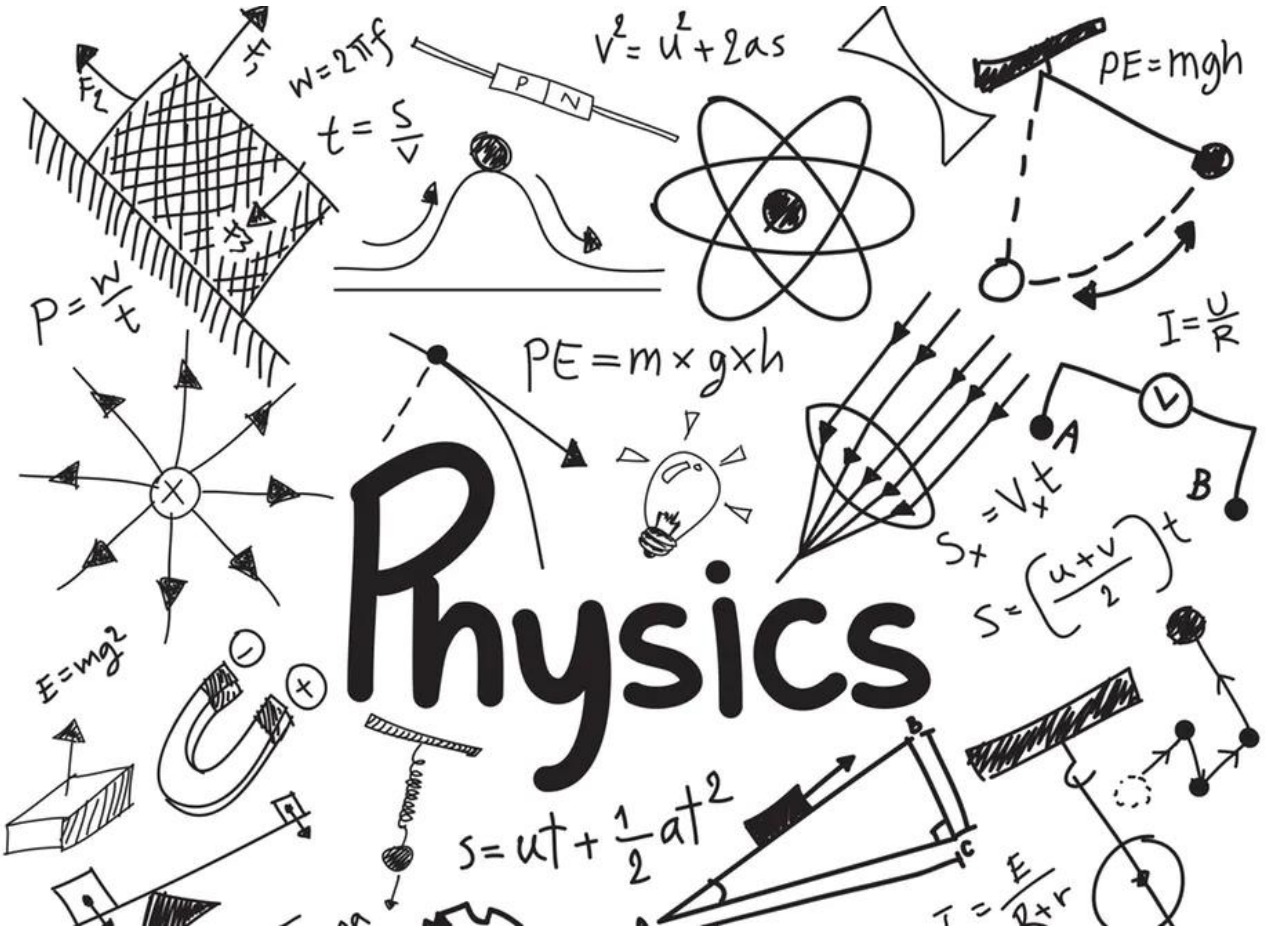
A-Level Physics Transition Work

Year 11



THOMAS TELFORD SCHOOL

Physics transition tasks

1. Dealing with symbols and SI units

multiple	prefix	symbol
10^{12}	tera-	T
10^{9}	giga-	G
10^{6}	mega-	M
10^{3}	kilo-	k
10^{-3}	milli-	m
10^{-6}	micro-	μ
10^{-9}	nano-	n
10^{-12}	pico-	p

One of the highest jumps between GCSE and AS physics is the way things are written down. At AS level you're expected to start using standard scientific notation.

