E409 PHYSICS (YEAR 12) – 2008-2009

Rationale

Physics is concerned with the study of matter and energy and their interactions.

From ancient times, people have marvelled at the world in which we live – at the sunsets and rainbows, waterfalls and birds in flight, electric discharges and magnetism – and have sought ways to explore and explain why the world should be this way.

Speculation about, and investigation of, the natural world enabled the development of physics as a science discipline having its own particular methods which value precise measurement, experimentation and mathematical expression. Today, its methods continue to develop and provide new information to explain observations, develop ideas and build theories. The study of physics contributes to its students' intellectual growth by supporting the development within them of transferable problem-solving skills and an inquiring attitude. It involves practical investigations, tasks incorporating logical and analytical thinking and the communication of scientific information and ideas. Especially important is the development of knowledge of the basic principles of physics. This knowledge enables students to explain many natural phenomena and the applications of those phenomena in the technologies on which a modern society depends. The subject also considers how major advances made in the past have led us to the understanding of physics and to the technology we have today. It provides knowledge that is useful to us in exercising our responsibilities as citizens, in applying new technologies, in pursuing hobbies and in understanding changes in our physical and social environment. Although the subject is designed to meet the interests of the majority of students who will not pursue a career in physics, it provides a basis for further study in physics and related areas such as engineering.

The Year 12 Physics subject builds on students' scientific background and uses certain mathematical skills.

General Aims

Through the study of this subject, it is intended that students will:

- comprehend the fundamental concepts and principles of physics through experimental and theoretical studies
- develop skills of logical thinking and be able to use these skills to solve problems of a theoretical and practical nature
- use the language and conventions of physics to develop skills in communication
- be encouraged to read and comprehend scientific and technological literature
- appreciate the link between the theoretical models in physics and their justification through experimentation
- demonstrate an awareness of the relevance of physics to technology and daily living
- recognise the limitations and capabilities of scientific knowledge
- develop a sustained interest in the study of physics.

Educational Objectives

Content and Process Skill Objectives

Where appropriate in the syllabus, students should be able to:

- describe the experimental evidence supporting fundamental laws and principles
- use models to relate observations and theory
- demonstrate that they have acquired a broad appreciation of the concepts in the syllabus to the point where qualitative predictions can be made by applying these concepts to specific situations
- explain in their own words all the laws, concepts and definitions specified in the syllabus, and discuss their relevance and applications
- apply equations describing laws and definitions to idealised situations and solve simple numerical problems
- apply known principles to unfamiliar physical situations
- comprehend and communicate scientific information
- discuss the link between science, technology and society
- formulate informed opinions on physics-related issues which could influence their lives
- follow instructions to carry out practical tasks
- draw clear diagrams to help explain experiments
- perform experiments to obtain data so that physical relationships can be formulated or tested
- formulate hypotheses, inferences and relationships from available data
- present and interpret experimental data in graphical and tabular form
- appreciate that all data obtained from experimental measurement is subject to uncertainty, and be able

to estimate the degree of uncertainty in such quantities.

Sensorimotor Skill Objectives

In each of the areas of the syllabus, students should, where appropriate, be able to:

- assemble and operate equipment in a safe and organised manner
- use instruments and procedures with an appropriate level of precision.

Attitudinal Objectives

Students should have the opportunity to:

- appreciate the limitations of scientific enquiry, theories and laws
- recognise the need for a questioning approach to contemporary knowledge and opinion
- accept the need for care and accuracy in the use of apparatus
- become aware of risk situations and willingly conform to safety regulations
- appreciate the interactions between science, technology and society, and recognise that problems can arise as a result of the introduction of new technologies
- develop a positive attitude to the learning of physics.

Teaching – Learning Program

The topics, or objectives within topics, can be taught in any order in keeping with the needs of teachers and students.

Units

The Year 12 Physics subject is divided into two units as follows:

Unit 1: Physics in the Modern World

Unit 2: Movement and Structures

Each unit incorporates two or three areas of study.

Areas of Study

Each area of study provides the following:

- a set of central ideas which must be studied
- contexts through which the area of study may be investigated
- student outcomes.

In each area of study:

- each of the central ideas must be studied within, or applied to, at least one context
- at least one context must be selected for detailed investigation. These context-based investigations will involve the application of relevant central ideas.

