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Information for Australian universities seeking to have a bachelor degree[1] accredited by the Australian Institute of Physics[2]

Physics is the study of matter and energy and their interaction. Physical laws are universal and international in their application. A bachelor graduate physicist should demonstrate the ability to[3] :

- Comprehend and demonstrate knowledge of physics laws, concepts and principles;
- Apply physics principles to understand the causes of problems, devise strategies to solve them and test the possible solutions;
- Use the tools (including mathematics), methodologies, language and conventions of physics to test and communicate ideas and explanations;
- Safely use laboratory apparatus for a measurement or experimental procedure;
- Execute and analyse the results of an experiment, measurement or investigation, including the evaluation of the level of uncertainty of these results, a comparison of these results with expected outcomes, as well as theoretical and computational models or published data and, hence, an assessment of their significance;
- Competently use computing technology and appropriate software for the analysis of data, the simulation of physical systems and the retrieval of appropriate information;
- Present and interpret information graphically, undertaking numerical manipulation as needed;
- Communicate scientific information, in particular through scientific reports, to both expert and non-expert audiences;
- Work effectively and ethically in a multi-faceted scientific environment; and
- Be responsible, critically reflective, self-directed and motivated learners.

The Institute encourages universities to offer degree programs that will provide its graduates with automatic eligibility for admission to the grade of Member of the Australian Institute of Physics (“the Institute”). The accreditation of qualifications is overseen by the Australian Institute of Physics (AIP) Accreditation Manager, who reports to the Executive of the Institute.

(1) Assessment guidelines for Membership of the Institute

It is expected that accredited qualifications will satisfy one of the following three categories:

(a) A Bachelor degree with a major in Physics or Applied Physics or with major studies involving substantial applications of Physics:

As a minimum requirement, 1 year equivalent of the total degree program should be classifiable as physics, with a half year equivalent of "core principles of Physics" (as specified below) beyond the introductory degree program level, or such alternative arrangements as satisfy the Institute. An Accreditation Panel will expect to see evidence of sequential development of physics and mathematics knowledge and skills.

The inclusion of substantial experimental experience is mandatory. Some laboratory components should be included at higher levels. While simulations may have a role in experimental work, they should not dominate the laboratory experience.

The mathematics components should reflect the importance of mathematics to physics and should require students to understand material beyond an introductory level. As a guide, a three year degree program should include appropriate problem solving skills in Pure and/or Applied Mathematics including Calculus, Differential Equations, Vector Analysis, Linear Algebra and Complex Analysis.

Degree programs must include a clear development sequence of physics computation skills either studied as discrete subject(s)/unit(s) or embedded within physics subjects/units. Computational skill development should cover more than one area of physics computation, e.g. algorithm development, high level data processing, and algebraic computing.

(b) A Bachelor degree with Honours in Physics or Applied Physics:

It is assumed that the requirements for such a degree program will be comparable, but not necessarily identical to the requirements in (a) above. Please note that if the three-year bachelor degree satisfies the requirements of the AIP there is no need to provide information regarding a separate honours program.

(c) Other qualifications:

Other qualifications which are demonstrably at least the equivalent of either of the above may be deemed sufficient grounds for admission to Membership of the Institute, as determined by the Accreditation Panel.

Notes:

- "Core principles of Physics" is taken to include a balance of topics such as: Classical Mechanics, Electromagnetism, Quantum Physics, Thermal Physics, Optics, Relativity, Nuclear and Particle Physics, Condensed Matter Physics, and, Sound and Waves.

- It is recognised that this core material may in some cases also be embedded in topics such as Geophysics, Photonics, Optoelectronics, Laser Science, Medical Physics, Biomechanics, Biophysics, Space Science, Materials Science, Nanoscience, Nanotechnology, Plasma Physics, Astrophysics, Crystallography, Surface Physics, Electronic Device Physics or Atmospheric Physics. Accreditation Panels will assess degree programs on the breadth and level of the physics and mathematics understanding and computational skills demonstrated by students rather than just on the description of the content.

