BILBOROUGH COLLEGE A-LEVEL PHYSICS PRE-COURSE TASKS

Your name_____ Other subjects chosen_____

Advice: Print this out and write on it OR work on it electronically and save your own copy, whichever you prefer.

Try to complete as much of this as you can. It is OK to use previous notes, books, websites etc to help if you need to, but please make sure the answers to questions are your own. Please complete as much as you can of tasks 1,2 and 3 below (plus optional task 4 if you wish) ready for submission to us during the first week of physics lessons… we'll give details on how to do this when we meet you in September.

Task 1 : Some quantities… Fill in the table below, the first one has been done as an example.

QUANTITY	**STANDARD UNIT**	**OTHER VERSIONS OF UNITS YOU MIGHT USE**	**EQUATION FEATURING IT**
Distance	m (metres)	mm, km, cm, nm	Speed = distance / time
Potential energy			
Frequency			
Force			
Current			
Power			
Work done			

Note: Being careful with quantities and their units is a key part of the A-level physics course.

Task 2 - Maths Check – Show working out when calculating values, please

1) A thin wire is wrapped 22.5 times around a reel of diameter 8cm. What is the length of the wire, in metres?

⇒ Length = _____m

2) A hot water cylinder has an internal diameter of 0.28m. Initially there is a height of 0.55m of water in the tank. A tap is opened at the bottom of the tank and water flows out until there is a height of 0.39m left in the tank. Calculate the volume of water that flowed out of the tap.

⇒ Volume = _____m^3

3) $V = IR$ Rearrange this to make R the subject

Rearrange: $R =$

Now calculate R if, $V = 200$, $I = 0.25$

R =

⇒ R = _____

4) $c = f\lambda$ Make λ the subject

Rearrange: $\lambda =$

Now calculate λ if, $c = 3\times10^{8}$, $f = 1.5\times10^{15}$

⇒ λ = _____

5) $x = \dfrac{h}{mv}$ Make v the subject

Rearrange: ⇒ $v =$

Now calculate v if, $h = 6\times10^{-34}$, $m = 9\times10^{-31}$, $x = 3\times10^{-10}$

⇒ v = _____

6) $s = \dfrac{1}{2}gt^2$ Make t the subject

Rearrange: $t =$

Now calculate t if, $s = 330$, $g = 10$

⇒ t = _____

7) $d \sin x = n\lambda$ Make x the subject

Rearrange: ⇒ $x =$

Now calculate x if d = 0.001, n= 3, and $\lambda = 2.4 \times 10^{-4}$

⇒ x = _____

8) Name two or more different examples where two variable quantities are *proportional* to each other (e.g *height of object* and *gravitational potential energy*):

_____

_____

_____

Note: Using skills of maths in almost every lesson is a key part of the A-level physics course.

Task 3 : Written explanations… Read the short passage below:

Measuring the Speed of sound

A group have students are attempting to measure the speed of sound in the college grounds. Their technique is to film an event at a distance. One student claps a pair of cymbals together at one end of the sports field. Another student films this event from the far end of the sports field. By analysing the film using the slow-motion feature on their phone's camera, the students are able to find a value for the time delay between the image of cymbals meeting and the sound of this being picked up by their phone's microphone.

In your own words, explain how the students are measuring the speed of sound. Your answer should include

- A description or diagram of how this experimental technique allows measurement of speed of sound
- A description of how they will use their measured results to calculate the speed of sound
- A description of any sources of error that may lead to them not getting exactly the right answer.
- Some likely values for their measurements (the following may be useful: speed of light = 3.0×10^8 m/s, speed of sound (approximately) = 330m/s, length of sports field = 120m, resolution of phone's time recoding = 0.01 seconds)

Note: Being able to interpret and explain the ideas of physics in situations is a key part of the A-level physics course.

Task 4 : Going further… A challenge to find things out:

(This task is optional… spend some time on it if you wish.. be aware that it may take you beyond even the A-level syllabus, so don't panic if you come across material that you can't understand yet, leave it and try to find other sources)

Just after the Big Bang the early Universe could consist only of hydrogen, the simplest atoms, made by joining one proton and one electron. Now the Universe consists of many other elements… lots of helium but also a significant amount of other stuff e.g iron, carbon, oxygen, the stuff that you and I are made from. How did this happen? Research into this, in the box below produce a brief summary of anything you find out.

Handy hints: Obviously many websites and educational film clips exist… search things like "universe creation", "where your elements come from" "elements formed in supernova events"

But also many good books, e.g " a Universe from Nothing" by Lawrence M Krauss, " A Short History of Nearly Everything" by Bill Bryson.

Note: Being interested in big ideas like this is what makes it worth doing all the work in the A-level physics course!

Going Further:

Things to read:

1. **Head start to A level Physics** CGP https://www.cgpbooks.co.uk/secondary-books/as-and-a-level/science/physics/pbr72-head-start-to-a-level-physics-with?srsltid=AfmBOoquCf6YKftLWQGxnqDQ8rtsf6LgxcL3nk3zbQw4Q8hipBK4WDFM

2. **Quantum Theory Cannot Hurt You:** Understanding the Mind-Blowing Building Blocks of the Universe Any physics book by Marcus Chown is an excellent insight into some of the more exotic areas of physics that require no prior knowledge

3. **A Short History of Nearly Everything**: A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will refamiliarise you with common concepts and introduce you to some of the more colourful characters from the history of science.

4. **Why the Universe Exists:** How particle physics unlocks the secrets of everything (New Scientist Instant Expert) If the recent discovery of the Higgs boson piqued your interest, then Why The Universe Exists will take you deeper into the world of particle physics, with leading physicists and New Scientist exploring how the universe functions at the smallest scales.

5. **Surely You're Joking Mr Feynman**: Adventures of a Curious Character By reading this book you will get insight into his life's work including the creation of the first atomic bomb and his work in the field of particle physics

Things to watch:

1. **A Trip to Infinity (2022)** The world's most modern scientists and mathematicians embark on a search for the infinite and its amazing effects on the universe (available on Netflix)

2. **Einstein and the Bomb (2024)** What happened after Einstein fled Nazi Germany? Using archival footage and his own words, this docudrama dives into the mind of a tortured genius. (available on Netflix)

3. **Is our Universe the only Universe? Brian Greene** (2012) Is there more than one universe? In this visually rich, action-packed talk, Brian Greene shows how the unanswered questions of physics (starting with a big one: What caused the Big Bang?) have led to the theory that our own universe is just one of many in the "multiverse." https://www.ted.com/talks/brian_greene_is_our_universe_the_only_universe?langua=&subtitle=en&trigger=5s

4. **We need nuclear power to solve climate change - Joe Lassiter (2016)** Joe Lassiter is a deep thinker and straight talker focused on developing clean, secure and carbon-neutral supplies of reliable, low-cost energy. His analysis of the world's energy realities puts a powerful lens on the stubbornly touchy issue of nuclear power, including new designs for plants that can compete economically with fossil fuels. We have the potential to make nuclear safer and cheaper than it's been in the past, Lassiter says. Now we have to make the choice to pursue it. https://www.ted.com/talks/joe_lassiter_we_need_nuclear_power_to_solve_climate_change?subtitle=en&trigger=5s

5. **Oppenheimer (2023)** The story of American scientist J. Robert Oppenheimer and his role in the development of the atomic bomb.

Websites:

https://physicsworld.com/

https://www.iop.org/