

AS PHYSICS

Introductory Class Working as a Physicist & Summer Tasks 2021



STUDENT NAME:

TUTOR NAME: Colin Brownbridge

S.I. units (Systeme International d'unites)

This is the system of “metric” units used in most scientific work. When a quantity such as length is measured the value is given a unit, in this case the unit being the metre. Remember that the value is meaningless unless the unit is shown. The name of each unit also has a standard symbol of no more than three letters, so for example the abbreviation for metre is m.

Base units and derived units

The S.I. system of units is based on seven **base units**, which are:

Quantity		Unit	
Name	Symbol	Name	Symbol
mass	<i>m</i>	kilogram	kg
length	<i>l</i>	metre	m
time	<i>t</i>	second	s
temperature	<i>T</i>	kelvin	K
luminous intensity	<i>I</i>	candela	cd
electric current	<i>I</i>	ampere	A
Quantity of matter	<i>n</i>	mole	mol
Luminous Intensity	<i>I_v</i>	candela	cd

All other units are **derived units** and can be expressed as a combination of base units, even when the unit is given its own name.

Examples of derived units are:

metre² (m²), the unit of area

newton (N), the unit of force,

where 1 newton = 1 kilogram metre / second²

Points to remember:

1. Symbols for units are always written in the singular. This is because s is the symbol for second e.g. 5 ms means 5 milliseconds, not 5 metres.
2. You must be careful to distinguish between upper and lower case letters (i.e. capital and small letters) because the same letter can mean different things depending on whether it is upper or lower case. For example the prefix M, standing for mega, multiplies a unit by 1 000 000 whereas the prefix m, standing for milli, multiplies a unit by 0.001.
3. When the name of a unit is written in full it nearly always starts with a lower case letter, even if the unit is named after a person e.g. the newton which is named after Sir Isaac Newton.
4. Quantities also have symbols. To distinguish between the symbols for quantities and the units that they are measured in, it is normal in printed text to write the symbols for quantities in italic (*sloping*) print and the symbols for units

in normal upright print e.g. the symbol for the quantity time is t and the unit of time is the second with the symbol s,

so that time = 5 seconds is written as $t = 5 \text{ s}$.

Obviously it is not possible to do this in hand written text, but it is usually obvious from its context. An equation relating several symbols together will usually involve quantities:

e.g. $s = \frac{d}{t}$ meaning speed = $\frac{\text{distance}}{\text{time}}$

whereas a symbol following a number will be the unit of the number e.g. in 8 kg, kg is the symbol for the unit kilogram.

The use of standard prefixes with S.I. units

Larger and smaller units are (with a few exceptions) obtained by placing one of the standard prefixes given below before the unit (a fuller set of prefixes is given on a separate sheet). For example, the prefix kilo with the symbol k gives a unit 1000 times larger than the basic unit, no matter what the unit is

e.g. 1 kilogram = 1,000 gram 1 kilometre = 1,000 metre.

Symbol	Prefix	Multiplies unit by	or	or
M (upper case)	Mega	1 000 000		10^6
k	kilo	1 000		10^3
d	deci	1/10	0.1	10^{-1}
c	centi	1/100	0.01	10^{-2}
m (lower case)	milli	1/1 000	0.001	10^{-3}
μ (Greek "mu")	micro	1/1 000 000	0.000001	10^{-6}
n	nano	1/1 000 000 000	0.000000001	10^{-9}
p	pico	?	?	12^{-12}

The problems that follow use these common units:

Quantity	Unit	Symbol
mass	kilogram	kg
length	metre	m
time	second	s
volume	litre	l
energy	joule	J
power	watt	W
voltage	volt	V

Exercise 1 - Express:

1. 8 kilometres in metres

Worked Example: 8 **kilo** metres, where kilo (k) multiplies by 1,000

$$8 \times 1,000 \text{ metres} = 8,000 \text{ m} \quad \text{or} \quad 8 \times 10^3$$

2. 2 milliseconds in seconds

3. 3 megajoules in joules

Exercise 2 - Express:

