Name:

THE ROYAL Society





All of physics is either impossible or trivial. It is impossible until you understand it, and then it becomes trivial.

- Ernest Rutherford -

AZQUOTES





Contents

- 1. A level OCR Physics course outline.
- 2. Becoming a better physicist Some successful strategies....and unsuccessful ones!
- 3. Knowledge to be consolidated.
- 4. Summer Tasks.

Welcome to A level Physics!

So, you have chosen to do the most amazing subject... Physics!

A lot of people think it is hard, and it is: if you do not like it, have a passion for it or do not work for it.

However, over the next two years we hope to inspire you in the physical world and drive your passion for it. This, along with some hard work from yourself will mean you will leave this college not only with a fantastic qualification, but a better appreciation of the world around you, skills that you can use for the rest of your life, and a problem-solving, intuitive, creative brain.

This pack contains a program of activities and resources to prepare you to start A-level in Physics in September. It is aimed to be used after you complete your GCSE throughout the remainder of the summer term and over the summer holidays to ensure you are ready to start your course in September.



SUBMIT ALL WORK to me at j.ison@barnsley.ac.uk by 24TH AUGUST

Course outline

This information is readily available on the OCR website at

https://www.ocr.org.uk/qualifications/as-and-a-level/physics-a-h156-h556-from-2015/specification-at-a-glance/

Subject content

Booklets	Content
1	Quantities, measurements and their errors
2	Properties of matter and materials
3	Moments and equilibrium
4-5	Electricity and circuits
6-8	Motion and fundamental mechanics
9-10	Waves and radiation
11	Quantum properties of atoms
12	Motion in circles
13	Thermal physics and kinetic theory
14	Further mechanics
15	Gravitational fields
16	Astrophysics and cosmology
17-18	Electric fields and capacitance
19	Magnetic fields and accelerators
20-21	Radioactivity and particle physics
22	Energy and nuclear processes
23	Medical imaging

A-Level

Modelling physics Paper 1	Exploring physics Paper 2	Unified physics Paper 3	
What's assessed Sections 1-3,6-8,12-15 (OCR modules 1,2,3 & 5)	<i>What's assessed</i> Sections 1,4-5,9-11,16-22 (OCR modules 1,2,4 & 6)	What's assessed All sections of the course Synoptic questions and a more on practical skills and data analysis	
 Assessed Written exam: 2.25 hours 100 marks 37% of A-Level 	 Assessed Written exam: 2.25 hours 100 marks 37% of A-Level 	 Assessed Written exam: 1.5 hours 70 marks 26% of A-Level 	
 Questions 15 marks of multiple choice questions short and long answer questions 	 Questions 15 marks of multiple choice questions short and long answer questions 	 Questions short answer and long answer questions 	

Careers



Using your Physics A-level can lead you to many careers, in the past 3 years the students have gone onto the following career pathways:

Astrophysics at Lancaster University, Physics at Leeds, Lancaster, York and Imperial University, Engineering apprenticeships with Rolls Royce, Engineering degrees at Nottingham, Leeds and the AIME at Sheffield, Accounting degrees, One previous student is even researching at CERN.

As well as these, you can use A-level Physics to go into practically any industry or career pathway, including Medicine, Construction, Finance and IT.

Preparation Tasks

- 1. Research a Physicist word limit **500 words ± 10%.** (see requirement below)
 - Choose at least one Physicist (ideally one you have not heard of) that is in a field of physics you are interested in.
 - who are/were they and what did they discover or are working on.
 - How their science applies to everyday modern life today
 - Why did you choose this Physicist?
 - Include your references (ideally Harvard referencing style there are plenty of free tools online to help you do this)

There are lots on Twitter/Instagram that you can get in contact with (they do not have to be super famous or dead or have won a Nobel prize). Or if you do not want to talk to anyone directly you can find long lists of people online.

- Complete the "Year 12 Transition Questions" at the end of this booklet. These are AS
 questions that are effectively extension questions of (what should be) your existing GCSE
 knowledge as well as maths and practical questions that you will need to know by heart by
 the end of your first year of A level Physics.
- Below is also a short list of some of the main maths skills you will need for A level Physics.
 Complete the maths skills questions at the end of the transition questions.
 - Prefixes
 - Ratios
 - Significant figures and rounding
 - Drawing graphs and lines of best fit
 - Work out gradients
 - Rearranging equations
 - Using Standard form
- 4. Go to OpenLearn (Open University distance learning platform) and sign up for the following course:

https://www.open.edu/openlearn/science-maths-technology/what-are-waves/contentsection-0?active-tab=description-tab

Complete the course and submit the free certificate as evidence of completion.

- 5. Choose a book or film from the lists on the next page or one of your choosing and write an essay on this word limit **500 words \pm 10%**.
 - You do not need to read the whole book
 - The book can be fiction or non-fiction but must relate in some way to physics
 - The film can be a documentary or a fictional sci fi film but must relate to physics.
 - Write why you like or chose this book/film (roughly 100-150 words)
 - Comment on some of the physics in the book/film (350-400 words)

If you would like to know more or have any questions please email me.

I hope you have a good break, stay safe and see you in September,

Mr. Jon Ison Teacher of Physics and Personal Progress Mentor

j.ison@barnsley.ac.uk

Movie Recommendations

















There are some great TV series and box sets available too! You might want to check out: Blue Planet, Planet Earth, Wonders of the Universe, Wonders of the Solar System, NASA TV, Shock & Awe – The Story of Electricity...

