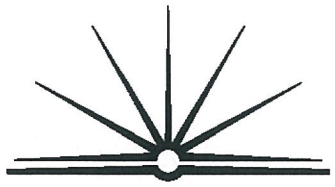


BOARD OF STUDIES
NEW SOUTH WALES

Physics

Stage 6
Syllabus

Amended October 2002

2 Rationale for Physics in the Stage 6 Curriculum

Physics in Science Stage 6 provides students with a contemporary and coherent understanding of energy, matter, and their interrelationships. It focuses on investigating natural phenomena and then applying patterns, models (including mathematical ones), principles, theories and laws to explain the physical behaviour of the universe. It uses an understanding of simple systems (single particles and pairs of particles) to make predictions about a range of objects from sub-atomic particles to the entire universe and aims to reveal the simplicity underlying complexity.

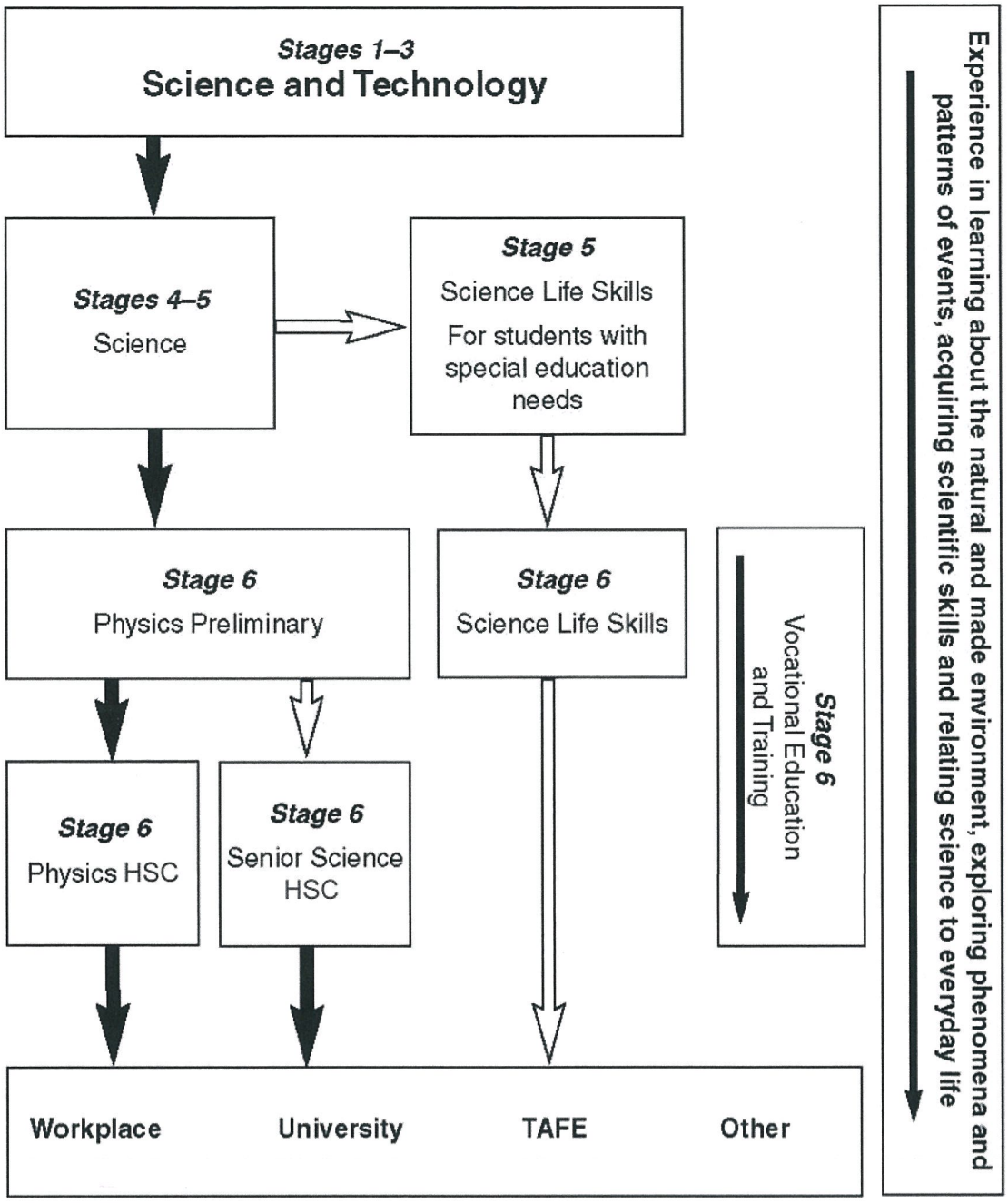
The study of physics relies on the understanding and application of a small number of basic laws and principles that govern the microscopic and macroscopic worlds. The study of physics provides students with an understanding of systems that is the basis of the development of technological applications. The interplay between concepts and technological and societal impacts is embodied in the history and philosophy of science and forms a continuum relating our past to our future.