1. 15 000 m in **km**

Worked Example: 15,000 metres, where kilo (k) multiplies by 1,000

$$15 \times 1,000 \text{ metres} = 15,000 \text{ m} \quad \text{or} \quad = 15 \times 10^3 \text{ m}$$

$$15 \text{ km} \quad \text{k is substituted for } \times 1,000 \text{ or } ,000 \text{ or } \times 10^3$$

2. 0.57 m in cm

3. 320 000 W in MW

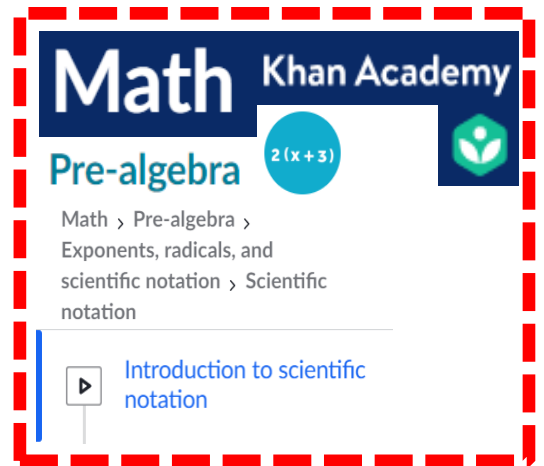
Utilising online teaching tools:

During the course, two online resources will be utilised extensively:

1. <https://www.khanacademy.org>
2. <https://isaacphysics.org/>

For your A-Level Physics course at Coulsdon College, for each topic of study you will be given a student learner pack. This should be completed as you move through the course with the learner pack sections having the same section reference as your textbook you will receive when you begin.

Khan Academy video links will be shown in red boxes next to topic headings or subheadings.

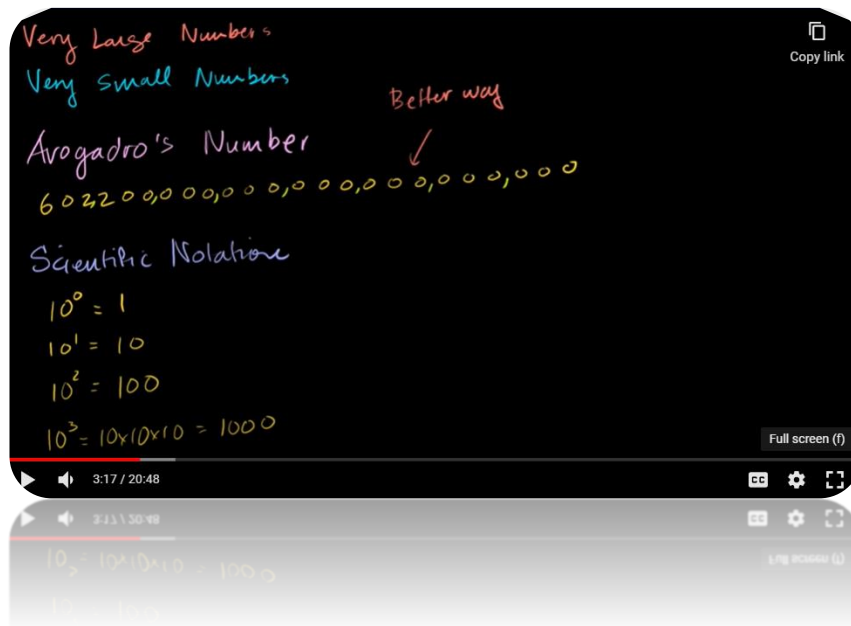


An example of this is on the right.

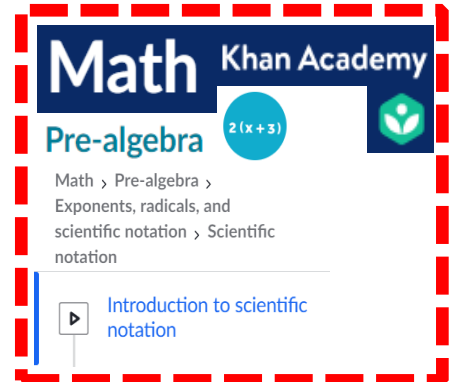
- Either;
- i) click on the link
 - ii) follow the URL:

<https://www.khanacademy.org/math/pre-algebra/pre-algebra-exponents-radicals/pre-algebra-scientific-notation/v/scientific-notation-old>






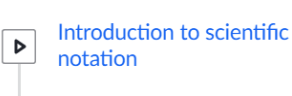
- iii) Click on the hyperlinked video image



Notice how it is referred to as scientific notation and not standard form as in the UK, if using Khan Academy and you can't find additional resources please ask for advice as they may utilise an alternative word for the same topic.



