GET READY TO STUDY A LEVEL PHYSICS

If you are planning to study A Level physics with us in September, please review this document and complete the required activities. Please bring the completed activities with you at induction.

FAQ

What specification will I study?

You'll be covering the OCR A specification – you can find it here.

How many lessons will I have a week?

You'll have 4 lessons a week, each lesson is 1 hours and 5 minutes

Who can I contact if I have a question about this subject?

Jonathan Ison, Teacher of Physics, j.ison@barnsley.ac.uk

Tracy Rowland, Curriculum Leader for Science, t.rowland@barnsley.ac.uk

What subjects go well with Physics?

It's a challenging subject with a strong mathematical element, so we insist that you take maths alongside physics. Other subjects that offer a strong combination for careers are geography or economics and STEM subjects such as computing, biology, or chemistry to complete your study programme. Many students also take further maths.

What grades should I have?

In addition to the general sixth form entry requirements, learners must have a 6 in physics and another science, or 66 in combined science, as well as a 6or above in maths

WHAT WILL I STUDY?

In Year 1, you will study the following topics:

Foundation skills in physics

- Measurement techniques, Number and Scale, Vectoral values
- Data analysis and spreadsheet analysis

Motion and Forces in Action

- Material properties, Equilibrium in motion and in static structures
- Dynamics, Newtonian mechanics, Motion and Collisions

Electrons, Waves & Photons

- Basic and advanced circuits, Electrical properties of materials, Making sensors
- Electrons and the Electromagnetic spectrum, Oscillations and Waves, Optical properties
- Quantum properties of atoms, Wave-particle duality

In Year 2, you will study the following topics:

The Newtonian world & Astrophysics

- Circular dynamics, Resonance and Harmonic motion
- Internal energy, Properties of matter, Gases, Kinetic theory, and applications
- Gravitational fields, Astrophysics and Cosmology

Fields, Particles, Nuclear & Medical physics

- Capacitor networks, Logarithmic change and Electrical fields
- Magnetic machines, Particle Accelerators & Detectors, Electromagnetic Induction
- Nuclear properties, Particle physics, Radioactivity and Nuclear energy
- X-rays formation & detection, Ultrasound – Doppler shift, Medical imaging

Practical skills are fundamental to studying physics and so are developed throughout the course

WHAT WILL I NEED?

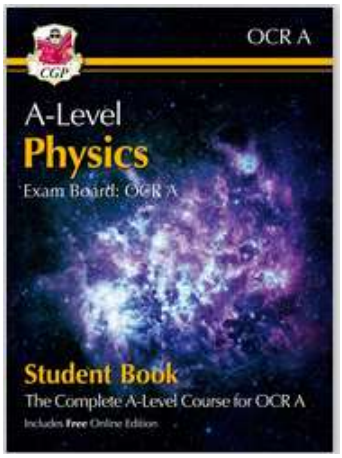
To study the course you will need the following equipment:

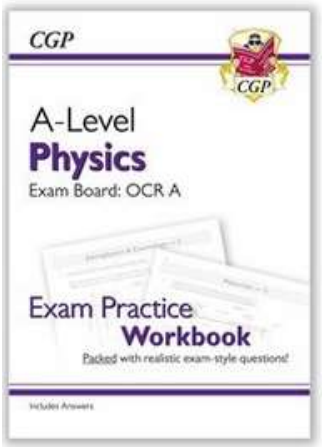
- A folder with divider sections
- Pens *including green*, pencils
- Highlighters
- A 30cm ruler
- Blank flashcards
- A scientific calculator – see requirements for maths department, especially Further Maths students

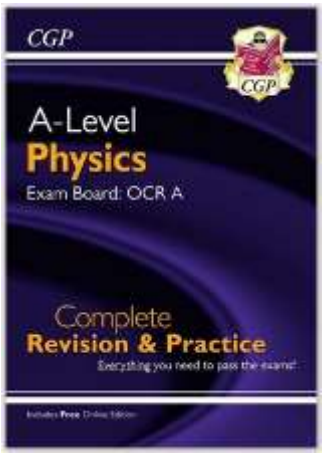
Many students find it useful to also have:

- A whiteboard and whiteboard pens
- A pad for summarising ideas & working out ideas

We recommend ***all*** students buy a textbook and these can be purchased from the college at the start of term. Financial support is available for those.







FIND OUT MORE

These activities are to help broaden your understanding of the subject in preparation for studying this subject at an advanced level.