Physics Stage 6 draws upon and builds on the knowledge and understanding, skills and values and attitudes developed in Science Stages 4–5. It further develops students' understanding of science as a continually developing body of knowledge, the interdisciplinary nature of science, the role of experiment in deciding between competing theories, the provisional nature of scientific explanations, the complex relationship between evidence and ideas and the impact of science on society.

The study of physics involves the students working individually and with others in active, practical, field and interactive media experiences that are related to the theoretical concepts considered in the course. It is expected that students studying Physics Stage 6 will apply investigative and problem-solving skills, effectively communicate the theoretical concepts considered in the course and appreciate the contribution that a study of physics makes to our understanding of the world.

The Physics Stage 6 course is designed for those students who have a substantial achievement level based on the Science Stages 4–5 course performance descriptors. The subject matter of the Physics course recognises the different needs and interests of students by providing a structure that builds upon the foundations laid in Stage 5 yet recognises that students entering Stage 6 have a wide range of abilities, circumstances and expectations.

3 Continuum of Learning for Physics Stage 6 Students



4 Aim

Physics Stage 6 aims to provide learning experiences through which students will:

- acquire knowledge and understanding about fundamental concepts related to natural phenomena and their causes, the historical development of these concepts and their application to personal, social, economic, technological and environmental situations
- progress from the consideration of specific data and knowledge to the understanding of models and concepts and the explanation of generalised physics terms; from the collection and organisation of information to problem-solving; and from the use of simple communication skills to those that are more sophisticated
- develop positive attitudes towards the study of natural phenomena and their causes and opinions held by others, recognising the importance of evidence and the use of critical evaluation of differing scientific opinions related to various aspects of physics.

5 Objectives

Students will develop knowledge and understanding of:

1. the history of physics
2. the nature and practice of physics
3. applications and uses of physics
4. the implications of physics for society and the environment
5. current issues, research and developments in physics
6. kinematics and dynamics
7. energy
8. waves
9. fields
10. matter.

Students will develop further skills in:

11. planning investigations
12. conducting investigations
13. communicating information and understanding
14. developing scientific thinking and problem-solving techniques
15. working individually and in teams.

Students will develop positive values about and attitudes towards:

16. themselves, others, learning as a lifelong process, physics and the environment.

6 Course Structure

This *Physics Stage 6 Syllabus* has a Preliminary course and an HSC course. The Preliminary and HSC courses are organised into a number of modules. The Preliminary modules consist of core content that will be covered in 120 indicative hours.

The HSC course consists of core and options organised into a number of modules. The core content covers 90 indicative hours with options covering 30 indicative hours. Students are required to complete one of the options.

Practical experiences are an essential component of both the Preliminary and HSC courses. Students will complete 80 indicative hours of practical/field work during the Preliminary and HSC courses with no less than 35 indicative hours of practical experiences in the HSC course. Practical experiences must include at least one open-ended investigation integrating the knowledge and understanding, and skills outcomes in both the Preliminary and HSC courses.