Figure 1 represents the relationship between units, areas of study and contexts for Unit 1, Physics in the Modern World, and Unit 2, Movement and Structures.

Unit 1	**Physics in the Modern World**	
Area of Study	Sound Waves	Electric Power
Central Ideas	*A list of central ideas is provided for each area of study. These must be studied.*	
	• Waves in one or two dimensions • Amplitude, intensity, frequency, wavelength, etc.	• Electric current • Electromagnetic induction, etc.
Contexts	*Each central idea must be studied within, or applied to at least one context and at least one context must be studied in detail.*	
	Speaking and hearing or Musical Instruments and Reproduction	Domestic power supply and consumption or Power for Transport
Student Outcomes	*Specific student outcomes that relate to the central ideas are listed for each of the areas of study.*	
	1. Describe the nature of a wave. 2. Define the terms amplitude, frequency, wavelength, displacement and speed of a wave etc.	1. Describe the behaviour of freely suspended magnets and magnetic compasses. 2. Describe the nature of the Earth's magnetic field etc.

Unit 2	**Movement and Structures**		
Area of Study	Movement	Structures and Materials	Atomic Physics
Central Ideas	*A list of central ideas is provided for each area of study. These must be studied.*		
	• Projectile motion • Circular motion • Universal gravitation	• Conditions for stability • Conditions for equilibrium • Stress, strain, Young's modulus	• Risks and benefits of radiation • Spectra • Photons • Energy levels • Quanta • Movement of charged particles in magnetic fields
Contexts	*Each central idea must be studied within, or applied to at least one context and at least one context must be studied in detail.*		
	Sport and physics or Playgrounds, fun fairs and physics and Satellites, planets, moon and stars	Bridges and buildings or Human and animal frames	Sunlight and starlight or Medical applications or Domestic/industrial applications
Student Outcomes	*Specific student outcomes that relate to the central ideas are listed for each of the areas of study.*		
	1. Add and resolve vectors in one plane. 2. State the equations of motion and the assumptions made in their derivation etc.	1. Define 'torque' or moment of force about a point. 2. State the principle of moments etc.	1. Describe the properties of electromagnetic waves. 2. Explain that electromagnetic radiation exhibits dual properties etc.

Figure 1: The structure of Units 1 and 2 of the Year 12 Physics subject showing the relationship between the units, areas of study, central ideas, contexts and student outcomes.

Student Activities

Class and home exercises

Purpose

The purpose of class and home exercises is to assist students to develop a qualitative and quantitative understanding of the central ideas specified in each area of study and to apply these to relevant technological and social contexts, and everyday phenomena and events.

These exercises introduce students to a broad range of physics ideas and provide a foundation for later learning in physics.

Description

Students should undertake short exercises related to each of the areas of study. **The exercises should include each of the following types:**

- Qualitative interpretation and reasoning: these exercises should develop students' capacities to interpret and understand phenomena and events with which they are familiar, and to explain what would happen in various situations if some of the conditions were changed.
- Quantitative reasoning: these exercises should develop the ability to apply mathematical formulations to physical phenomena, the ability to estimate the magnitude of physical quantities, and an appreciation of the strengths and limitations of mathematical formulations in interpreting physical phenomena.
- Current sources of information: these exercises should be used to relate ideas from the areas of study to articles in newspapers or popular magazines, and to television and radio programs. Examples would include making summaries of or discussing the ideas referred to in the material and their relevance to the situation under consideration.

These exercises may be completed by students either in groups or individually, with or without access to references.

Students should maintain a record of the work undertaken in the exercises.

Written presentations

Purpose

To develop students' capacities to:

- analyse and synthesise ideas
- communicate their understanding in written form
- relate physics ideas to a context
- formulate and respond to questions about physics.

Description

Students should prepare and present at least one written presentation during the year. The topic of each presentation should relate to one of the areas of study and be based on one or more of the following:

- a technical application of physics
- an issue which is personally or socially significant to the student
- the historical setting in which an idea or group of ideas evolved
- the contribution of an individual, group or institution to present-day understanding
- an everyday situation in which the ideas apply and are useful.

For the written presentation:

- students should be encouraged to use a range of reference material to assist their investigation
- the piece may include diagrams and graphs, and need not be presented as a formal essay.