(2) Issues considered in the accreditation process

In examining a degree program for accreditation purposes, the Accreditation Panel will consider the following input factors:

- the general academic practices and standards of the university;
- the objectives of the degree program and the methods adopted to achieve these objectives;
- the requirements for and standards of admission to the degree program;
- the duration of the degree program;
- the breadth, depth and balance in the subjects/units involved and the intellectual effort and demands of the degree program;
- the methods of assessment of student progress;
- the arrangements for practical training and experience as part of the degree program;
- the teaching staff conducting the degree program, their numbers, professional qualifications and experience and their educational expertise;
- the accommodation and facilities available including equipment, libraries, experimental and computing laboratories, workshops, etc.
- the extent, quality and level of student feedback provided through program and subject/unit evaluation processes.

The primary output factor of concern to the Accreditation Panel is the quality of the student experience and the graduate abilities demonstrated, including at the threshold level. This will be assessed through interviews with students and consideration of student assessments.

Each university requesting accreditation of a degree program (or a suite of degree programs) will be required initially to provide the information listed below in a clear and concise form and subsequently to host a visit of up to one day's duration by an Accreditation Panel.

(3) Documentation and supporting information required from a university to support accreditation

Required one month before the date of the Accreditation Panel visit. (It is anticipated that much of the documentation required could be extracted by the university from existing handbooks, the university web site and similar publications.)

- a statement of the objectives of the degree program;
- a statement of the requirements for completion of the degree (or the degree sequence for which accreditation is sought);
- a demonstration that the physics, mathematics and computational physics studied in the degree program meets the AIP requirements (see section 1);
- Outlines of all subjects/units including objectives/outcomes and syllabi, classifiable as physics or mathematics, which could be included in a properly constituted degree program including details of texts, the relevant pre- and co-requisites and details of the methods and types of assessment used and their relative weightings;
- A tabulation of all the assessments in all the physics subjects/units indicating type, percentage, individual or group with group size, if a group task what is the component of individual and shared assessment in the outcome, and hurdle requirements that are implemented in the assessment. Preferably examination will corresponds to ~60% or more of the assessment in a given subject/unit and involve a hurdle requirement. If this is not the case the submission needs to detail how deep learning and hierarchical knowledge and understanding is ensured in the graduate abilities over the full duration of the qualification. The AIP strongly encourages arrangements that ensure that the individual performance of each graduate is ascertained. The standard and level of examination/tests are a key focus of the accreditation process;
- a description of a typical program of study leading to the award of the degree;
- brief (one page) resumes of the continuing and contract physics staff involved in teaching the degree program and a summary list of all physics teaching staff which includes their highest academic qualification, and professional memberships. If this qualification is not in physics then the highest physics qualification should also be given;
- A profile of the experience and qualifications of all staff involved in face to face teaching in the degree program for the current semester; this includes all sessional staff involved in the teaching program and is probably best presented as a matrix;
- A table of the physics and mathematics studied in the degree program and its assessment against the following list of competencies for a graduate physicist, showing how the assessment components address specific competencies:

  1. **Comprehend and demonstrate knowledge of physics laws, concepts and principles;**
  2. **Apply physics principles to understand the causes of problems, devise strategies to solve them and test the possible solutions;**
  3. **Use the tools (including mathematics), methodologies, language and conventions of physics to test and communicate ideas and explanations;**
  4. **Safely use laboratory apparatus for a measurement or experimental procedure**
  5. **Execute and analyse the results of an experiment, measurement or investigation, including the evaluation of the level of uncertainty of these results, a comparison of these results with expected outcomes, as well as theoretical and computational models or published data and, hence, an assessment of their significance**
  6. **Competently use computing technology and appropriate software for the analysis of data, the simulation of physical systems and the retrieval of appropriate information**
  7. **Present and interpret information graphically, undertaking numerical manipulation as needed;**
  8. **Communicate scientific information, in particular through scientific reports, to both expert and non-expert audiences**
  9. **Work effectively and ethically in a multi-faceted scientific environment; and**
  10. **Be responsible, critically reflective, self-directed and motivated learners.**

- Evidence of a quality improvement process for the past 5 years. This should include a review of the recommendations in the previous accreditation report and how these have been acted upon, and the results of any internal evaluation data of courses/units/subjects/programs relevant to the degree program being accredited, and evidence of action taken in light of these results;
- pass, withdrawal rates for the program and core subjects/units of the program;
- marks/grade distribution profiles of core subjects/units of the program;

