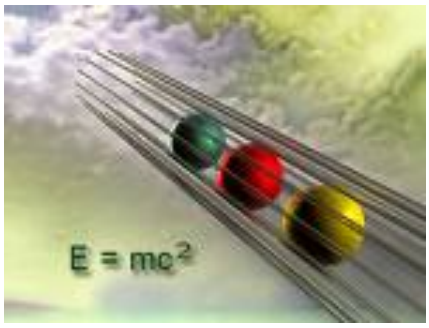
Bayside Christian College
"Unity and Maturity in Christ"

Physics



Structure
The study is made up of four units:

Unit 1: How is energy useful to society?
Unit 2: How does physics help us to understand the world?
Unit 3: How do fields explain motion and electricity?
Unit 4: How have creative ideas and investigation revolutionised thinking in physics?

Unit 1: How is energy useful to society?

The study of VCE Physics involves investigating, understanding and explaining the behaviour of physical phenomena in the Universe. Models, including mathematical models, are used to explore, simplify and predict how physical systems behave at varying scales from the very small (quantum and particle physics) through to the very large (astronomy and cosmology). Beginning with classical ideas and considering their limitations, and then being introduced to more modern explanations of the world, provides a novel lens through which students experience the world around them, drawing on their natural curiosity and wonder.

Area of Study 1: How are light and heat explained?

Students study light using the wave model and thermal energy using a particle model forming an understanding of the fundamental physics ideas of reflection, refraction and dispersion. They use these to understand observations made of the world such as mirages and rainbows. They investigate energy transfers and explore how light and thermal energy relate to one another. They apply light ideas to explain how light is used through optical fibres in communication, and how physics is used to inform global warming and climate change.

Area of Study 2: How is energy from the nucleus utilised?

Students build on their understanding of energy to explore energy that derives from the nuclei of atoms. They learn about the properties of the radiation from the nucleus and the effects of this radiation on human cells and tissues and apply this understanding to the use of radioisotopes in medical therapy.
Students explore the transfer of energy from the nucleus through the processes of fission and fusion and apply these ideas to evaluate the viability of nuclear energy as an energy source for Australia.

Area of Study 3: How can electricity be used to transfer energy?

Students develop conceptual models to analyse electrical phenomena and undertake practical investigations of circuit components. Concepts of electrical safety are developed through the study of safety mechanisms and the effect of current on humans. Students apply and critically assess mathematical models during experimental investigations of DC circuits. They explore electrical safety and the use of transducers to transfer energy in common devices.

Unit 2: How does physics help us understand the world?

In this unit students explore the power of experiments in developing models and theories. They investigate a variety of phenomena by making their own observations and generating questions, which in turn lead to experiments. Students make direct observations of physics phenomena and examine the ways in which phenomena that may not be directly observable can be explored through indirect observations.
In the core component of this unit students investigate the ways in which forces are involved both in moving objects and in keeping objects stationary. Students choose one of eighteen options related to astrobiology, astrophysics, bioelectricity, biomechanics, electronics, flight, medical physics, nuclear energy, nuclear physics, optics, sound and sports science. The option enables students to pursue an area of interest by investigating a selected question.

Area of Study 1 - How can motion be described and explained?

In this area of study, students describe and analyse graphically, numerically and algebraically the energy and motion of an object, using specific physics terminology and conventions. They consider the effects of balanced and unbalanced forces on motion and investigate the translational and rotational forces on static structures. Students apply mathematical models during experimental investigations of motion, and apply their understanding of motion and force through a case study.

Area of Study 2 - Options

Eighteen options are available for selection in Area of Study 2. Each option is based on a different observation of the physical world. One option is to be selected by the student from the following:

- How does physics explain climate change?
- How do fusion and fission compare as viable nuclear energy power sources?
- How do heavy things fly?
- How do forces act on structures and materials?
- How do forces act on the human body?
- How is radiation used to maintain human health?
- How does the human body use electricity?
- How can human vision be enhanced?
- How is physics used in photography?
- How do instruments make music?
- How can performance in ball sports be improved?
- How can AC electricity charge a DC device?
- How do astrophysicists investigate stars and black holes?
- How can we detect possible life beyond Earth's Solar System?
- How can physics explain traditional artefacts, knowledge and techniques?
- How do particle accelerators work?
- How does physics explain the origins of matter?
- How is contemporary physics research being conducted in our region?

Area of Study 3 - Practical investigation

Systematic experimentation is an important aspect of physics inquiry. In this area of study students design and conduct a practical investigation related to knowledge and skills developed in Area of Study 1 and/or 2. The investigation requires the student to develop a question, plan a course of action that attempts to answer the question, undertake an investigation to collect the appropriate primary qualitative and/or quantitative data, organise and interpret the data, and reach a conclusion in response to the question. The student designs and undertakes an investigation involving two independent variables one of which should be a continuous variable. A practical logbook must be maintained by the student for recording, authentication and assessment purposes.

Unit 3: How do fields explain motion and electricity?

In this unit students use Newton's laws to investigate motion in one and two dimensions. They explore the concept of the field as a model used by physicists to explain observations of motion of objects not in apparent contact. Students compare and contrast three fundamental fields – gravitational, magnetic and electric – and how they relate to one another. They consider the importance of the field to the motion of particles within the field. Students examine the production of electricity and its delivery to homes.

They explore fields in relation to the transmission of electricity over large distances and in the design and operation of particle accelerators. Students design and undertake investigations involving at least one continuous independent variable.

Area of Study 1 - How do physicists explain motion in two dimensions?

