Physics

Brief Overview of the Course

The Physics course consists of three units assessed by written examinations. In the first of these, students will study many of the core areas of Physics including Mechanics, Electricity, Electric and Magnetic Fields as well as being introduced to more esoteric aspects such as Particle Physics. The second unit covers Materials, Gravitational Fields, Space as well as Quantum and Nuclear Physics.

Unit 3 is about practical skills and data analysis as well as synoptic questions covering material from the full course. Throughout the course, students will develop a variety of practical skills such as experimental design, problem solving, processing data and evaluating their results including quantifying uncertainty. Students will be required to achieve a level of practical competency that will have to be endorsed by their teacher to pass the course. 15% of the questions in the A-Level examinations will test a student's practical skills.

(For further details, please see our Sixth Form Prospectus
Sixth Form Prospectus • Sir Thomas Rich's School (strschool.co.uk)*)*

Exam Board: Edexcel

Specification web link: Specification - A level (pearson.com)

Please follow the instructions in the boxes below. The aim of these activities is to introduce you to the study of this subject at Advanced Level by:

- reinforcing your core knowledge and understanding of your chosen subject;
- encouraging you to think more deeply about your subject;
- supporting you to develop a deeper understanding of and appreciation for your subject as an academic discipline.

Core Knowledge and Understanding Task

Whether you have studied this subject before or not, there are elements of core knowledge and understanding that you must have prior to starting the A Level course.

Please answer the questions that have been set up for you at Seneca Learning.

The link is below, please **SIGN UP** at the top right of the welcome page**.**

The school is Sir Thomas Rich's School, and the teacher is Mr Cooper. You will need the following code to access the resources (Use the **JOIN CLASS** button) :

hflt9z4jp3

The material has been specifically designed to help you make the transition from GCSE to A-Level. We look forward to seeing how you get on.

Links to support:

https://senecalearning.com/en-GB/

The Bigger Picture Task

As well as reinforcing your core knowledge and understanding, our A Level curriculum will expose you to what are called the 'established orthodoxies' within each subject, which can include key research, important people who have contributed to the field, as well as broader methods and theories that exist within the subject.

Prior to starting the A Level course, it is important that you are aware of the following themes and topics so that you can develop an understanding of how they contribute to some of the established orthodoxies within Physics.

https://openstax.org/details/college-physics
Download for free at http://cnx.org/content/col11406/latest/.

Please read Openstax College Physics Textbook ('view online') from below the beautiful image of Andromeda galaxy and for the following two pages. Try and answer the questions below. It is indicated in the questions which section they are based on. Some of the questions have very open-ended answers or are just prompts to think about what you have read. Others can be answered directly.

Physics: An Introduction

"the basic simplicity of nature"

"Science is a hall full of awe and wonder. The problem is the long dark kitchen you have to go through to get there."

i. From your studies of science, which of the above statements are you most in agreement with?

Science and the Realm of Physics

i. Science encompasses three aspects. What are they?

ii. Which four phenomena is physics trying to describe the interaction of?

