BLANCHELANDE COLLEGE

Sixth Form Bridging Courses

Physics

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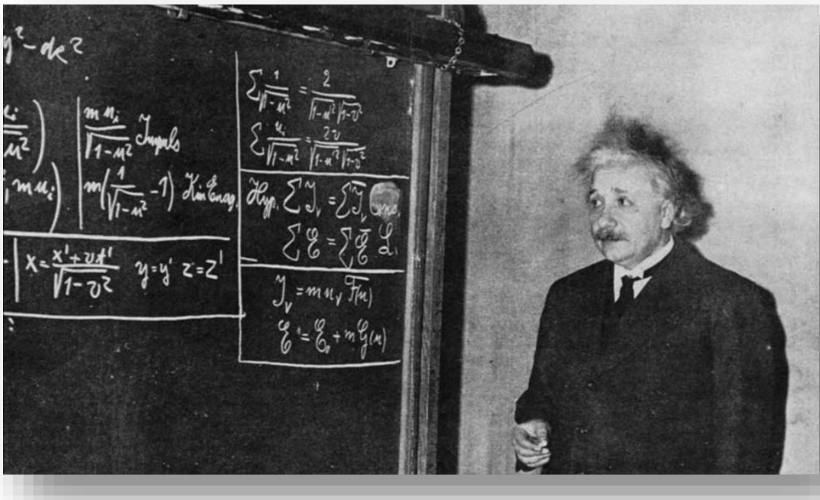
A-Level Bridging Work
Physics
For Summer 2020



The aim of this Bridging work is to ensure you have the knowledge and understanding required to start the A-Level in Physics. Physics requires a lot of Mathematics, which is why you can expect this to be present in this pack.

You must complete aspects of this pack before your first Physics Lesson, during which you will be checking your work for its correctness. You will also have a mini test during your first week in September, through which I will be able to establish which misconceptions exist and where your strengths and weaknesses lie.

There are some compulsory activities, coloured in **Green**. You will need to complete **all** of these.

There are other optional activities, coloured in **Blue**. You will need to complete **at least 3** of these.

The contents table on the next page outline what is required to be completed.

You should:

1. Complete the questions on the sheet. Should you need more space, you can add more sheets.
2. Bring it with you, completed, to your first Physics lesson.

In addition to these physical packs, CGP has also made available the Head Start to A-Level Physics ebook free of charge. I have converted it so you can use it – Head start to A-Level Physics. This is another excellent starting point to help you with your transition from KS4 to KS5.

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Concepts

SI units

In science, the metric system is used for measurements. This enables easy conversion: no constants (other than whole powers of 10) are needed to convert between different units. For instance, to convert between inch and feet, we use the number 12 (12 inch to a foot). But to convert from feet to yard, it's 3 (3 feet to a yard).

There are many different units of measurements for different quantities: the second (for time), the kilogram (for mass), the metre per second (for speed), the newton (for weight), etc. All of these can be reduced to 7 SI base units.

TASK 1

Complete the following table. Ensure you are clearly writing whether a letter is capitalised or not, and whether they are superscript (like powers), subscripted, or not.

Quantity	Abbreviation	Unit	Abbreviation
time	t	second	s
length			m
		kilogram	
temperature	☐		°C
absolute temperature	T		
		ampere	
force			
work			
energy			
			W
		Ohm	
			Hz

Prefixes

To avoid writing too large numbers – or too large powers of ten – a set of prefixes exist. They signify a power of ten, and it is important you write clearly whether they are a capital or a lowercase letter. For example, M stands for mega, 10^6. But m is milli, 10^{-3}. Remember: mega or larger is capitalised. Everything smaller (kilo and lower) is lowercase.

TASK 2

Complete the following table. Ensure you are clearly writing whether a letter is capitalised or not, and whether they are superscript, subscripted, or not.