Careers	Here are some useful links looking at careers in physics and engineering Science and research careers Career options in physics Prospects

Social Media	Massimo & Veritasium on Twitter
YouTube	There are many useful videos that support the OCR course; I recommend subscribing to the following channels Physics Online – the Lego Guy Z-Physics
Further Reading / Useful websites	Keep up to date with the latest news and events in physics & engineering Physics world Institute of Physics The Royal Institute The Royal Society The Institution of Engineering and Technology

REQUIRED ACTIVITIES

The course involves much more than just completing lessons and choosing your A Levels can be a challenge, therefore if you are undecided around which subjects you are planning to study completing these activities will give yourself greater insight into the course to help ensure you have made the right choice.

It is important that all the required activities are completed in preparation for starting your course. Research is a crucial skill in A-levels, so the 1st two tasks require you to 'go beyond'; one to use researching to build an argument, the second is to prepare for a 'big' topic, and to give you an edge in your career applications next year. Task 3 is for you to prepare to 'hit the ground running' from the start.

THIS WORK IS DUE FOR:

- **Task 1 & 2** – email me your work (essay & certificate) to j.ison@barnsley.ac.uk
- **Task 3** - Please make sure that your bring this to your Induction lesson.

If there are any questions about this work, you can email

INDUCTION TASKS

Task 1 – Choose from either Research a Physicist ***OR*** Research a book / film

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 discoveries did / are they working on.
    - How their science applies to everyday modern life today
    - Why did you choose this Physicist?
    - Include your references that you used for this *(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.

OR

2. Choose a book, film or documentary & write an essay on this - word limit **500 words ± 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)

Some suggestions can be found here:
https://drive.google.com/file/d/1tRjQEbUiQd7GbB010JJzLTzogxNl0vmu/view?usp=sharing

Task 2 – Completing an OU course

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/content-section-0?active-tab=description-tab
Complete the course and submit the free certificate as evidence of completion.

Task 3: Questions to submit **Prior knowledge**

Q1. (a) An ion of plutonium $^{239}_{94}Pu$ has an overall charge of $+1.6 \times 10^{-19}$C.

For this ion state the number of

(i) protons _____

(ii) neutrons _____

(iii) electrons _____

(3)

(b) Plutonium has several *isotopes*.

Explain the meaning of the word isotopes.

_____

_____

(2)

(Total 5 marks)

Q2. (a) For a sound wave travelling through air, explain what is meant by *particle displacement, amplitude* and *wavelength*.

Particle displacement _____

_____

_____

amplitude _____

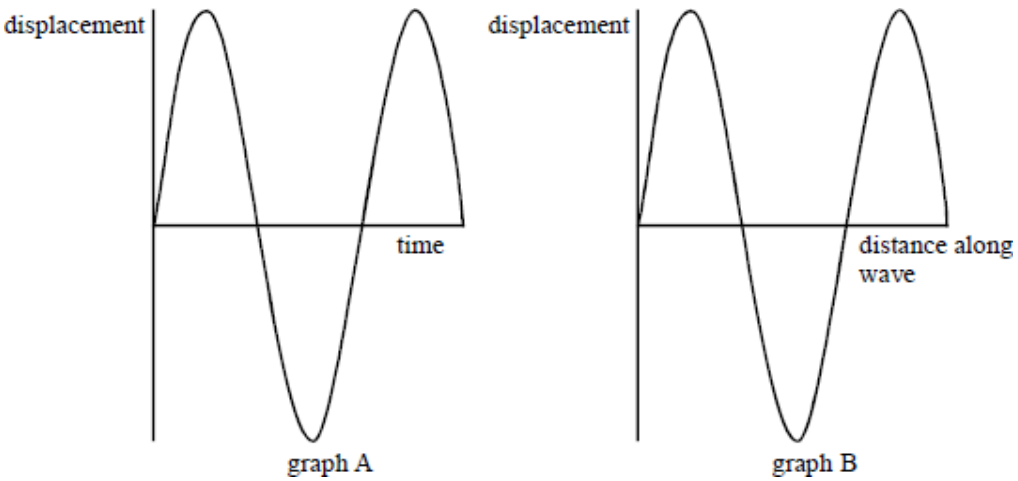
_____

wavelength _____

_____

(4)

(b)