Practical work

Purpose

Practical work is intended to:

- support conceptual development relating to each of the areas of study
- link concepts studied to appropriate real-world phenomena or situations
- promote the development of practical skills, including:
  - safe conduct in relation to handling equipment and other activities inside and outside the laboratory
  - careful qualitative observation
  - measurement to an appropriate degree of accuracy
  - estimation of the uncertainty in experimental measurements (not computed results)
  - recording, analysis and graphing of data
  - working cooperatively in groups, or independently, as the situation requires.

Description

An appropriate time should be spent by students on practical exercises relating to the areas of study. Exercises may be drawn from the following categories:

- Modelling/verification exercise: observations or measurements designed to introduce students to, or enable them to verify, physical principles or laws.
- Field exercise: a series of careful observations and possibly also measurements in a real-life situation, designed to explore the relationship between the situation and applicable physics concepts.
- Applications exercise: an investigation of a practical application of relevant concepts in a particular device, appliance or piece of technology.
- Practical skills exercise: a series of short measurement exercises, preferably undertaken by students individually, that develop their ability to make careful measurements and analyse results efficiently.
- Long-term investigations.

Unit 1 Physics in the Modern World

The areas of study for this unit are Sound Waves and Electric Power.

1.1 Sound Waves

The central ideas for this area of study are listed below:

- waves in one or two dimensions
- amplitude, intensity, frequency, wavelength
- reflection
- refraction
- phase difference
- beats
- diffraction
- standing waves
- comparison of noise intensities
- differences between sound and electromagnetic waves.

Each of the central ideas must be studied within, or applied to, at least one of the following contexts. At least one context must be selected for detailed investigation.

Contexts

Speaking and hearing

e.g. production of sound (pitch, loudness, quality); transmission of sound; recording of sound (microphones, tape recorders, records, compact disc players); reproducing sound (amplifiers, loudspeakers, phasing loudspeakers, frequency responses and ranges); structure and function of the ear (causes of deafness, hearing aids, bionic ear, hearing testing); audio phenomena (sound delays, hearing around corners, determining the direction of sound, loudness of noise, distinguishing noise from music, room acoustics).

or

Musical Instruments and Reproduction

e.g. production of sound (pitch, loudness, quality); transmission of sound; musical instruments (string, wind, percussion); electronic keyboards and synthesisers; orchestra shells and music auditoriums, distinguishing music from noise; recording of sound (microphones, tape recorders, record players, compact disc players); reproducing sound (amplifiers, loudspeakers, phasing loudspeakers, frequency responses and ranges); special sound effects; loudness and noise level measurement.

Student Outcomes

1. Describe the nature of a wave.
2. Define the terms ‘amplitude’, ‘frequency’, ‘wavelength’, ‘displacement’ and ‘speed’ of a wave.
3. Describe the particle motion in a longitudinal wave, transverse mechanical wave.
4. Explain the two types of waves – mechanical and electromagnetic.
5. Draw graphs of displacement/time and displacement/distance (or position) for progressive waves (no transposition).
6. Solve problems using
   $T = \frac{1}{f}, v = f\lambda$
7. Describe the reflection of wave fronts at a rigid barrier.
8. Describe the refraction of wave fronts.
9. Explain what is meant by the term diffraction.
10. Illustrate the superposition of two waves in the chosen context.
11. Explain constructive and destructive interference and the effects.
12. Describe the conditions required for beats and the effect experienced when beats are formed.
13. Use the relationship: $f_{beat} = |f_2 - f_1|$ to solve simple problems.
14. Describe and explain the conditions required for the production of a standing wave and the effects observed.
15. Sketch displacement-distance graphs to illustrate standing (stationary) waves.
16. Identify nodes and antinodes, and use the expression internodal distance equals ½ λ to solve simple problems.
17. Explain the difference between free oscillations and forced oscillations.
18. Describe how the amplitude of the forced vibrations of a system varies as the frequency of the driving force is altered.
19. Define ‘resonance’. State the conditions under which it will occur and identify examples within the chosen context.
20. Define the intensity of a sound wave as energy transmitted per unit area per unit time.
21. Interpret sound level readings in terms of intensity level differences measured in decibels using the relationship $10\log\left(\frac{I_2}{I_1}\right)$ where I_2 is the sound intensity and I_1 is a reference intensity.
22. Comprehend and communicate scientific information relevant to the contextual and central ideas of this section.
23. Demonstrate familiarity with, and conduct experimental activities related to, these student outcomes.

