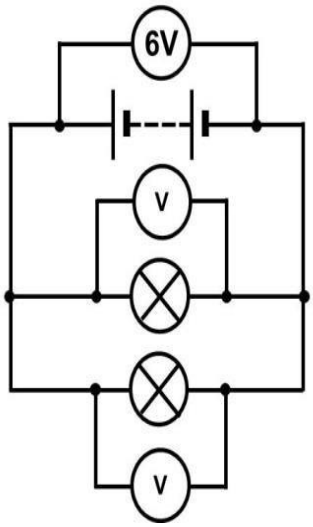
9c) Add the missing potential differences to the following circuits





10. 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.

http://www.bbc.co.uk/education/clips/zb7gkqt

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

TASK 10a: Draw a diagram showing the refraction of a wave through a rectangular glass block. Explain why the ray of light takes this path.

10b) Describe the difference between longitudinal and transverse waves and give an example of each

10c) Draw a wave and label the wavelength and amplitude

11. Research activities

TASK 11a:

Newton's Laws of Motion are fundamental laws for the motion of all the object we can see around us. Use this website and the suggested further reading links on the webpage to make your own 1 page of notes on the three laws.
http://www.livescience.com/46558-laws-of-motion.html

TASK 11b:

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

Select **3 questions** that interest you which have clips above 2 minutes long. Watch them and write a summary to answer each question.

12. Watch video- BBC The fantastic Mr Feynman

https://www.youtube.com/watch?v=H9fjhQMsDW4
Richard Feynman was a Nobel Prize winning Physicist. In my opinion, he epitomises what a Physicist is.

TASK 12: Watch the video to give you some insight into his life's work including the creation of the first atomic bomb, his bongo playing adventures and his work in the field of particle physics. Write a one-page summary on various aspects of Richard Feynman's life and work.

Wider reading

Book recommendations:

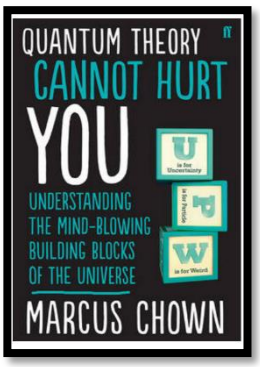
1. **Thing Explainer: Complicated Stuff in Simple Words**

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.

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

I would recommend you read one of these books if you hope to achieve an A or A* at A level

Below are two books that should appeal to a physicist – someone with an enquiring mind who wants to understand the universe around us. Neither of them is a textbook 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. Pick one.

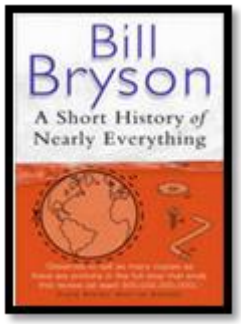


1. Quantum Theory Cannot Hurt You: Understanding the Mind-Blowing Building Blocks of the Universe

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

2. 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

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 are stuck indoors here are some ideas for films to watch or clips to find online. **Science Fictions Films**

1. **Moon (2009)**
2. **Gravity (2013)**
3. **Interstellar (2014)**

Online Clips / Series

1. **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.
2. **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. Do not 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**
3. **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/**