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

(1) the wave amplitude,

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

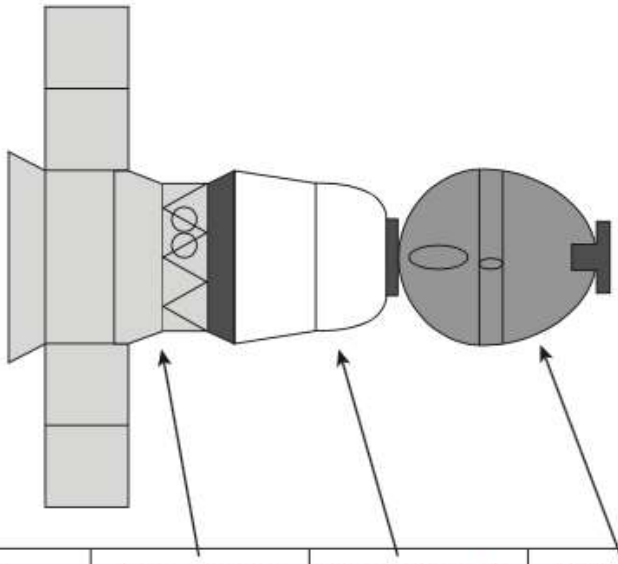
(ii) Show on graph B

(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 below.



Section	Service module	Descent module	Orbital module
Mass / kg	2600	2900	1300

(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}

(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.

_____ **(1)**

(ii) State **one** way in which a pair of forces are different.

_____ **(1)**

(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.

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

State **one** reason why the two forces shown in **Figure 2** are **not** a pair of forces as referred to in Newton's Third Law.

_____

_____

(1)

(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}.

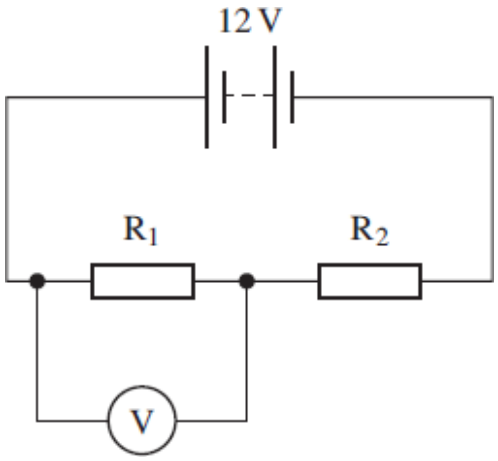
Determine whether these engines are able to reduce the speed of the descent module to its safe value.

At these landing speeds atmospheric drag is negligible.

(3)

(Total 8 marks)

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.



(a) The reading on the voltmeter is 8.0 V and the resistance of R_2 is 60 Ω.

(i) Calculate the current in the circuit.

answer = _____ A **(2)**

(ii) Calculate the resistance of R_1.

answer = _____ Ω **(1)**

(iii) Calculate the charge passing through the battery in 2.0 minutes. Give an appropriate unit for your answer.

answer = _____ unit = _____ **(2)**

(b) In the circuit shown in the figure above R_2 is replaced with a thermistor. State and explain what will happen to the reading on the voltmeter as the temperature of the thermistor increases.

_____

_____

_____

(3)

(Total 8 marks)

Questions to submit - Skills

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.

Symbol	Name	What it means		How to convert	
P	Peta	10^{15}	1000000000000000		↓ x1000
T	Tera	10^{12}	1000000000000	↑ ÷ 1000	↓ x1000
G	Giga	10^{9}	1000000000	↑ ÷ 1000	↓ x1000
M	Mega	10^{6}	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	↑ ÷ 1000	↓ x1000
n	nano	10^{-9}	0.000000001	↑ ÷ 1000	↓ x1000
p	pico	10^{-12}	0.000000000001	↑ ÷ 1000	↓ x1000
f	femto	10^{-15}	0.000000000000001	↑ ÷ 1000	

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

s	ms	µs	ns	ps
96.21				
0.773				

m	km	mm	Mm	Gm
12873				
57.23				

Significant figures

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

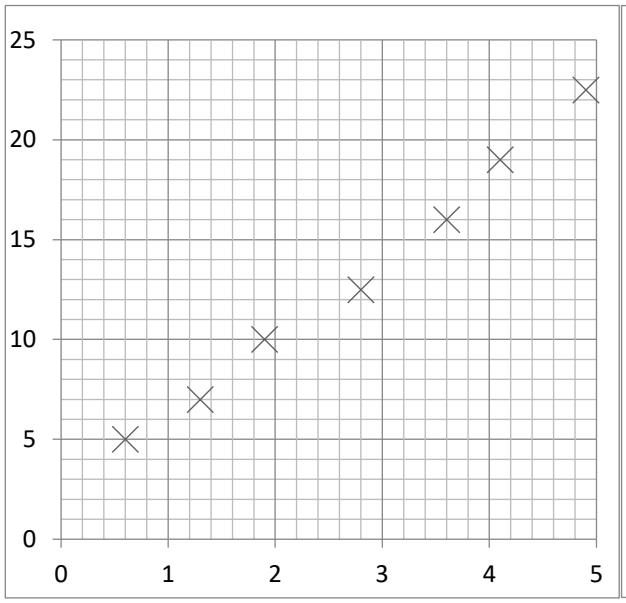
Value	Sig Figs	Value	Sig Figs	Value	Sig Figs	Value	Sig Figs
2		1066		1800.45		0.07	
2.0		82.42		2.483×10^{4}		69324.8	
2.00		750000		2.483		0.0063	
0.136		310		5906.4291		9.81×10^{4}	
0.34		3.10×10^{2}		200000		6717	