Practical experiences should emphasise hands-on activities, including:

- undertaking laboratory experiments, including the use of appropriate computer based and digital technologies
- fieldwork
- research using a wide range of sources, including print material, the Internet and digital technologies
- the use of computer simulations for modelling or manipulating data
- using and reorganising secondary data
- extracting and reorganising information in the form of flow charts, tables, graphs, diagrams, prose and keys
- the use of animation, video and film resources that can be used to capture/obtain information not available in other forms.

6.1 Preliminary Course

120 indicative hours

The Preliminary course incorporates the study of:

- The World Communicates (30 indicative hours)
- Electrical Energy in the Home (30 indicative hours)
- Moving About (30 indicative hours)
- The Cosmic Engine (30 indicative hours)

6.2 HSC Course

120 indicative hours

The HSC course builds upon the Preliminary course. The Preliminary course content is a prerequisite for the HSC course.

The HSC course incorporates the study of:

The core, which includes:

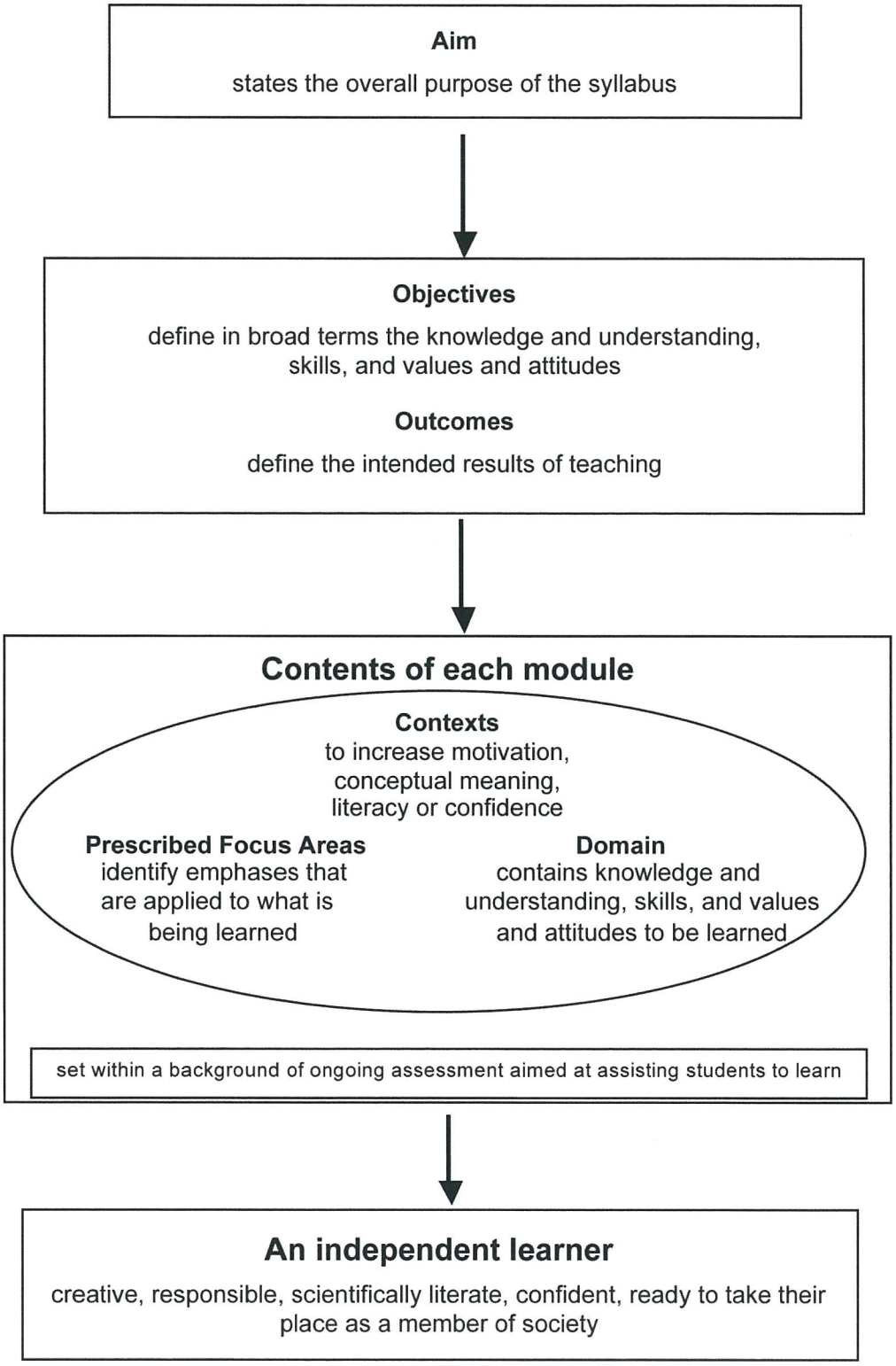
- Space (30 indicative hours)
- Motors and Generators (30 indicative hours)
- From Ideas to Implementation (30 indicative hours)