The box contains the following information:

Image	Information
	Khan Academy (KA) logo so you know the source of the material.
	The course within KA In future this will usually be either Physics or AP Physics
	The sub course within the main course
	The KA symbol for the sub course, look out for the AP symbol for the physics course. This can be found in the sciences section of KA. 
Math > Pre-algebra > Exponents, radicals, and scientific notation > Scientific notation	The full links to follow to find the video(s) on the KA system.
	The name of the video(s) you are expected to watch, it may not be the first and within a sequence on KA you may not be required to view all of the videos. It is useful to be aware of the other videos in a KA sequence if you require additional info/resources on another topic.

Isaac Physics has been produced in collaboration between the University of Cambridge Physics Department and the Department for Education.

Create an account with Isaac Physics using the above link or the apple above. When you start I will link your account to the College so I can view your responses.

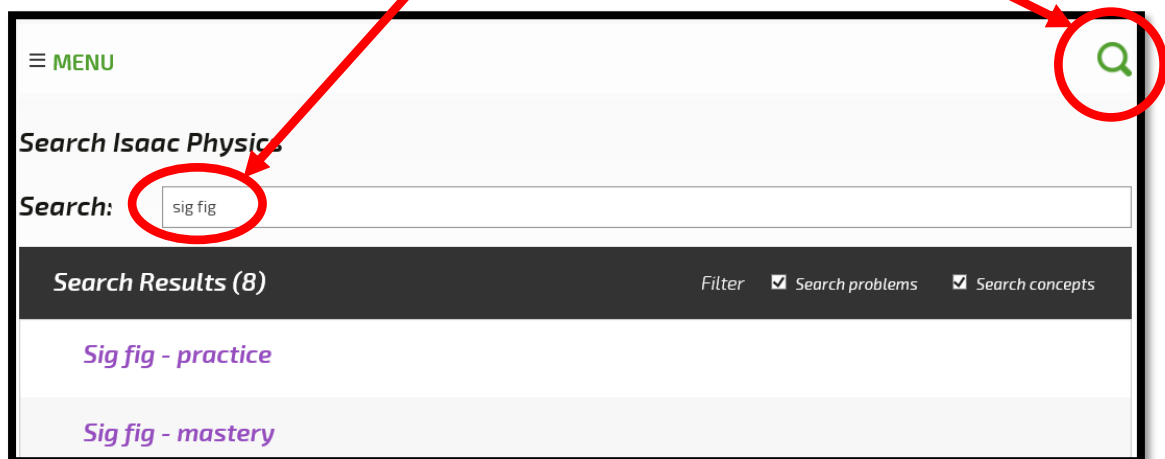
To begin with you must get used to how the Isaac Physics system operates.

Always ensure you sign in before beginning work so your progress can be tracked.

Before we begin the book and online version we must learn how Isaac Physics wants us to form our responses, exactly the same system is utilised in you're A-Level Physics examination.



Use the 'search function' as shown below to find two tasks related to 'sig fig'.




When you choose to answer a question, the question always appears first.

Useful information can be unhidden in the 'Hints' tab as shown below if you are stuck or your answer is incorrect.

In this case, Hint 1, is an explanation of what you the student are expected to do to complete this task. Please read through this and then complete the two tasks.

Q: Sig fig - practice



Part A **Sig fig 1**

Answer Now
Hint 1

When the question only involves multiplication and/or division of values, the number of significant figures in the answer is the same as the smallest number of significant figures of any data **used** in the question.

Sig fig rules are always applied to all Isaac questions and must be followed.

For incorrect answers:

It should be noted now that during our course some of the values Isaac wants you to use may differ from those supplied by Edexcel for your exams, if your answers, having applied the rules of sig fig, are still incorrect it is worth checking the Hints tabs to see if Isaac is asking you to utilise a slightly different value.