1.2 Electric power

The central ideas for this area of study are listed below:

- magnetism and electromagnetism
- electromagnetic induction
- force on a current-carrying conductor in a magnetic field
- dc motors.

Each of the central ideas must be studied within, or applied to, at least one of the following contexts. At least one context must be selected for detailed investigation.

This area of study requires that students use the fundamental relationships and concepts dealt with in the Year 11 area of study ‘Electricity’ in Unit 2: ‘Movement and Electricity’

Contexts

Domestic power supply and consumption
e.g. electricity generation; applications to domestic appliances; magnetic storage devices (including sound tapes, videotapes, computer disks); speakers; electromagnetic cookplates; solenoid switches; electricity reticulation (transmission line losses, grid system, reasons for high voltage transmission, house and industry wiring, single phase and three phase, earth leakage protection); transformers; electric motors.

or

Power for transport
e.g. electricity generation; navigation; electricity reticulation (transmission line losses, supply over long distances, electric trains); electric motors; electricity storage (electric cars, motorised buggies, lifts); diesel electric vehicles (bulk ore loaders, trains); transformers; ac/dc converters; magnetic levitation systems.

Student Outcomes

1. Describe the behaviour of freely suspended magnets and magnetic compasses.
2. Describe the nature of the Earth's magnetic field.
3. State the attraction and repulsion effects for magnets.
4. Describe, using diagrams, the magnetic field in various magnetic configurations.
5. State that magnetic fields are associated with moving charges.
6. Draw the field due to a current flowing through a long straight wire, a short coil and a solenoid.
7. Describe the force on a conductor in a magnetic field.
8. Describe the factors which affect the force on a current-carrying conductor in a magnetic field.
9. Perform calculations using $F = IlB$ (for perpendicular cases).
10. Describe the turning effect produced by the force on a rectangular coil carrying a current in a magnetic field.
11. Explain the principle of the direct current electric motor.
12. Describe the force acting on the electrons in a conductor moving in a magnetic field.
13. Define magnetic flux (Φ) as $\Phi = BA$
14. Interpret situations involving induced emf and Lenz's Law applications.
15. Perform, within the context studied, calculations using

    $$\text{induced emf} = -N\frac{(\Phi_2 - \Phi_1)}{t}$$

    induced emf = lvB.

16. Explain the principle of the ac generator.
17. Explain the principle of the transformer.
18. Understand that the turns ratio formula determines the voltage output of a simple transformer.
19. Solve problems involving the turns ratio formula.

    $$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

20. Explain why electrical power is transmitted at very high voltages.
21. Discuss the major environmental impacts of electricity production and transmission.
22. Comprehend and communicate scientific information relevant to the contextual and central ideas of this section.
23. Demonstrate familiarity with and conduct experimental activities related to these student outcomes.

Unit 2 Movement and structures

The areas of study for this unit are Movement, Structures and Materials, and Atomic Physics.

2.1 Movement

The central ideas for this area of study are listed below:

- projectile motion
- circular motion
- universal gravitation.

Each of the central ideas must be studied within, or applied to, at least one of the following contexts: ‘Sport and physics’ or ‘Playgrounds, funfairs and physics’ and ‘Satellites, planets, moon and stars’. At least one of the first two contexts and the third context must be studied in detail.

This area of study requires that students use the fundamental relationships and concepts dealt with in the Year 11 area of study ‘Movement’ in Unit 2: ‘Movement and Electricity’

Contexts

Sport and physics
e.g. swinging racquets and clubs; balls in flight (netball, basketball, golf, cricket, shotput); sportspeople in flight (pole-vaulting, diving, ballet, trampolining, ski-jumping, waterski-jumping, skydiving); bodies in circular motion (gymnastics, athletics tracks, velodromes, motor cycle and car racing).

or

Playgrounds, funfairs and physics
e.g. balls and objects in flight (the shooting gallery, ‘knock-’em-down’ games, circus trapeze, rope over the diving pool, acrobatics); bodies in circular motion (ferris wheel, maypoles, swings, roundabouts, go-carts); boomerangs; frisbies; roller coasters; waterslides.

and

Satellites, planets, moon and stars
e.g. motion; satellites; binary stars; ocean tides; energy cost of artificial satellites; geosynchronous satellites; space stations; weightlessness