Options, which constitute 30 indicative hours and include any one of the following:

- Geophysics
- Medical Physics
- Astrophysics
- From Quanta to Quarks
- The Age of Silicon

6.3 Overview

The following diagram summarises the relationship between the various elements of the course:



Context

Contexts are frameworks devised to assist students to make meaning of the Prescribed Focus Areas and Domain. Contexts are culturally bound and therefore communicate meanings that are culturally shaped or defined. Contexts draw on the framework of society in all aspects of everyday life. The contexts for each module encourage students to recognise and use their current understanding to further develop and apply more specialised scientific understanding and knowledge.

Prescribed Focus Areas

The Prescribed Focus Areas are different curriculum emphases or purposes designed to increase students' understanding of physics as an ever-developing body of knowledge, the provisional nature of scientific explanations in physics, the complex relationship between evidence and ideas in physics and the impact of physics on society.

The following Prescribed Focus Areas are developed in this syllabus:

History of physics

Knowledge of the historical background of physics is important to adequately understand natural phenomena and explain the applications of those phenomena in current technologies. Students should develop knowledge of:

- the developmental nature of our understanding of energy, matter and their interrelationships
- the part that an understanding of energy, matter and their interrelationships plays in shaping society
- how our understanding of energy, matter and their interrelationships is influenced by society.

Nature and practice of physics

A study of physics should enable students to participate in scientific activities and develop knowledge of the practice of physics. Students should develop knowledge of the provisional nature of physical explanations and the complex relationship between:

- existing physical views and the evidence supporting these
- the process and methods of exploring, generating, testing and relating ideas
- the stimulation provided by technological advances and constraints imposed on understanding in physics by the limitations of current technology that necessitates the development of the required technology and technological advances.

Applications and uses of physics

Setting the study of physics into broader contexts allows students to deal with real problems and applications. The study of physics should increase students' knowledge of:

- the relevance, usefulness and applicability of laws and principles related to physics
- how increases in our understanding in physics have led to the development of useful technologies and systems
- the contributions physics has made to society, with particular emphasis on Australian achievements.

Implications of physics for society and the environment

Physics has an impact on our society and the environment, and students need to develop knowledge of the importance of positive values and practices in relation to these. The study of physics should enable students to develop:

- understanding about the impact and role of physics in society and the environment
- skills in decision-making about issues concerning physics, society and the environment.

Current issues, research and developments in physics

Issues and developments related to physics are more readily known and more information is available to students than ever before. The syllabus should develop students' knowledge of:

- areas currently being researched in physics
- career opportunities in physics and related fields
- events reported in the media which require an understanding of some aspect of physics.

Domain

Knowledge and understanding

As one of the major disciplines of science, the Physics Stage 6 course presents a particular way of thinking about the world. It encourages students to use inference, deductive reasoning and creativity. It presumes that the interrelationships within and between matter and energy in the universe occur in consistent patterns that can be understood through careful, systematic study.