Prefix	Name	Power of ten
E		
		+6
K		
	peta	
G		
		-1
Da		
	milli	
		+12
	nano	
F		
	micro	
		+2
		-12
C		

Vectors and Scalars

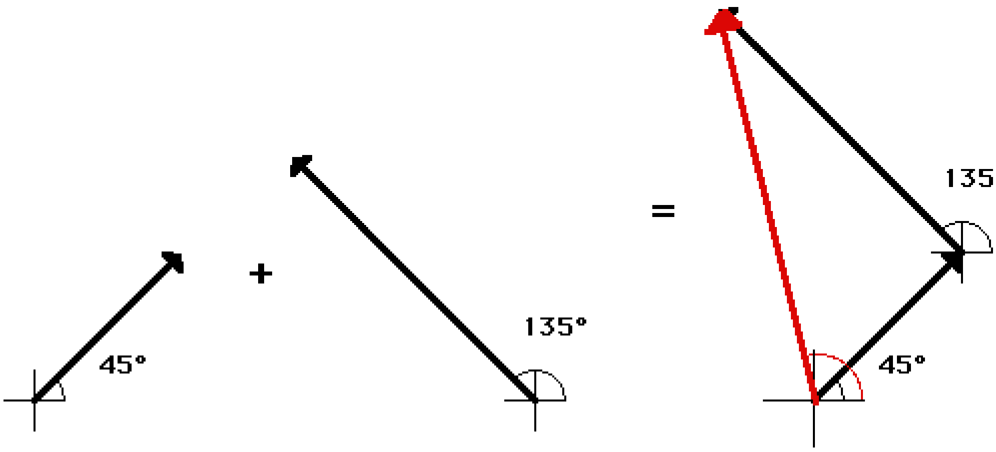
A vector is an object which has magnitude (size) and direction. Conversely, a scalar is an object which only has magnitude, no direction. Energy, mass and time are scalars. Force, weight and displacement are vectors.

As a general rule of thumb: if the magnitude of the sum of two objects is not equal to the sum of the magnitudes of the two objects, they are vectors. For example, if I walk three metres in a straight line, then make a right angle, and walk another 4 metres in a straight line, I will have walked 7 metres (3+4=7). However, the distance to my original point is only 5 metres (as I turned during the walking). The quantity which has magnitude of 5 metres is called displacement, and it is a vector.

In A-Level Physics, we will only consider vectors in two dimensions (x and y).
To add vectors together, you separately add their x and y components together.

TASK 3

Use the diagram to add these vectors together:



(The first vector is 3.0 m/s; the second vector is 5.0 m/s)

Show your working out here:

Answer:

Rearranging formulae

You need to be able to use any formula which is given to you – you get the majority of the formulae on the 5 page long formula sheet on every test. "use" in this context includes rearranging.

TASK 4

Complete the next table, to make the asked quantity the subject:

Formula	Subject	New formula
$V = IR$	R	
$v^2 = u^2 + 2as$	u	
$v = f\lambda$	f	
$V = IR$ and $P = IV$	P in terms of I and R	
$\Delta E = mc\Delta\theta$	c	

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Important Command words

TASK 5

Questions in the Physics exam are asked using very specific command words. You are required to understand these words very clearly. Below are a selection of the command words – link them with their correct meaning.