Student Outcomes

1. Add and resolve vectors in one plane.
2. State the equations of motion and the assumptions made in their derivation

$$a=\frac{v-u}{t}$$

$$s=ut+\tfrac{1}{2}at^2$$

$$v^2=u^2+2as$$

3. Describe qualitatively the motion of a projectile in a uniform gravitational field.
4. Solve problems involving projectiles using the equations of motion and two dimensional vectors (neglect air resistance).
5. Use the terms ‘time of flight’, ‘range’ and ‘maximum height’ in solving projectile motion problems within the chosen context.
6. Describe qualitatively the effects of air resistance on projectile motion.
7. Explain that motion of an object in a circle with a constant speed involves a constant magnitude of acceleration towards the centre.
8. Define and explain the concept of centripetal force.
9. Use $a=\frac{v^2}{r}$ to calculate centripetal acceleration.
10. Use resultant $F=ma=\frac{mv^2}{r}$ to solve problems.
11. Identify the force required to produce circular motion in a variety of simple situations (including gravitational and magnetic fields).
12. Analyse the motion of an object undergoing uniform circular motion in a horizontal plane.
13. Analyse the forces acting when an object undergoes circular motion in a vertical plane.
14. Define the term ‘centre of mass’.
15. State Newton's Law of Universal Gravitation.
16. Use Newton's Law of Universal Gravitation to solve simple problems.

$$F = G\,\frac{m_1 m_2}{r^2}$$

17. Use Newton's Law of Universal Gravitation to evaluate the gravitational field ‘g’ at any point in the vicinity of a large object.

$$g = G\,\frac{M}{R^2}$$

18. State the conditions for a satellite to remain in a stable circular orbit.
19. Perform calculations involving all the parameters of a satellite in circular orbits using

$$F = \frac{mv^2}{r} = G\,\frac{m_1 m_2}{r^2}$$

20 Comprehend and communicate scientific information relevant to the contextual and central ideas of this section.

2.2 Structures and materials

The central ideas for this area of study are listed below:

- conditions for stability
- conditions for equilibrium
- stress, strain, Young's modulus.

Each of the central ideas must be studied within, or applied to, at least one of the following contexts. At least one context must be selected for detailed investigation.

Contexts

Bridges and buildings

e.g. simple suspended and supported structures; open frameworks; bridges (force on pylons, suspension bridges, compression bridges); buildings (arches, flying buttresses, catenary arches, Gothic arches, semi-circular arches, suspended structures); building materials (steel, concrete, glass, aluminium).

or

Human and animal frames

e.g. simple stick model structures; bones (fractures, stresses under compression, greenstick fractures, spinal injuries); muscles (tendons and ligaments); safe lifting practices; prosthetic devices (artificial limbs); physical disabilities.

Student Outcomes

1. Define ‘torque’ or moment of a force about a point.
2. State the principle of moments.
3. Interpret problems involving moments and perform calculations, including examples where the applied force is not perpendicular to the lever arm, using the relationships

$$M = rF \text{ and } \Sigma M = 0.$$

4. Identify situations where a rigid body is in equilibrium.
5. Perform simple 2-dimensional calculations on a rigid body in equilibrium within the chosen context.
6. State the conditions for stable, unstable, and neutral equilibrium and apply them to simple situations within the chosen context.
7. Define ‘stress’ and ‘strain’.
8. Draw and describe the stress-strain curve for typical brittle and ductile materials.
9. Calculate stress using $\frac{F}{A}$ and strain using $\frac{\Delta l}{l}$.
10. Explain why the terms ‘stress’ and ‘strain’ are used rather than force and extension.
11. Define Young's modulus (Y).
12. Explain the use of tables giving values of Young's modulus for different materials.
13. Within the chosen context perform simple calculations using

$$\frac{\text{stress}}{\text{strain}} = \frac{F/A}{\Delta l/l} = \text{Young's modulus (Y)}$$

14. Demonstrate familiarity with, and conduct experimental activities related to, these student outcomes.

2.3 Atomic physics

The central ideas for this area of study are listed below:

- risks and benefits of radiation
- spectra
- photons
- energy levels
- quanta
- movement of charged particles in magnetic fields.

Each of the central ideas must be studied within, or applied to, at least one of the following contexts. At least one context must be selected for detailed investigation.

