

# SURANER SURANER WORK A LEVEL PHYSICS

## **STUDENT NAME:**





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# **About the Summer Work**

This booklet contains a number of tasks that students are expected to complete to a good standard in order to be able to be enrolled in this subject.

Welcome to Dixons 6<sup>th</sup> Form Academy and well done for taking A-Level Physics! Please complete this work on A4 lined paper or print and complete as a booklet if you are able to. You should bring your completed summer work with you to your first Physics lesson in September. The Physics summer work should only take 5-6 hours in total so don't spend days on this.

This booklet also contains significant additional information and a range of optional tasks. We would encourage you to complete all the tasks including the optional ones to fully prepare for Sixth Form study.



# **Welcome to Physics**

#### Subject outline

Physics helps us to understand and explain the Universe around us; from the smallest of particles to the stars and galaxies that make up the Universe itself. In this course you will expand upon a range of familiar topics: forces, energy, motion, waves and electricity as well as introduce to new, unfamiliar and strange areas such as quantum Physics, particle Physics and relativity.

#### **Careers & Higher Education**

A Physics degree is highly sought-after and sets you up for a wide range of possible career options. These include Accelerator Operator, Applications Engineer, Data Analyst, Design Engineer, High School Physics Teacher, IT Consultant, Lab Technician, Laser Engineer, Optical Engineer, Research Associate, Software Developer, Systems Analyst, Technical Specialist, Web Developer.

#### Links to key information

For more information about the course see this <u>Course Information Guide</u>.

The Institute of Physics guide to studying Physics at A Level: https://www.iop.org/publications/ iop/2015/file\_65520.pdf

AQA A-Level Physics Syllabus: https://www.aqa.org.uk/subjects/science/as-and-a-level/physics-7407-7408/specificationat-a-glance



# Summer work tasks

The summer work is arranged into four sections:

- Section 1 Maths skills in Physics
- Section 2 GCSE content review
- Section 3 Research project
- Section 4 Optional extras



### Section 1 – Maths skills in Physics

Scientific notation – need some help? <u>Bitesize link</u>.

Physics covers concepts that are very, very small such as subatomic particles, right up to the entire Universe! As such, scientific notation or standard form is essential for calculations. Refresh using the link above if needed, or attempt the problems below.

1. Please write these numbers in scientific notation or standard form.

a. 47399632	d. 120
b. 0.0000005428	e. 0.00602 x 10 <sup>26</sup>
c. 10.26	f. 663 x10 <sup>-36</sup>

SI units and prefixes – need some help? Bitesize link.

SI units, are a system of seven fundamental units and a complex system of derived units which are used throughout the world to allow *international collaboration* in Physics.

1. Research the 7 fundamental units, write them down and describe what they are used for.

Eg, "candela is the fundamental unit of light intensity or brightness" - this is the only one that you don't need to know for A-level Physics!



Prefixes are used to help Physicists with the enormous range of numbers that are dealt with in the subject. Common ones that you will already be aware of are mili, centi and kilo (as in millimetre, centimetre and kilometre). Physicists use powers of three (ie  $10^3$ ,  $10^6$ ,  $10^9$ , etc) as their main prefixes and will often present a number to the most appropriate unit (ie width of a human hair = 48 micrometers, power output of a fission reactor = 582 megawatts).

- 2. Research the name and symbol of the prefixes used for the following powers of ten:  $10^{-15}$ ,  $10^{-12}$ ,  $10^{-9}$ ,  $10^{-6}$ ,  $10^{-3}$ ,  $10^{3}$ ,  $10^{6}$ ,  $10^{9}$
- 3. Write the following quantities using the most appropriate prefixes.
  - a. Diameter of a single proton =  $1.75 \times 10^{-15} \text{ m}$
  - b. Atomic radius of uranium =  $1.56 \times 10^{-10} \text{ m}$
  - c. Speed of light =  $3.0 \times 10^8$  m/s
  - d. Distance from the Earth to the Sun = 150 million km

#### **Rearranging equations**

It is an important for A-level Physicists to be able to rearrange equations. <u>This video</u> reminds you of how to do this.

4. Show your working and *annotate* with an explanation of how to rearrange the following equations.

a. 
$$\rho = \frac{m}{V}$$
 rearrange for V  
b.  $v = u + at$  rearrange for t  
 $F = \frac{mv^2}{r}$  rearrange for v  
d.  $F = \frac{Gm_1m_2}{r^2}$  rearrange for r



### **Section 2 – GCSE content review**

Atomic and Nuclear Physics

Rutherford's gold leaf scattering experiment
Why were some of the alpha particles scattered?
Why did some go through undeflected?
Why did some go directly backwards

Radioactive decay	What are the properties, range, decay equations and uses of each type?
Alpha decay	
Beta decay	
Gamma decay	



#### Light and the EM Spectrum

What are the p	properties and uses of the EM spect	rum?	Se-	3		d.
EM wave	Properties and uses		-	-	* 3	4
R			1-1	, Ø,	>	62
м			gamma ray X	(-ray ultraviolet	visible infra	ared microwave radi
1			-		Na_14	4.7
v			<b>*</b>	1 Car	<b>.</b>	
U						and the local day
x						
G						





#### **Motion**





#### **Forces and Motion**

What are Newton's 3 laws of motion. Give examples of each.			
Newton's 1st law	Newton's 2nd law	Newton's 3rd law	





#### Work, Energy and Power



Power and Efficiency	
Power equation:	Efficiency equation:
Example Q: A light bulb uses 3600 J of energy in one minute. What is it's power?	Example Q: A light bulb uses 60W of electrical energy, and emits 24J of light every second. What efficiency does it have?