It may also be incorrect due to an error, check your working to see if you have made a mistake. When using the Isaac system, always use a pen and paper so you can check for mistakes, remember, in the exams you will only have a pen and paper to communicate with the examiner and you won't know if you answer is correct or not straight away. Always prepare yourself for how you are going to work in the exam.

For the next task we will be using the book (or online book in this case).

Click on the Apple to return to the main menu, you can always click on the apple from any page to return to the home screen.



Follow the link, for **A-Level** learning as shown on the left.

LEARN

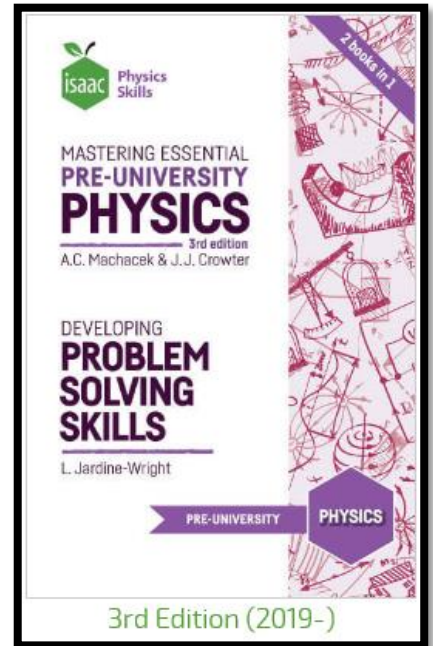
GCSE
A Level
Student Support

Choose the, Physics Skills Mastery link shown on the right.

Choose to answer questions from the latest version of the Isaac Physics Pre-University physics book. (3rd edition 2019+)

We advise students to use the online version (mobile phones work excellently in addition to your pen and paper but a hard copy is available for students who wish to order one.

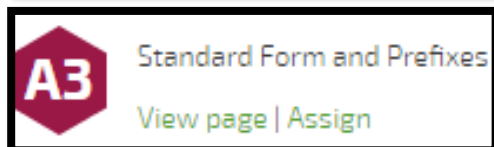
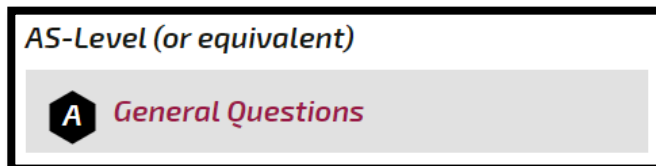
We are now going to complete task A3, Standard Form and Prefixes.



Select: A General Questions

Select: A3

This should be completed for your return, please ensure you are logged in in order to save your responses and access them.



Physicists utilise a lot of mathematical skills within their field of study and work. It is vital that all applicants on a Physics A-Level course have the required algebraic level in order to succeed.

Isaac tasks in your A-Level Physics Learner Packs will have the following layout:



Complete Isaac Physics: A1 Using and Rearranging Equations

A1 on Isaac is the last online based task to complete.

Once on the course, any Isaac tasks to be completed will be accompanied with an email from the Isaac system.

The Topic List for the AS Physics course is as follows:

- TOPIC 2: Mechanics
- TOPIC 3: Electric Circuits
- TOPIC 4: Materials
- TOPIC 5: Waves and the Particle Nature of Light

For each of these topics, create a power-point slide (4 slides in total) on what sub topics will be covered in each of these headings.

You may use any format you believe appropriate (Spider diagram, bullet points, flow chart, experiments list, famous names or breakthroughs in the field of physics etc.) but you must include **at least one image** for each slide.

Include one extra slide on which topic, you believe will be your strong area and your weak area and which you are looking forward to studying the most and why.

Completion Checklist (*Tick box when complete*):

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1. Exercise 1 & 2 on metric prefixes in pack
2. Watch Khan Academy video
3. Register with Isaac Physics
4. Sig fig on Isaac (2 tasks)
5. A3 on Isaac Physics
6. A1 on Isaac Physics
7. 5 Powerpoint slides on AS Physics and your relation to the course