In this area of study, students use Newton's laws of motion to analyse linear motion, circular motion and projectile motion. Newton's laws of motion give important insights into a range of motion both on Earth and

beyond through the investigations of objects on land and in orbit. They explore the motion of objects under the influence of a gravitational field on the surface of Earth, close to Earth and above Earth. They explore the relationships between force, energy and mass.

Area of Study 2 - How do things move without contact?

Field models are used to explain the behaviour of objects when there is no apparent contact. In this area of study, students examine the similarities and differences between three fields: gravitational, electric and magnetic. Students explore how positions in fields determine the potential energy of, and the force on, an object. They investigate how concepts related to field models can be applied to construct motors, maintain satellite orbits and to accelerate particles including in a synchrotron.

Area of Study 3 - How are fields used in electricity generation?

The production, distribution and use of electricity has had a major impact on the way that humans live. In this area of study, students use empirical evidence and models of electric, magnetic and electromagnetic effects to explain how electricity is produced and delivered to homes. They explore the transformer as critical to the performance of electrical distribution systems in minimising power loss.

Unit 4: How have creative ideas and investigation revolutionised thinking in physics?

In this unit, students explore some monumental changes in thinking in Physics that have changed the course of how physicists understand and investigate the Universe. They examine the limitations of the wave model in describing light behaviour and use a particle model to better explain some observations of light. Matter, that was once explained using a particle model, is re-imagined using a wave model.

Students are challenged to think beyond how they experience the physical world of their everyday lives to thinking from a new perspective, as they imagine the relativistic world of length contraction and time dilation when motion approaches the speed of light. They are invited to wonder about how Einstein's revolutionary thinking allowed the development of modern-day devices such as the GPS.

A student-designed practical investigation involving the generation of primary data and including one continuous, independent variable related to fields, motion or light is undertaken either in Unit 3 or Unit 4

Area of Study 1 - How has understanding about the physical world changed?

In this area of study, students use evidence from experiments to explore wave concepts in a variety of applications. Wave In this area of study, students learn how understanding of light, matter and motion have changed over time. They explore how major experiments led to the development of theories to describe these fundamental aspects of the physical world.

When light and matter are probed, they appear to have remarkable similarities. Light, previously described as an electromagnetic wave, appears to exhibit both wave-like and particle-like properties. Findings that electrons behave in a wave-like manner challenged thinking about the relationship between light and matter.

Students consider the limitations of classical mechanics as they explore Einstein's view of the Universe. They consider postulates as distinct from theories and explore ideas related to objects moving at speeds approaching the speed of light. They use special relativity to explore length contraction and time dilation as observations are made by observers in different frames of reference, and the interrelationship between matter and energy.

Area of Study 2 - How is scientific inquiry used to investigate fields, motion or light?

Students undertake a student-designed scientific investigation in either Unit 3 or Unit 4, or across both Units 3 and 4. The investigation involves the generation of primary data relating to fields, motion or light.

The investigation draws on knowledge and related key science skills developed across Units 3 and 4 and is undertaken by students in the laboratory and/or in the field.

When undertaking the investigation students are required to apply the key science skills to develop a question, state an aim, formulate a hypothesis and plan a course of action to answer the question, while complying with safety and ethical guidelines. Students then undertake an investigation to generate primary quantitative data, analyse and evaluate the data, identify limitations of data and methods, link experimental results to scientific ideas, discuss implications of the results, and draw and evaluate a conclusion in response to the question.

Students are expected to design and undertake an investigation involving one continuous independent variable. The presentation format for the investigation is a scientific poster. A logbook is maintained by the students for record, assessment and authentication purposes.

Assessment

Satisfactory Completion
Demonstrated achievement of the set of outcomes specified for the unit.

Units 1 and 2
This is an individual school decision based on levels of achievement.

Units 3 and 4
The Victorian Curriculum and Assessment Authority will supervise the assessment of all students undertaking Units 3 and 4. In Physics the student's level of achievement will be determined by school-assessed coursework, and an end-of-year examination.
Percentage contributions to the study score in Physics are as follows:

- **Unit 3 school-assessed coursework: 27 %**
- **Unit 4 school-assessed coursework: 23 %**
- **End-of-year examination: 50 %**

ELIGIBILITY
Unit 1 and 2: It is expected that students would have passed Year 10 Science and Mathematics.
It is recommended that students concurrently study Unit 1&2 Maths Methods
Unit 3 and 4: Passed Physics Units 1and 2

COURSE EXPECTATIONS
- A desire not just to know **how**... but to know **why**?
- Full participation in class questions and discussion, practical experiments and write-ups
- Independent study using Edrolo videos and questions
- Answering questions relating to an understanding of the concepts covered

POSSIBLE TERTIARY / CAREER LINKS:

Physics is a pre-requisite for many medical and engineering, technology and science-based careers. Physicists end up in all sorts of interesting jobs and are virtually never unemployed, because of their broad training and adaptability. In particular they are needed at the start of new technologies and machines, or in particularly challenging projects such as space missions, remote explorations, and failure assessment.

As a working physicist you may find yourself: trying to predict the stock market on Wall Street, testing satellites for space missions, developing new materials for industry, developing new electronic devices and components, doing medical physics in a hospital, teaching the next generation of physicists in a high school, trying to predict the next major earthquakes to hit San Francisco or Japan, developing flight simulation software, optimizing industrial manufacturing or transformation processes, developing a new measurement instrument, performing materials testing and characterization for special applications, launching a new software company or product, performing urban planning and optimization, etc.