Contexts

Sunlight and starlight

e.g. determining the composition of a star; invisible radiations (infrared), ultraviolet, X-rays; astronomy; stellar evolution; shielding effect of the atmosphere; ozone layer; 'greenhouse effect'; skin cancer; mutations, auroras, solar cells.

or

Medical applications

e.g. effects on humans of both natural and artificial X-ray radiation; production and use of X-rays in diagnostics including safety/risk/benefit analyses; cathode ray oscilloscopes for monitoring heartbeats; electron microscopes; lasers; cancer therapy; mutations.

or

Domestic/industrial applications

e.g. neon signs and street lights; fluorescent tubes; light meters (used in sport, photography); automatic doors; film sound tracks; television picture tubes; cathode ray oscilloscopes; electron microscopes; lasers; X-ray weld inspection equipment; industrial/forensic analysis using spectrophotometers; reducing risks to workers exposed to radiation; mass spectrometer; solar cells.

Student Outcomes

1. Describe the properties of electromagnetic waves.
2. Explain that electromagnetic radiation exhibits dual properties.
3. Name the major regions of the electromagnetic spectrum and describe applications and the risks and benefits associated with the use of each.
4. Describe the line emission spectra of gases.
5. Describe the Bohr model of the hydrogen atom.
6. State that an atom is in an excited state if its electrons are in energy levels other than the ground state.
7. Explain how an atom may be ionised.
8. Interpret energy level diagrams.
9. Explain the terms 'quantum', 'photon', 'energy level'.
10. Explain how an excited atom may return to its ground state.
11. Explain the relationship between the energy level of an atom and the energy of photons emitted by an atom returning to the ground state by a single or several transitions.
12. Perform calculations involving the relationship $E = hf$ and $E_2 - E_1 = hf$
13. Within the chosen context, explain how photon emission from an excited atom is related to the line emission spectrum of the atom.
14. Explain the formation of line emission spectra and line absorption spectra.
15. Classify spectra into emission spectra and absorption spectra and into line, broadband and continuous spectra.
16. Describe the principle of fluorescence using the chosen context.
17. Describe the generation of X-rays.
18. Describe the force on a charged particle moving through a magnetic field.
19. Describe the factors which affect the force on a charged particle moving through a magnetic field.
20. Perform calculations using $F = qvB$.
21. Comprehend and communicate scientific information relevant to the contextual and central ideas of this section.

Time Allocation

The subject has been designed to be completed through a structured education program of approximately 110 hours in any suitable contexts and series of learning experiences. Typically the subject will be studied over the period of one school year. For administrative reasons schools wishing to vary this delivery pattern (e.g. over a shorter period or over a longer period up to two school years) are required to notify the Chief Executive Officer of the Curriculum Council.

Subject Completion

Students must complete the school's structured educational and assessment program for a subject in order to be eligible to receive a grade unless there are exceptional and justifiable circumstances. In situations where the school considers that insufficient information has been gathered to justify the award of a grade for the subject, a result of U (for unfinished) should be allocated. The Curriculum Council offers the flexibility for the U to be converted to a grade after the final grades have been submitted. Further details on assessment and grading are provided in Volume I of the Syllabus Manuals.

Resources

Note: 1: The resources in this list were available at the time of printing, but please be aware that their subsequent availability cannot be guaranteed.

Note 2: '(OP)' identifies resources that are out of print but still valuable if teachers can locate them in their department or library.

A range of textbooks and problems books are currently available for Year 12 Physics.

Textbooks

Cahill, J., *Physics for Western Australia Year 12*, Heinemann, 1998.

Davies, P.H., and Harding, J.W., *Physics Around You, Book 2,* Longman Cheshire, 1991.

De Jong, E., et al., *Physics Two,* Heinemann, 1991.**(OP)**

Henderson, P., Bowers, J., *Electric Power – TEE Physics*, World of Energy, Fremantle, WA, 1998.

Lofts, et al., *Jacaranda Physics 2.*, Jacaranda.

Lucarelli, M., *TEE Physics Study Guide*, Academic Associates, 1994.

Mazzolini, M., et al., *Physics Revealing Our World, Book 2,* Jacaranda Press 1992.**(OP)**

McKittrick, B., *Physics Experiments and Student Investigations,* McGraw-Hill, 1991.

Rear, J., *Physics for Year 12*, Academic Achievement Services, 1997.

