GCSE to A Level Physics

Welcome to A Level Physics. The course we will be studying is OCR GCE Physics A (code: H556 from 2015). In this booklet there is information on the textbook we will using, revision guides that match our course and some recommended books for wider reading as well as some tasks you are expected to complete before September to give you a head start on the mathematical skills needed throughout the course.

It is expected that you have a basic understanding of the concepts covered at GCSE level such as electricity, waves, forces and motion. Along with that, mathematical skills are a key part of the course; equation manipulation, prefix conversion, significant figures and using quantities and units.

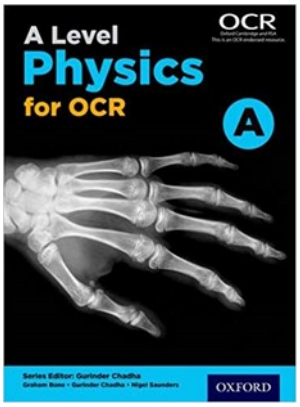
Textbook:

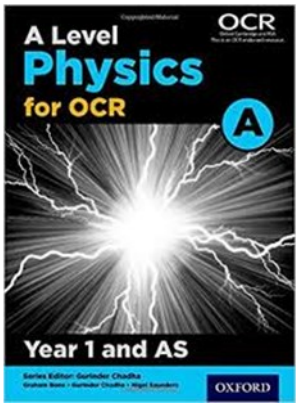
There are multiple versions of the textbook, the complete A level course is covered in the combined textbook or you can choose to buy the Year 1 and Year 2 separate textbooks. The combined textbook will be available through school in September at a discounted price.

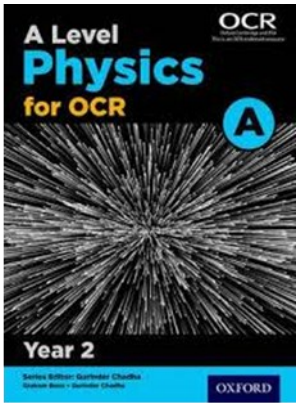
Combined: ISBN: 978 019 835218 1 approx. £40

Year 1 and AS: ISBN: 978 019 835217 4 approx. £28

Year 2: ISBN: 978 019 835766 7 approx. £28







Revision guides:

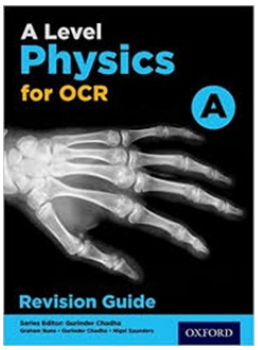
There are multiple versions of revision guides for this course, depending on the brand you would like.

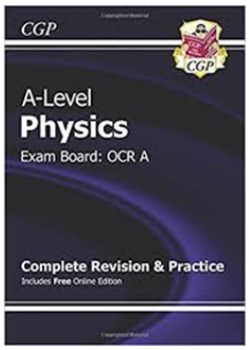
Oxford A level RG: ISBN: 978 019 835778 0 approx. £15

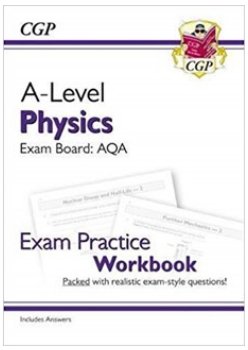
CGP A Level Physics RG: ISBN: 978 178 294306 8 approx. £15

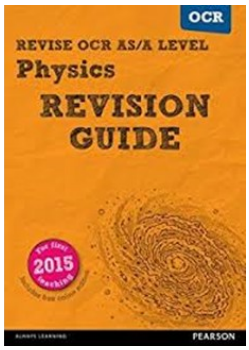
CGP A Level Physics Exam Practice: ISBN: 978 178 294916 9 approx. £10

Pearson A Level Physics RG: ISBN: 978 144 798438 2 approx. £10









Other resources:

There are lots of other resources out there to help you during your A level Physics course.

Youtube is a fantastic resource, just type in the topic you want to find out about in the search bar and off you go. Below are the names of some really good channels you might want to subscribe too. Between them contain videos on content covered at GCSE level if you need to revise the basic of a certain concept, interesting facts about the wider details of a concept as well as going through practice papers to show you how to apply your knowledge.

A level Physics Online

Science Shorts

CrashCourse

Kurzgesagt

SciShow

Websites can be really useful too. The following are really good for up-to-date Physics news, finding advice about Physics careers and explanations for Physics concepts.

Institute of Physics - www.physics.org

Physics World - www.physicsworld.com

Sixty Symbols - www.sixtysymbols.com

New Scientist - www.newscientist.com

Future Learn - www.futurelearn.com

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Books written about Science for the general public can be really useful to help you gain ideas about how Physics fits into every day life. None of the below books are compulsory to read for the Physics course, but during the time you will have to write a research report about a concept of Physics where the below could be useful to give you inspiration and sources to reference.

A Short History of Nearly Everything - Bill Bryson

Why don't penguins' feet freeze - New Scientist

Why does $E = mc^2$ - Brian Cox and Jeff Forshaw

The Grand Design - Stephen Hawkins and Leonard Mjodinow

The Quantum Universe: Everything that can happen does happen - Brian Cox and Jeff Forshaw

A Brief History of Time - Stephen Hawkins

Newton - Peter Ackroyd

From Greek Atoms to Quarks - Sally Morgan

Six Easy Pieces: Fundamentals of Physics Explained - Richard Feynman

Using equations:

At Physics A level, you are expected to be able to manipulate formulae correctly and confidently. You must practice rearranging and substituting equation until it becomes second nature. We shall be using quantity symbols, and not words, to make the process easier to rearrange.