- the general quality of student work (laboratory/project reporting, assignments and examinations, also see section (5) on the portfolios of assessment that need to be available to view during the Accreditation Panel visit);
- Graduate employment/study destinations;
- Gender and equity group distributions of the students, how these are changing in time and what programs or initiatives are in place to support these students;
- (Supporting electronic file/folder) Major test and examination papers as set for the most recent full year of physics subjects/units and sat by students. The student scripts and marking schedules will be viewed during the Accreditation Panel visit as part of the portfolios of assessment (section 5).
- any other material considered relevant by the university.

If the university is unsure of any of these requirements they should contact the AIP Accreditation Manager[4].

(4) Accreditation process

a. The Accreditation Manager (AM) appoints a three member Accreditation Panel for each accreditation from members of the Accreditation Committee. The AM will ensure Accreditation Panel members have no conflicts of interest. One member will be asked to chair the Accreditation Panel. This will often be the AM. The three individuals from the Accreditation Committee will include at least one Accreditation Committee member from within the state in which the accreditation is to be carried out, and at least one member from another state.

b. The Panel Chair contacts the Chair/Head of the relevant Academic Unit of the university seeking program accreditation and discusses the accreditation process and determines possible timelines.

c. The Panel Chair writes to the Chair/Head of the Academic Unit and formally invites the university to put forward their degree program(s) for accreditation. This document is included with this invitation.

d. The university responds formally to the Panel Chair’s invitation agreeing to the timelines and process.

e. The university makes a **hard copy** and **soft copy** submission to the Panel Chair in the manner required by the Institute (section 3). The submission should be provided at least one month before the date of the Accreditation Panel visit. Late submissions may incur an administrative fee (See section 7).

f. The university arranges guest access to the physics (and mathematics, if possible) content of the online learning and teaching platform used in subject/unit delivery, to Accreditation Panel members, prior to the visit. If for any reason this is not possible the Panel should have access to this during and/or after the site visit.

g. The submission is circulated by the Panel Chair to the Accreditation Panel.

h. The one day site visit takes place – see arrangements in section 5, below.

i. The Panel Chair writes the draft report and after obtaining the agreement of the rest of the Panel, sends it to the university for Comment.

j. The Panel Chair attempts as far as possible to get the agreement of the university on the contents of the report. When no further progress seems possible or necessary, the report is presented to the Accreditation Manager who then submits it to the AIP Registrar to schedule it for consideration by the Executive of the Institute for approval. In the event of a negative report or one lacking the agreement of the university concerned, the Accreditation Manager and Panel Chair will also advise the Executive of these matters and recommend on any relevant action as a consequence of the report.

k. After approval of the Executive, the final report is signed by the AIP President and sent to the University. A covering letter is also sent advising the university of an appeals process in the event that it wishes to challenge any aspect of the report.

(5) Arrangements for a site visit

During the site visit, the Accreditation Panel will wish to meet the Chair/Head of the Academic Unit or his/her nominee(s) in the first instance, to clarify any queries related to their examination of the documentation provided to the Panel. The Panel will also wish to meet a sample of staff involved in teaching the program(s) and students in separate sessions.

The Panel will seek to examine portfolios of assessment for physics units (and mathematics as achieveable) covering the full range of academic ability of the students involved. The collation for an individual (anonymised as appropriate) student's work should clearly indicate how the individual components combine to achieve a final grade. There should be a sufficient number of student examples to cover the range of student abilities. Examples of assessment tasks may need to collected over more than one academic year to evidence this. Copies of the assessment tasks are also needed to correlate with the student responses.

The assessment portfolios for the units of study in the final year of the degree are particularly significant for accreditation purposes.

The Panel will tour the physical facilities available to students enrolled in the degree program, including laboratories, computing facilities, lecture theatres, libraries, technical workshops, etc. Two sample programs for a site visit are listed in Appendix D.

(6) Report

Following the site visit, the Accreditation Panel will produce a report which will be confidential between the Academic Unit of the university involved, the Panel and the Executive of the Institute.

The Panel Chair is expected to produce the first draft for discussion within one month of the site visit and if he/she is unable to do that he/she will ask another Panel member to write the draft. The report should be finalised within two months.