Book Recommendations

- Many are available to download free from "Audible" at the moment!















Transition questions...



(Total 6 marks)

Q3. (a) For a sound wave travelling through air, explain what is meant by particle displacement, amplitude and wavelength.

Particle displacement

amplitude wavelength displacement displacement time distance along wave

graph A



Graph A shows the variation of particle displacement with time at a point on the path of a progressive wave of constant amplitude.

Graph B shows the variation of particle displacement with distance along the same wave at a particular instant.

(i) Show on graph A

(b)

(1) the wave amplitude, a,

(2) the period, T, of the vibrations providing the wave.

(ii) Show on graph B

(1) the wavelength of the wave, λ ,

(3) (Total 7 marks)

Q4. The Soyuz Spacecraft is used to transport astronauts to and from an orbiting space station. The spacecraft is made up of three sections as shown in **Figure 1**.



Figure 1

(a) On leaving the space station the spacecraft is given an initial horizontal thrust of 1400 N. Calculate the initial acceleration of the spacecraft during the firing of the thruster engines.

acceleration = _____ m s⁻²

- (b) Newton's Third Law refers to pairs of forces.
 - (i) State **one** way in which a pair of forces referred to in Newton's Third Law are the same.

- (ii) State **one** way in which a pair of forces are different.
- (c) When the spacecraft returns to the Earth's atmosphere the orbital module and the service module are separated from the descent module. This descent module has its speed greatly reduced by drag from the atmosphere.

Figure 2 shows two of the forces acting on the descent module as it travels down through the atmosphere.



(d) In one particular descent, the descent module has its speed reduced to 5.5 m s⁻¹ by parachutes. The descent module also releases its empty tanks and shield to reduce its mass to 890 kg.

A final speed reduction can be carried out by using engines which operate for a maximum time of 3.5 s. When the engines are in use, the resultant upward force on the descent module is 670 N. The safe landing speed of the descent module is 3.0 m s^{-1} .

Determine whether these engines are able to reduce the speed of the descent module to its safe value.

At these landing speeds atmospheric drag is negligible.

(1)

(1)

Q5. The figure below shows two resistors, R_1 and R_2 , connected in series with a battery of emf 12 V and negligible internal resistance.



- The reading on the voltmeter is 8.0 V and the resistance of R_2 is 60 Ω . (a)
 - Calculate the current in the circuit. (i)

		answer =	A
	(ii)	Calculate the resistance of R ₁ .	
		answer =	Ω
	(iii)	Calculate the charge passing through the battery in 2.0 minutes. Give an appropriate unit for your answer.	1
		answer = unit =	
))	In ti expl ther	he circuit shown in the figure above R_2 is replaced with a thermistor. State lain what will happen to the reading on the voltmeter as the temperature of mistor increases.	and the

Maths and Practical skills Prefixes

In Physics we have to deal with quantities from the very large to the very small. A prefix is something that acts as a multiplier for a unit and. Here is some practice at converting figures between prefixes.

Symbol	Name		What it means	How to	convert
Р	peta	10^{15}	100000000000000		↓ x1000
Т	tera	10^{12}	100000000000	\uparrow ÷ 1000	↓ x1000
G	giga	109	100000000	↑ ÷ 1000	↓ x1000
М	mega	106	1000000	↑ ÷ 1000	↓ x1000
k	kilo	10 ³	1000	↑ ÷ 1000	↓ x1000
			1	↑ ÷ 1000	↓ x1000
m	milli	10-3	0.001	↑ ÷ 1000	↓ x1000
μ	micro	10-6	0.000001	\uparrow ÷ 1000	↓ x1000
n	nano	10-9	0.00000001	↑ ÷ 1000	↓ x1000
р	pico	10-12	0.00000000001	↑ ÷ 1000	↓ x1000
f	femto	10-15	0.0000000000000000000000000000000000000	$\uparrow \div 1000$	

Convert the figures into the prefixes required (in standard form).

S	ms	μs	ns	ps
134.6				
96.21				
0.773				

m	km	mm	Mm	Gm
12873				
0.295				
57.23				

Significant figures

For each value state how many significant figures it is stated to.

Value	Sig Figs	Value	Sig Figs	Value	Sig Figs	Value	Sig Figs
2		1066		1800.45		0.07	
2.0		82.42		2.483 x 10 ⁴		69324.8	
2.00		750000		2.483		0.0063	
0.136		310		5906.4291		9.81 x 10 ⁴	
0.34		3.10×10^2		200000		6717	

Value 1	Value 2	Value 3	Total Value	Total to correct sig figs
51.4	1.67	3.23		
7146	-32.54	12.8		
20.8	18.72	0.851		
1.4693	10.18	-1.062		

Add the values below, then round up the answer to the appropriate number of significant figures

Experimental Skills

Lines of best fit



Draw a line of best fit for each of the graphs.



Gradients



Calculate the gradients of the graphs below = change in y / change in x (think about y=mx+c)

Vernier calipers and micrometers

These are frequently used, for very precise measurements. Look up how to read these online / YouTube.

State the reading for each Vernier Calipers (on the left) and micrometer (on the right)