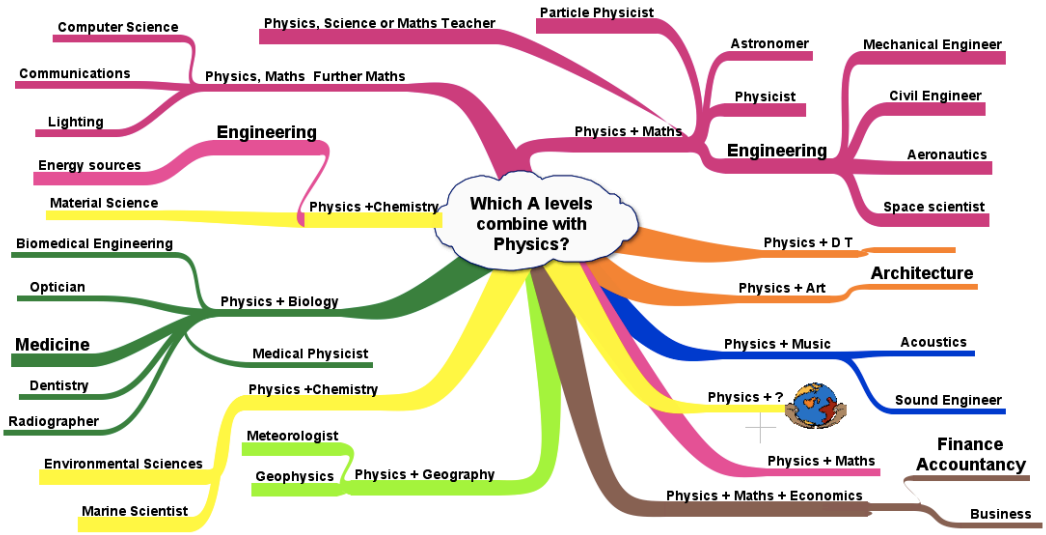
"It is important to realize that in physics today, we have no knowledge of what energy is."
Richard Feynman

iii. Does this bother you? Do you think the other three phenomena are likely to be easier to pin down than energy?

iv. What is the difference between a physicist and an engineer? Is an understanding of physics essential to becoming an engineer?

Applications of Physics

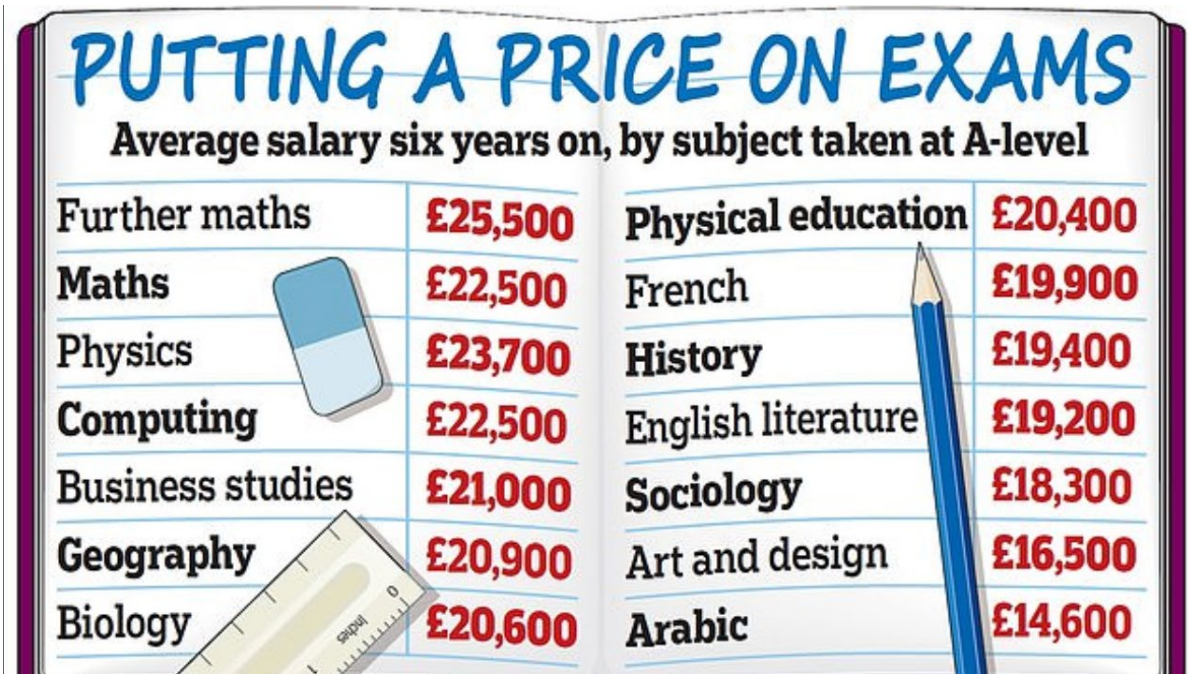
i. How would your life be different if our understanding of physics was put back 100 years? 50 years?



ii. How do you think the involvement of physics in medicine has changed over your lifetime? Over your parent's lifetime?