Standard notation means:

- using the conventional symbols for quantities
- writing all quantities in terms of SI units (Système International)
- writing very large and very small numbers in standard form (e.g. 10^{-6} instead of 0.000001)

You will need to have memorised the unit prefixes shown in the table on the right – they are used in exams and it is assumed that you know what they mean.

Of course people in the real world don't use standard scientific notation – you don't see car speedometers with ms^{-1} scales on them or tyre pressure gauges calibrated in kNm^{-2}. You'll also encounter non-standard units in the physics course itself – megaparsecs, electronvolts and a.m.u. for example.

In the following ten pairs of quantities, circle the quantity which is greater.

a. 12 mW or 12 MW

b. 3.0 μs or 3.0 ns

c. 27 kV or 27 GV

d. 6 pm or 6 μm

e. 1024 TW or 1024 GW

f. 22×10^{-2} Ω or 220 Ω

g. 300 kg or 3×10^{3} kg

h. 121 kN or 0.0121×10^{6} N

i. 30×10^{-6} F or 0.003 pF

j. 14000 MHz or 1.4×10^{9} Hz

When you write out the name of a unit in full it is always written completely in lower case letters. For example: the unit of power is the watt (symbol W). In the box above, next to each question write the full name of the SI unit in the question. Bonus points if you find out why some symbols are written using upper case (e.g. N) whereas other unit symbols are written using lower case (e.g. s).

You must bring a working scientific calculator to all of your physics lessons and exams. Your calculator has a button that says ENG . Find out what this button does, and why it will be useful to you on your physics course. Describe the function and usefulness in the space below.

2. Dealing with equations

One of the biggest problems that students face when moving to A-level is being comfortable and proficient at rearranging formulae.

For 'three-term equations' like $\boldsymbol{F} = \boldsymbol{ma}$ or $\boldsymbol{V} = \boldsymbol{IR}$ it is sometimes useful to teach GCSE students the idea of the 'formula triangle'.

At A-level, however, this will no longer be sufficient. You need to learn how to properly change the subject of a formula since you will meet far more complicated formulae than the simple three-term equations shown above.

Remember that the '=' sign in an equation does not mean 'equals' – rather it is the 'equality' operator. This means that whatever you do to one side of the '=' you must do the same to the other.

For example: "Change the subject of the formula: $v = u + at$ to give *a*"

Step1: Subtract *u* from both sides: $v - u = at$

Step 2: Divide both sides by t: $\frac{v-u}{t} = a$

Now have a go at these six for yourself. You might need to do a bit of research to find out how to do them all. (This last one involves the exponential function (e), so you will have to find out how you remove this from the equation)

$s = ut + \frac{1}{2}at^2$ Find *a*	$v^2 = u^2 + 2as$ Find *u*
$y = mx + c$ Find *m*	$T^2 = \left(\frac{4\pi^2}{GM}\right)r^3$ Find G
$\emptyset = BA\cos\theta$ Find θ	$V = V_0 e^{-\frac{t}{CR}}$ Find t

3. Research Activities

To get the best grades in A Level Physics you will have to get good at completing independent research and making your notes on difficult topics. Below are 5 links to websites that cover some interesting Physics topics.

You need to choose 3 out of the 5 websites and make 1 page of notes on each. Your notes can be on any particular area of Physics that interests you on that website.

http://home.cern/about

CERN encompasses the Large Hadron Collider (LHC) and is the largest collaborative science experiment ever undertaken. Find out about it here and make a page of suitable notes on the accelerator.

http://joshworth.com/dev/pixelspace/pixelspace_solarsystem.html

The solar system is massive and its scale is hard to comprehend. Have a look at this award winning website and make a page of suitable notes.

https://phet.colorado.edu/en/simulations/category/html

PhET create online Physics simulations when you can complete some simple experiments online. Open up the resistance of a wire html5 simulation. Conduct a simple experiment and make a one page summary of the experiment and your findings.

http://climate.nasa.gov/

NASA's Jet Propulsion Laboratory has lots of information on Climate Change and Engineering Solutions to combat it. Have a look and make notes on an article of your choice.

http://www.livescience.com/46558-laws-of-motion.html

Newton's Laws of Motion are fundamental laws for the motion of all the object we can see around us. Use this website and the suggested further reading links on the webpage to make your own 1 page of notes on the topics.