#### **Electricity**

Current, voltage and resistance	
<u>1. Define</u>	2. Calculations
current:	If the current is 6mA, how long does it take for 12C of charge to flow past a point on the wire.
potential difference:	
EMF:	What is the emf of a cell providing 60J of electrical energy per 24C of charge?
resistance:	
power:	A motor uses 6000 J of energy in 2 minutes. What is the power of the motor?
3. Series and parallel circuits	<u>4. Circuit calculations</u>
Describe and explain how current is different between series and parallel circuits:	Calculate the current that each ammeter will show.
Describe and explain how potential difference is different between series and parallel circuits:	What can you tell from this circuit about the resistors R1 and R2?



### Section 3 – Research project

The first two units of the course will be particles and radiation, followed by waves. Please research and prepare an informative poster or presentation on <u>one</u> of the topics below. Some of the course is a recap from GCSE, but you will also need to do some research to extend your understanding. Use the prompt questions in each box to get started, but these are not exclusive, feel free to expand your research! A great example of an informative poster <u>can be found here</u> – detailing the history of the atom.



#### 2025 SUMMER WORK







### **Section 4 – Optional extras**

Some of you will be very excited to get started with studying A-Level Physics, and keen to do some extra work to help you prepare. Here are some extension tasks that go beyond the GCSE syllabus and start to tackle the A-level syllabus.

Particle Physics	
What is the structure of a proton:	What is the structure of a neutron:
What are:	What are the forces acting on the inside of an atom?
1. Hadrons	
2. Baryons	
3. Mesons	
4. Leptons	
5. Quarks	

#### **Quantum Physics**

#### Nature of light

Light is described as a wave. It can also be described as a particle. Investigate the particle nature of light.













Electricity	
The resistance of a wire is directly proportional to length and inversely proportional to cross-sectional area. It also depends on the material of the wire.	What is resistivity?
	What is the resistivity of copper?
What is the equation that links resistance, resistivity, cross sectional area and length of wire? Give the units	Taking the resistivity of platinoid as 3.3 x 10 <sup>-7</sup> Ωm, find the resistance of 7.0 m of platinoid wire of average diameter 0.14 cm.



#### **Isaac Physics Problems:**

Please find below links to gameboards which have been created on Isaac Physics. Each gameboard consists of up to ten questions for you to work on. If you would like your progress to be saved then you can register with Isaac Physics – it's free – or you can work on the problems without registering.

#### Electricity:

Level 1 Gameboard: <u>https://isaacphysics.org/gameboards#020465a5-ba73-4ebc-a0c2-</u> 21c56daed1a1

Level 2 Gameboard: https://isaacphysics.org/gameboards#9a5fbb69-dd14-463f-95e4-11fab6885ac6

#### **Mechanics:**

Level 1 Gameboard: https://isaacphysics.org/gameboards#26a4d8d7-ba77-430a-a0babbd8b06f3c4a

Level 2 Gameboard: https://isaacphysics.org/gameboards#7f567d6e-bc2d-4983-a363-3a393c8dec36

#### Waves and Optics:

Level 1 Gameboard: https://isaacphysics.org/gameboards#52949353-eb05-4b5d-be8af30839593db6

Level 2 Gameboard: https://isaacphysics.org/gameboards#241623b7-6b9f-4f04-87fb-463d613094b7

#### **Particle Physics:**

Atomic Numbers and Nomenclature: https://isaacphysics.org/gameboards#phys\_book\_gcse\_ch\_6\_51

Radioactive Decay: <u>https://isaacphysics.org/gameboards#phys\_book\_gcse\_ch\_6\_52</u>



# **Reading list**

**Book recommendations** 



#### Podcasts

Podcasts are a brilliant way of engaging with a scientific topic, beyond the curriculum. Awesome for University interviews! Take a look at this list below.

Podcast series	Some good episodes
Guardian Science Weekly	Why is the scientific revolution still controversial?
	Steven Weinberg on the history of science
	Could a new force of nature reveal the universe's dark side?
	The quest for a theory of everything
	What is Dark Matter?
	How did life begin?
	Is our universe infinite?
	Is time an illusion?
	Are we on course to find the solution to Earth's energy crisis?
	The truth about radiation
	The search for planet Earth's twin
	Smashing Physics - how we discovered the Higgs boson
The Infinite Monkey Cage with Brian	How we measure the universe
Сох	Are humans still evolving?
	GCHQ
	Microbes: Secret rulers of the world?
	Immune System
	Invasion
	Big Data
	Teenage Brain
	The Secret Life of Birds
	The Mind v the brain
	The Human Voice



<u>Science VS</u> by Gimlet Media	How To Stop A Killer Asteroid		
	5G: Welcome To The Revolution?		
	Ancient Aliens: Who Really Built The Pyramids Scott Kelly: How A Year In Space Changes You Nuclear WarTotal Annihilation?		
	The Bee-Pocalypse		
	100% Renewable Energy – Can We Do It?		
<u>13 Minutes To The Moon</u>	You need to listen to every episode in order to really appreciate this.		
The Curious Cases of Rutherford	The Flying Clock and The Stopped Watch		
and Fry	The Martian Mission		
	The Hamster Power Hypothesis		
	The Space Burrito		
	The End of Everything		
	The Seeded Cloud		
	The Exotic Wormhole		
	The Heart of the Antimatter		
	Jurassic Squawk		
	An Instrumental Case		