"A skill in the analytical methods for applying them".

iii. Financially, the skills gained by studying physics are highly rewarded, on average. Are these skills inherently more valuable than those gained by studying Arabic, or is society appraising these skills inappropriately?



PUTTING A PRICE ON EXAMS

Average salary six years on, by subject taken at A-level

Further maths	£25,500	Physical education	£20,400
Maths	£22,500	French	£19,900
Physics	£23,700	History	£19,400
Computing	£22,500	English literature	£19,200
Business studies	£21,000	Sociology	£18,300
Geography	£20,900	Art and design	£16,500
Biology	£20,600	Arabic	£14,600

Models, Theories, and Laws; The Role of Experimentation

i. How is a law of physics (or science) different to other laws, such as those in economics?

https://www.presentationzen.com/presentationzen/2014/04/richard-feynman-on-the-scientific-method-in-1-minute.html

"The cornerstone of discovering natural laws is observation; science must describe the universe as it is, not as we may imagine it to be". Genius therefore can be thought of as "seeing what everybody else has seen, but thinking what nobody else has thought"

ii. To what extent do you think your understanding of science involves describing the universe as it is?

Some would say that science and religion are the two great ways in which humanity has attempted to interpret the universe.

iii. If scientific laws must be evidence-based, and religion is a matter of faith, are science and religion necessarily incompatible?

iv. What is the difference between a theory and a law?

v. In A-level we will much more explicitly talk about models of the way nature works. Why do we not just tell you the 'truth' instead of using simpler models? (likely two good answers here)

The Evolution of Natural Philosophy into Modern Physics

i. The ancient Greeks were great natural philosophers, and we still use many of their ideas today in physics. Why do we not consider them to be scientists?

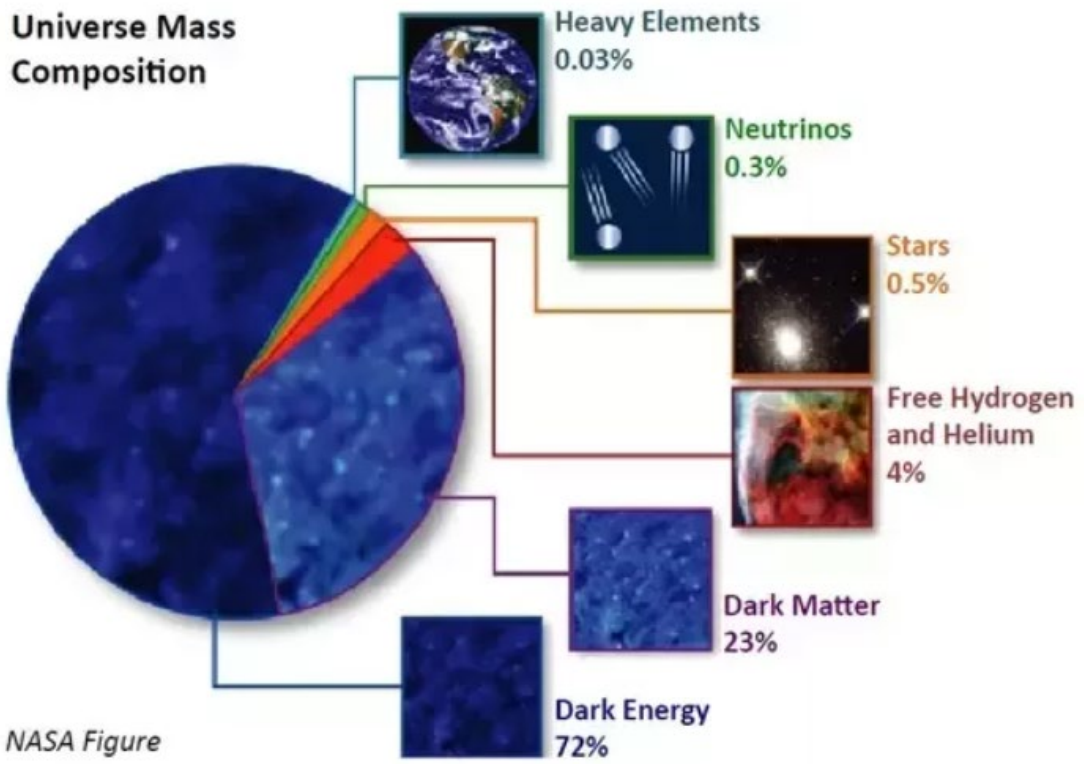
From Wikipedia:

So profound were these and other developments that it was generally accepted that all the important laws of physics had been discovered and that, henceforth, research would be concerned with clearing up minor problems and particularly with improvements of method and measurement.

ii. Why did the greatest minds of their age apparently think this?

iii. Which two theories have replaced Classical Physics?

iv. Under what conditions does Classical Physics work best?



Currently we do not know what Dark Matter or Dark Energy are.

v. How close are we to "solving Physics" now?

A wise Doctor of Engineering once said: "The door marked unknown is very close"

vi. Is this true of Physics in 2020? What about the other sciences?

Links to support:

https://openstax.org/details/college-physics

Recommended Reading List and the Department's 'Top Pick' Title

As an A Level student, we want you to value academic endeavour (scholarship) and develop a thirst for learning in your chosen subject. Our curriculum will help you to understand that scholarship is not just about learning facts, it is about nurturing powerful knowledge.

We will help you with this by directing you to resources that will not only deepen your knowledge and strengthen your understanding of the A Level content, but also broaden it beyond that of the exam board specification.

Please find the full subject reading list alongside our prospectus on the Sixth Form section of the STRS website here: https://strschool.co.uk/sixthform/prospectus. We would encourage you to explore as many of these titles as you can.

From the published reading list, the most highly recommended book(s)/article(s) to read before September are:

A Short History of Nearly Everything by Bill Bryson

Chapters most relevant to Physics

Introduction
Ch 1 - The Universe and the Big Bang
Ch 2 - The Solar System
Ch 3 - Formation of stars, lifecycles and supernovae
Ch 4 - Newton, gravity
Ch 7 - Elements, atoms
Ch 8 - Space and Time (relativity, cosmology)
Ch 9 - Atoms and basic quantum physics
Ch 11 - Quarks and fundamental particles
Ch 16 - Planetary habitability

Once you have read the recommended book/chapter/article, consider the following:

- What did you learn from the reading?
- Have you identified any patterns or made any connections?
- What unanswered questions has the reading left you with?
- Did you agree entirely with what you have read? If so, why? If not, why not?
- Are there any themes or topics that you would like to explore further?

Other Recommended Activities

Please find below a selection of suggested additional activities that the department feel it would be useful for you to explore prior to starting the A Level course in September.

Isaac Physics
https://isaacphysics.org/
Do as much as you can!

Universe Adventure
https://www.universeadventure.org/

Particle Adventure
https://particleadventure.org/

Veritasium YouTube channel
https://www.youtube.com/channel/UCHnyfMqiRRG1u-2MsSQLbXA

Sixty Symbols YouTube channel
https://www.youtube.com/results?search_query=sixty+symbols

Minute Physics YouTube channel
https://www.youtube.com/user/minutephysics

Podcasts:

Physics World
https://physicsworld.com/p/audio-and-video/

The Infinite Monkey Cage
https://www.bbc.co.uk/programmes/b00snr0w/episodes/downloads

Astronomy 161
http://www.astronomy.ohio-state.edu/~pogge/Ast161/Audio/