Note Taking *– Not sure where to start on how to take notes. There are many different ways you can effectively take notes. Look at this website for some ideas:*
https://collegeinfogeek.com/how-to-take-notes-in-college/

4. Watch Physics

- Watch any or all of the "Schools Lecture series" videos made by the Institute of Physics. Don't be put off by the title – they are all presented by experts in physics at the right kind of level, and the topics covered will really help you understand some of the details of the A-level course. http://www.iop.org/resources/videos/education/

- You could spend your whole life watching physics video clips on YouTube. Here are some that I recommend:
    - The '**minutephysics**' channel covers a lot of the physics covered at A-Level – and all clips are only a minute long. http://www.youtube.com/user/minutephysics
    - '**Alevelphysicsonline**' Youtube channel covers all A-Level content and has specifically been made for A-Level students. https://www.youtube.com/channel/UCZzatyx-xC-Dl_VVUVHYDYw
    - '**Veritasium**' Youtube channel covers lots of everyday science and answers some interesting questions. https://www.youtube.com/user/1veritasium

Channels on Freeview to keep an eye on are BBC2, BBC4, Quest and Dave. Specific programmes to look out for, in no particular order, are:

- **Mythbusters** (on Quest, but also on cable and satellite channels) – arguably the best show about scientific investigation, with added rockets! Watch it.

- **The Sky at Night** (BBC4) – longest running science TV programme in the universe, everything current in space and astronomy with proper experts.

- **Horizon** (BBC2 and BBC4) – topical science documentary, often physics-based. There have been some really interesting episodes about neutrinos, time, black holes, etc.

- There are also many programmes (and series of programmes) available on catch-up services like iPlayer, 4OD, etc. They all usually have the option to search for a program based on a topic so see what you can find in the science sections.

There are also some good science fiction films you can watch if you get time:

- Interstellar
- Gravity
- Apollo 11
- The Imitation Game
- The Abyss
- The Theory of Everything
- Particle Fever

5. Complete Physics Research

There are many different scientific research projects that are currently happening that you can get involved with. Large scale physics research often involves vast amounts of data. Many research projects look for the public to analyse this data to help them out with the research. There are five different projects below that you can get involved with. You never know, you might be the person to discover the next asteroid or even a form of alien life!

- **SETI@home** is a scientific experiment that uses Internet-connected computers in the Search for Extra-Terrestrial Intelligence (SETI). You can participate by running a free program that downloads and analyses radio telescope data. http://setiathome.berkeley.edu/

- **Asteroid Watch** allows you to search for Near Earth Objects (i.e. asteroids) in observations that have been made, and report back their positions. It is important we know the trajectory of asteroids in case any of them are on a path towards Earth.
  http://www.schoolsobservatory.org.uk/activ/asteroidwatch

- **Galaxy Zoo** – to understand how galaxies, and our own, formed we need your help to classify them according to their shapes — a task at which your brain is better than even the most advanced computer. If you're quick, you may even be the first person in history to see each of the galaxies you're asked to classify. http://www.galaxyzoo.org/

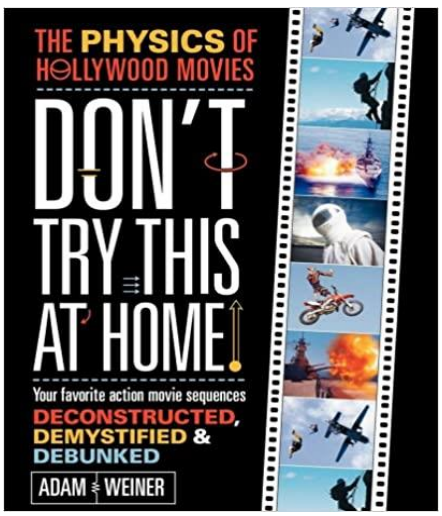
- **Zooniverse** – many other projects similar to galaxy zoo: solar stormwatch, planet hunters, the Milky Way project. https://www.zooniverse.org/

- **PhET interactive simulations**. Fun, interactive, research-based simulations of physical phenomena from the PhET project at the University of Colorado. This site will be used again and again during your A-level course. http://phet.colorado.edu/

6. Hollywood Physics

There are many films that seem to defy the laws of Physics. As you progress through A-Level Physics you will gain the knowledge to be able to look back at films and work out if what you saw could have actually happened in real life. One film that has been criticised many times is Speed which was released in 1994.
Watch this Mythbusters episode which sets out to find out if the jump in the film really happened:
https://www.dailymotion.com/video/x2n91sy

Now you have seen the Mythbusters episode you can read through this website which goes through all the calculations needed for the jump: https://physics.info/projectiles/practice.shtml



Task:

What film can you think of that might not be obeying the laws of Physics? Write a 1 page report based on the Physics in a film of your choice and why it might not be correct.