Sofoulis, N., (ed.), *Physics in Context Year 12*, STAWA, 1994.

Soufoulis, N., *Year 12 Investigations in Context*, STAWA, 1994.

Sofoulis, N., *Year 12 Physics Problems in Context*, STAWA, 1994.

Storen, A., and Martine, R., *Physics for Senior Students, Book 2,* Nelson, 1992.

Tytler, R., *VCE Physics Review Questions for Units 3 and 4,* Coghill, 1992.

Wilkinson, J., *Contextual Physics Book 2*, Longman, 1998.

Wilkinson, J., *World of Physics, Book 2,* McMillan, 1991.

Examination Details

The examination will consist of one written paper of three hours duration.

The written paper will consist of the following sections:

Section A: short answers (30%).

Section B: problem solving (50%).

Section C: comprehension and interpretation (20%). Students will be presented with one or more Physics texts and will be asked questions about related scientific matters.

Resources:

- A drawing compass, protractor, set square, Mathomat, and/or Mathaid
- Calculators satisfying the conditions set by the Curriculum Council for this subject, which are listed on the Curriculum Council website: http://www.curriculum.wa.edu.au/pages/student/calculators.htm

Assessment Structure

Assessment structures are an integral part of all Accredited Subjects.

The structure specifies:

1. the components and learning outcomes to be included in assessment
2. weightings to be applied to these components
3. the types of assessment considered appropriate for the subject.

The assessments outlined here should provide information concerning student performance in relation to the educational objectives and student outcomes.

Table 1

Syllabus Content	**Weighting percentage**
Physics in the modern world:	
Sound waves	15-20
Electric power	20-30
Movement and structures	
Movement	20-30
Structures and materials	15-25
Atomic physics	10-20

Table 2

Learning Outcomes	**Weighting percentage**
Cognitive :	90-95
Knowledge	
Scientific process skills	
Sensorimotor	5-10

Table 3

Types of Assessment	**Weighting percentage**
Examinations	45-55
Tests	20-30
Practical tests	10-15
Practical reports	0-5
Assignments	0-5
Written presentation(s)	5

The assessment program must provide students with the opportunity to demonstrate achievement of the requirements of the subject.

and

Students must complete the requirements of the subject.

Notes on Table 1

The weightings reflect the time devoted to each area of study.

Notes on Table 2

Knowledge includes: identifying, defining, recalling, relating, listing, describing, using equations and laws, and performing simple calculations etc.

Scientific process skills include: classifying, interpreting, applying, explaining, demonstrating, analysing, inferring, predicting, evaluating, communicating, problem-solving, planning, estimating etc.

Sensorimotor involves specific laboratory manipulative skills e.g. constructing an electric circuit, reading a voltmeter, ammeter etc.

Laboratory work in physics contains a mixture of the specific sensori-motor skills necessary to carry out investigations with equipment, and the knowledge and process skills required to comprehend and interpret the results of the investigation.

Notes on Table 3

Examinations are formal written examinations covering major portions of the syllabus such as term or semester examinations.

Tests are class tests covering a restricted portion of work, for example a test based on one area of study.

Practical tests are tests involving the practical aspects of the subject. These could be in-class tests on a specific area of study or an extended test on longer periods of time. Such assessment is to include such skills as the following:

- ability to follow directions
- use of safe procedures
- manipulative skills/sensorimotor skills
- understanding experimental procedure
- scientific process skills such as analysing, inferring, observing, interpreting, graphing.

Written presentations will assess students abilities to analyse and synthesise ideas, communicate their ideas in written form, relate physics to a context and formulate and respond to questions about physics. Written presentations may be submitted in a variety of formats including formal essays, reports or posters.

Practical reports are the students' written records of experiments or investigations and could include such sections as aim, apparatus/equipment, method/ procedure, results, discussion, conclusion and answers to set questions.

Assignments should include a range of challenging questions, particularly those which require students to explain their answers. The purpose of assignments should be to provide opportunities to develop and consolidate knowledge and process skills in physics. Such work should contain a range of question types including:

- qualitative interpretation and reasoning
- quantitative reasoning
- current sources of information.

Grade-Related Descriptors

Grade-Related Descriptors describe the student performance standards that are used to award grades in this subject. Schools delivering this subject have been provided with a copy of the document. Additional copies may be purchased from the Curriculum Council.