Hints: whatever mathematical operation you apply to one side to an equation must be applied to the other and don't try to tackle too many steps at once.

For example: make *r* the subject of the following formula

$A = \pi r^2$

$$r^2 = \frac{A}{\pi}$$

$$r = \sqrt{\frac{A}{\pi}}$$

Practice: Rearrange the following formula to make *c* the subject - make sure you show every step.

a. $v = t + c$

b. $E = m\,c\,T$

c. $r = \frac{m}{c}$

d. $\frac{x}{y} = k\,c^2$

e. $c^2 = \frac{t}{c}$

f. $t^2 = g^2 + 2cd$

g. $t^2 = c^2 + 2gm$

h. $P = \frac{m}{c^3}$

i. $P = \frac{c^3}{m}$

j. $P = c^{2/3}$

k. $P = \frac{1}{2}c^3 + g$

l. $P = \frac{ck}{2}$

m. $\sqrt{\frac{c}{k}} = he$

Using prefixes:

Often the value of the quantity we are interested is very big or small. To save space and simplify these number, we prefix the units with a set of symbols. It is common practice at A level and above to use standard form or prefixes rather than writing at the whole number.

Prefix	Symbol	Standard Form
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}

Practice: Using the table above, convert these figures into both the standard form version and prefix version.

a. 10,000 m

b. 500,000,000 J

c. 2,000 s

d. 5,075 °C

e. 87 m/s

f. 960,000 W

g. 34 Ω

h. 0.03 A

i. 0.24 C

j. 0.0007 s

k. 0.000,002 J

l. 0.000,000,074 N

m. 0.01 g

n. 0.000,000,000,05 m

o. 200 s

Using significant figures:

Numbers in Physics also show us how certain we are of a value. How sure we are of a certain value or measurement is shown by how many significant figures we quote the number to. The more significant figures, the more precise the measurement is. In calculations, we have to round to the same number of significant figures as the least precise value used.

The Rules:

1. All non-zero digits are significant
2. In a number with a decimal point, all zeros to the right of the right-most non-zero digit are significant.
3. In a number without a decimal point, trailing zeros may or may not be significant, you can only tell from the context.

Practice: Write the following to the stated number of significant figures:

a. 5.0319 m to 3sf

b. 500.00 s to 2sf

c. 0.95678545 J to 5 sf

d. 0.00006532 A to 1sf

e. 536214 V to 3sf

f. 24.65984 to 4 sf

Write how many significant figures the following numbers are quoted to:

g. 224.26415

h. 0.00000000002458

i. 456

j. 200000

k. 4.54

l. 3.00

Calculate the following and write your answer to the correct number of significant figures:

m. 2.65 m x 3.015 m

n. 22.37 cm x 3.10 cm

o. 0.16 m x 0.02 m

p. 54.401 m^3 ÷ 4 m

q. 6000 A ÷ 378 A

r. 6.84 V ÷ 0.04 V

Using units for quantities:

The measurement of physical quantities are expressed in terms of units, which are standardised values. Without standardised units, it would be extremely difficult for scientists to express and compare measured values in a meaningful way. All physical quantities in the International System of Units (SI) are expressed in terms of combinations of seven fundamental physical units; at A level we only need six of these. All other units are made by mathematically combining the fundamental units.

Quantity	**Unit**	**Unit Symbol**
Length (l)	metre	m
Mass (m)	kilogram	kg
Time (t)	second	s
Electrical current (I)	Ampere	A
Temperature (T)	Kelvin	K
Amount of substance	mole	mol

eg. 1 N = kg m/s (F=ma)

For the majority of quantities, we also give them symbols so we can show relationships more simply

eg. Ohm's law - Potential difference = Current x Resistance - can be written as V = IR

Practice: Convert the following units into their equivalent SI units:

a. Coulomb
b. Hertz
c. Joule
d. Ohm
e. Pascal
f. Volt
g. Watt

Give the symbols and common units for the following quantities:

h. Length
i. Volume
j. Electrical charge
k. Time interval
l. Angle
m. Speed
n. Energy
o. Specific heat capacity
p. Momentum

Practice questions:

Using your knowledge from the previous tasks, answer the following questions showing your complete working, giving the answers in standard form/prefixes if necessary to the correct answer of significant figures with the correct common units.

1. Calculate the resistance of a component with a potential difference of 7.5 kV and an electric current of 2A.
2. Calculate the power of a component with a potential difference of 35V and an electric current of 3 mA.
3. Calculate the time it takes an electric charge of 1.6×10^{-19} C to produce an electric current of 10 A.
4. Calculate the frequency of a wave that has a wavelength of 790 nm and travels at a wave speed of 3×10^{8} m/s.
5. Calculate the density of an object with a mass of 1 tonne and a volume of 50 Mm^3.
6. Calculate the mass of an object with a gravitational potential energy of 50 TJ at a height of 67.5 Gm on Earth.
7. Calculate the time taken for an object with a mass of 500 kg to accelerate from rest to 22.5 m/s with an acceleration of 2.75 m/s^2.
8. Calculate the velocity of a falling object with a gravitational potential energy of 84,624 J, a mass of 65.4 kg and height of 4 m
9. Calculate the force of an cylinder-shaped object resting on a surface with a pressure of 694 µPa, a mass of 5.2 kg and a diameter of 3.7 mm
10. Calculate the elastic potential energy of a spring when a force of 5.4pN gives an extension of 173 cm.
11. Calculate the momentum of an object under a resultant force of 14MN with an acceleration of 12.4 m/s^2 with a final velocity of 7fm/s.
12. Calculate the time period of an electromagnetic wave with a wavelength of 38 pm.