Once formally received by the university it is anticipated that the report will be made available to any of the staff within the academic unit involved in the accreditation

(7) Fees and charges

The fee for an accreditation within Australia is $10,000 plus GST and this includes all travel and accommodation costs incurred by Accreditation Panel members.

An administration fee applicable for late submissions of documentation of $500 plus GST may be applied subject to the circumstances.

(8) Appeal

An appeal of matters pertaining to an AIP Accreditation outcome will be considered by the AIP Executive after receiving a written submission from the university, and written comments on that submission from the Panel Chair, and, if required, from the Accreditation Manager. The university will have the right to have a member of the staff present its case of appeal in person to the AIP Executive provided that all costs associated with such presentation are met by the university.

(9) Notes and References

1. Updated April 2019. This regulations document is a living one subject to regular review and updating as approved by the AIP Executive. This version will be used for AIP Accreditations being initiated and completed in 2019.

2. Physics bachelor degrees that meet the requirements for AIP Accreditation also satisfy the Australian Qualification Framework Level 7 (Bachelor Degree) as demonstrated by correlation between the AIP requirements and AQF Level 7 (threshold) learning outcomes (AQF LO's are under review) requirements are detailed in Appendix C. Note a standards document pertaining to physics, astronomy, astrophysics etc. has not been researched and developed for use by TEQSA as of this update.

3. https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/sbs-physics-astronomy-and-astrophysics-17.pdf?sfvrsn=2f94f781_12 (modified for Australia). UK Quality Control for Higher Education Subject Benchmark Statement - Physics, Astronomy, and Astrophysics

4. AIP Accreditation Manager (2017-2021) Professor Deb Kane, Dept. of Physics and Astronomy, Macquarie University, NSW 2109, Australia, deb.kane@mq.edu.au

Appendices to the "Information for Australian Universities seeking to have a qualification accredited by the Australian Institute of Physics"

Appendix A
An AIP Accredited Physics Degree as benchmarked to the current AQF Level 7 Australian Qualification Framework

Currently, the AQF is undergoing a review. For more information on the AQF Review
https://www.education.gov.au/australian-qualifications-framework-review-0

AQF Level 7 – Bachelor Degree

The purpose of the Bachelor Degree qualification type is to qualify individuals who apply a broad and coherent body of knowledge in a range of contexts to undertake professional work and as a pathway for further learning.

Bachelor Degree qualifications are located at level 7 of the Australian Qualifications Framework.

Bachelor Degree qualifications must be designed and accredited to enable graduates to demonstrate the learning outcomes expressed as knowledge, skills and the application of knowledge and skills specified in the level 7 criteria and the Bachelor Degree descriptor.
https://www.aqf.edu.au/aqf-qualifications

AQF level 7 criteria

Summary

Graduates at this level will have broad and coherent knowledge and skills for professional work and/or further learning.

Knowledge

Graduates at this level will have broad and coherent theoretical and technical knowledge with depth in one or more disciplines or areas of practice.

Skills

Graduates at this level will have well-developed cognitive, technical and communication skills to select and apply methods and technologies to:

- analyse and evaluate information to complete a range of activities
- analyse, generate and transmit solutions to unpredictable and sometimes complex problems
- transmit knowledge, skills and ideas to others

Application of knowledge and skills

Graduates at this level will apply knowledge and skills to demonstrate autonomy, well-developed judgement and responsibility:

- in contexts that require self-directed work and learning
- within broad parameters to provide specialist advice and functions

https://www.aqf.edu.au/aqf-levels

Appendix B
Higher Education Standards Framework (Threshold Standards) 2015 (Excerpt – Section 3 Teaching)