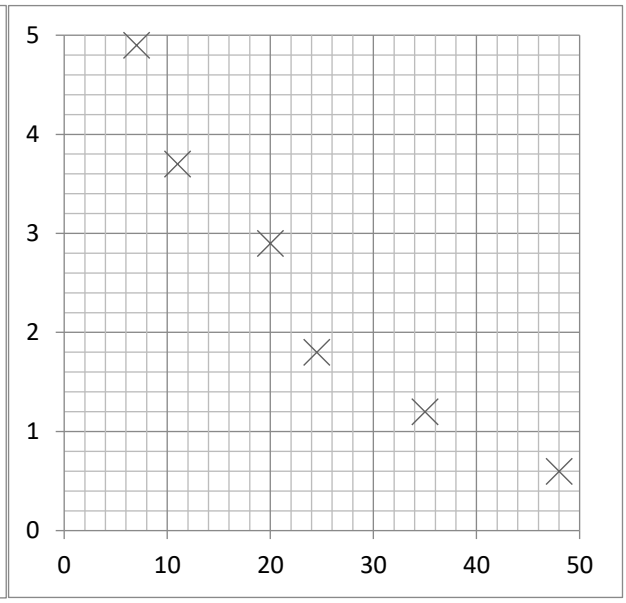
*Add the values in each row, then round the answer to the **appropriate number of significant figures***

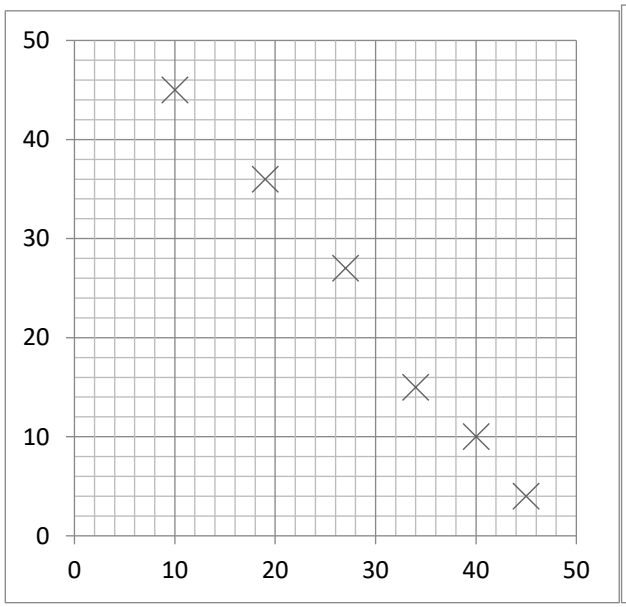
Value 1	Value 2	Value 3	Total Value	Total to *correct* sig figs
51.4	1.67	3.23		
7146	–32.54	12.8		
20.8	18.72	0.851		
1.4693	10.18	–1.062		

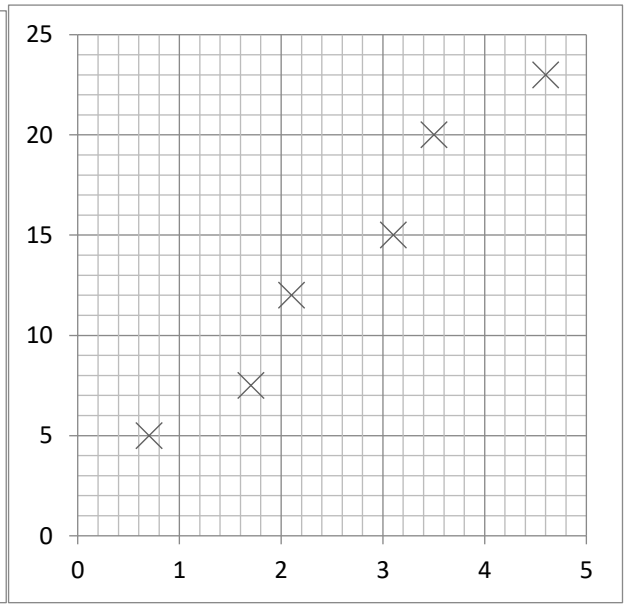
Lines of best fit

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)