The course extends the study developed in the Science Stages 4–5 course, particularly in relation to students' knowledge and understanding of the law of conservation of energy, Newton's Laws, the wave model, particle theory of matter, atomic theory, types of energy, types of force, technology and resources.

This course will build upon this fundamental knowledge to increase students' conceptual understanding of systems involving energy, force and motion as well as interactions between these systems and the living and non-living world. The course will assume that students have an elementary knowledge and understanding of energy, motion, electricity and forces as developed in the Science Stages 4–5 course.

Skills

The Physics Stage 6 course involves the further development of the skills students have developed in the Science Stages 4–5 course through a range of practical experiences in both the Preliminary and HSC courses.

Practical experiences are an essential component of both the Preliminary and HSC courses. Students will complete **80 indicative hours of practical/field work across both the Preliminary and HSC courses** with no less than 35 indicative hours of practical experiences in the HSC course. Practical experiences have been designed to utilise and further develop students' expertise in each of the following skill areas:

- **planning investigations**

  This involves increasing students' skills in planning and organising activities, effectively using time and resources, selecting appropriate techniques, materials, specimens and equipment to complete activities, establishing priorities between tasks and identifying ways of reducing risks when using laboratory and field equipment.
- **conducting investigations**

  This involves increasing students' skills in locating and gathering information for a planned investigation. It includes increasing students' skills in performing first-hand investigations, gathering first-hand data and accessing and collecting information relevant to physics from secondary sources using a variety of technologies.
- **communicating information and understanding**

  This involves increasing students' skills in processing and presenting information. It includes increasing students' skills in speaking, writing and using nonverbal communication, such as diagrams, graphs and symbols to convey physical information and understandings. Throughout the course, students become increasingly efficient and competent in the use of both technical terminology and the form and style required for written and oral communication in physics.

- **developing scientific thinking and problem-solving techniques**

  This involves further increasing students' skills in clarifying issues and problems relevant to physics, framing a possible problem-solving process, developing creative solutions, anticipating issues that may arise, devising appropriate strategies to deal with those issues and working through the issues in a logical and coherent way.

- **working individually and in teams**

  This involves further increasing students' skills in identifying a collective goal, defining and allocating roles and assuming an increasing variety of roles in working as an effective member of a team within the agreed time frame to achieve the goal. Throughout the course, students will be provided with further opportunities to improve their ability to communicate and relate effectively with each other in a team.

Values and attitudes

By reflecting about past, present and future involvement of physics with society, students are encouraged to develop positive values and informed critical attitudes. These include a responsible regard for both the living and non-living components of the environment, ethical behaviour, a desire for critical evaluation of the consequences of the applications of physics and recognising their responsibility to conserve, protect and maintain the quality of all environments for future generations.

Students are encouraged to develop attitudes on which scientific investigations depend such as curiosity, honesty, flexibility, persistence, critical thinking, willingness to suspend judgement, tolerance of uncertainty and an acceptance of the provisional status of scientific knowledge. Students need to balance these with commitment, tenacity, a willingness to take risks, make informed judgements and at times, inflexibility. As well as knowing something about physics, students also need to value and appreciate physics if they are to become scientifically literate persons.

6.4 Other Considerations

Safety Issues

Schools have a legal obligation in relation to safety. Teachers will need to ensure that they comply with the *Work Health and Safety Act 2011* (NSW) and the *Work Health and Safety Regulations 2011* (NSW), as well as system and school requirements in relation to safety when implementing their programs.

Schools should refer to the resource package *Chemical Safety in Schools* (DET, 1999) to assist them in meeting their legislative obligations.

Animal Welfare Act

Schools have a legal responsibility in relation to the welfare of animals. All practical activities involving animals must comply with the *Animal Welfare Act 1985* (NSW) as described in the *Animals in Schools: Animal Welfare Guidelines for Teachers* produced on behalf of the Schools Animal Care and Ethics Committee (SACEC) by the NSW Department of the Education and Training.