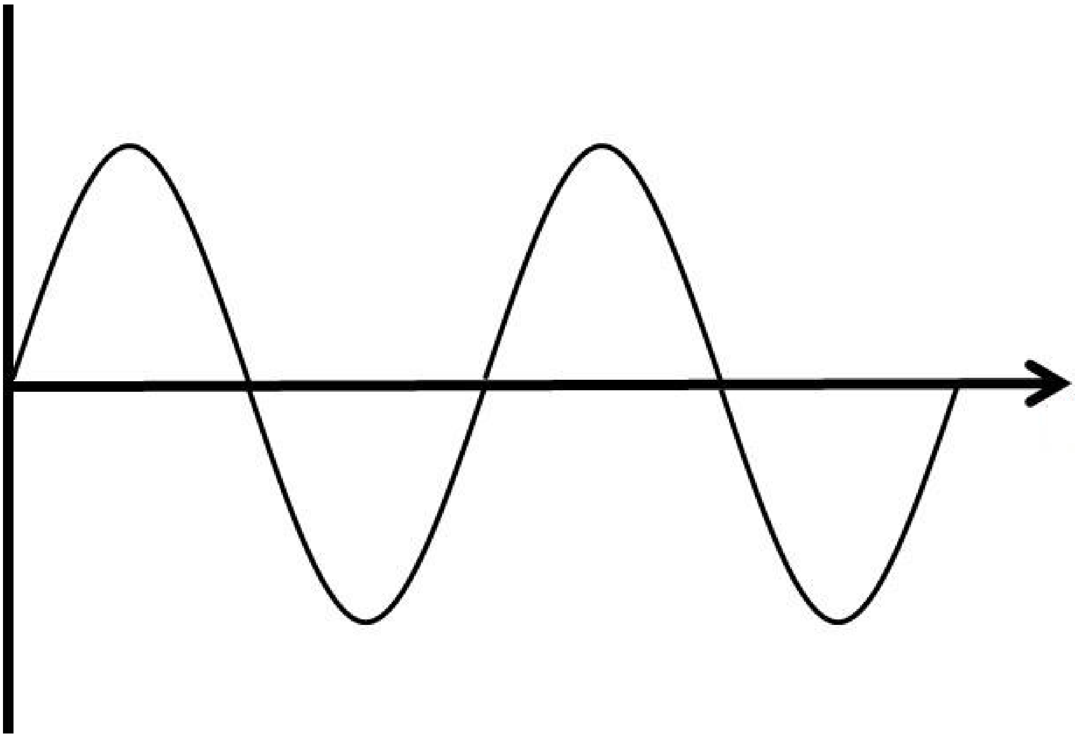
Command word		Meaning
Calculate		Give reasons to a statement, which follow logic.
State		Draw approximately. Whilst it should be a "best guess" drawing, you should normally not worry about being accurate.
Explain		Repeated measurements give answers close to each other.
Sketch		Present key points about different or opposing ideas, including their strengths or weaknesses.
Precision		Express in clear terms. No explanation is required.
Precise		To work out something. It is necessary to show how you obtain the answer, as well as use correct rounding rules.
Accurate		The exam board gets it wrong – they really mean resolution. The lowest non-zero measurement one can make with a specific piece of equipment.
Discuss		Provide an answer from a number of alternatives.
Identify		Close to the true value. Whilst it is impossible to be certain of this, how close the points are to a line of best fit gives a good measurement of this.

Physics

Waves

On the wave, label:

- Wavelength
- Amplitude
- Trough
- Peak



Write a short definition for:

Frequency:

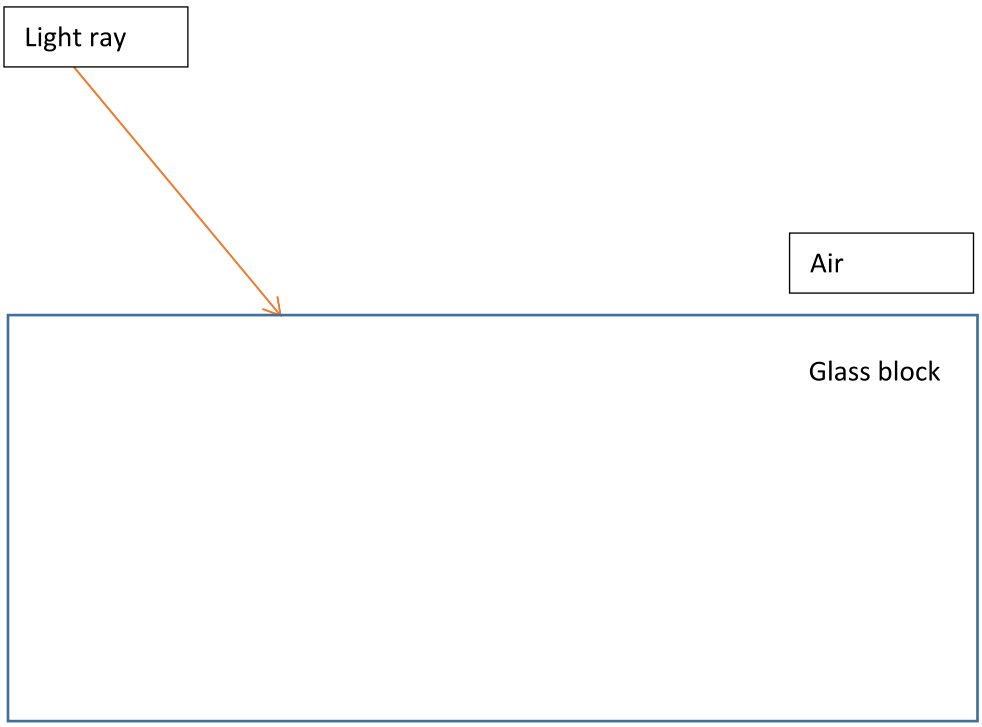
Time period:

Amplitude:

Wavelength:

The diagram below shows a light ray entering a glass block. Complete the diagram, by drawing:

(1) the refracted ray
(2) the emerging ray
(3) label the angle of incidence
(4) label the angle of refraction
(5) draw the two normal lines.



Mechanics

Write down the principle of moments:

Write down the law of Conservation of Momentum:

Write down the law of Conservation of Energy:

Density

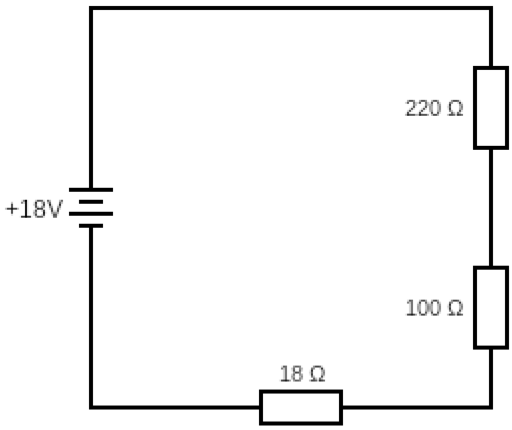
Challenge question: The weight of a stone is 3.139 N in air. When suspended in water, it only weighs 2.845 N. What is:

(a) the mass of the stone?
(b) the volume of the stone?
(c) The density of the stone?

You may assume that water has a density of 1 g cm^{-3}, and the Earth's gravitational field strength is
9.81 N kg^{-1}.

Electricity

Calculate the current through, and the potential difference across every component in this circuit:



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Heat

A block of 2.1 kg water ice at -5.0°C is heated up until it reaches 200°C. How much energy is needed?

Latent heat of fusion	333 kJ/kg
Latent heat of vaporisation	2256 kJ/kg
Specific heat capacity of solid water	2108 J/kg °C
Specific heat capacity of liquid water	4186 J/kg °C
Specific heat capacity of gaseous water	1850 J/kg °C

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Electromagnetism

Explain how ‘Fleming’s Left Hand Rule’ is used in electromagnetism. You may use a diagram.

Neptunium -237 is radioactive. It will decay to a new nucleus, which is still radioactive. This process continues, until Thallium-205 is reached – a stable nucleus.

Assuming only □- and □-decay occur, calculate how many □- and how many □-particles are emitted, when one ^{237}Np nuclide decays to form one ^{205}Tl nucleus.

Extra information: the correct notations for the particles involved are:

$^{237}_{93}Np$, $^{205}_{81}Tl$, $^{4}_{2}\alpha$, $^{0}_{-1}\beta$

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Summer Reading List

A level lessons will also involve a lot more discussion than at GCSE. To get the most out of your studies, you should take an active interest in the subject. This would require you to use additional resources, both print and online to read around the subject and familiarise yourself with the most recent developments in the field.

Your summer reading list could include other physics books on more contemporary science, such as:

- *A Short History of Nearly Everything* by Bill Bryson
- *Surely You're Joking, Mr Feynman* by Richard Feynman
- *Big Bang: The Most Important Scientific Discovery of All Time and Why You Need to Know About It* by Simon Singh
- *A Brief History of Time* by Stephen Hawking
- *13 Things That Don't Make Sense: The Most Intriguing Scientific Mysteries of Our Time* by Michael Brooks
- *Quantum: Einstein, Bohr and the Great Debate About the Nature of Reality* by Man

You should join the Institute of Physics (www.iop.org) as a student member. This is free and gives you access to the digital version of their magazine, Physics World.