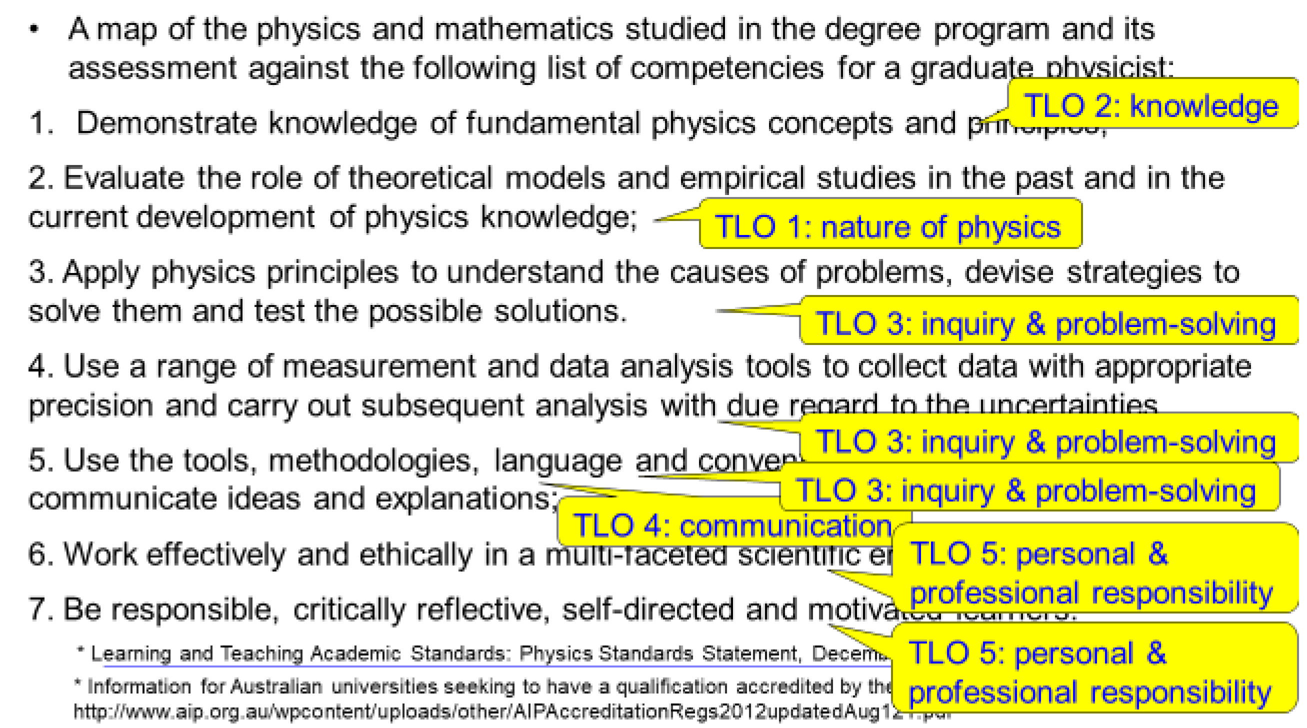
https://www.teqsa.gov.au/higher-education-standards-framework-2015
https://www.legislation.gov.au/Details/F2015L01639

3 Teaching
3.1 Course Design
1. The design for each course of study is specified and the specification includes:
    a. the qualification(s) to be awarded on completion
    b. structure, duration and modes of delivery
    c. the units of study (or equivalent) that comprise the course of study
    d. entry requirements and pathways
    e. expected learning outcomes, methods of assessment and indicative student workload
    f. compulsory requirements for completion
    g. exit pathways, articulation arrangements, pathways to further learning, and
    h. for a course of study leading to a Bachelor Honours, Masters or Doctoral qualification, includes the proportion and nature of research or research-related study in the course.
2. The content and learning activities of each course of study engage with advanced knowledge and inquiry consistent with the level of study and the expected learning outcomes, including:
    a. current knowledge and scholarship in relevant academic disciplines
    b. study of the underlying theoretical and conceptual frameworks of the academic disciplines or fields of education or research represented in the course, and
    c. emerging concepts that are informed by recent scholarship, current research findings and, where applicable, advances in practice.
3. Teaching and learning activities are arranged to foster progressive and coherent achievement of expected learning outcomes throughout each course of study.
4. Each course of study is designed to enable achievement of expected learning outcomes regardless of a student's place of study or the mode of delivery.
5. Where professional accreditation of a course of study is required for graduates to be eligible to practise, the course of study is accredited and continues to be accredited by the relevant professional body.

3.2 Staffing
1. The staffing complement for each course of study is sufficient to meet the educational, academic support and administrative needs of student cohorts undertaking the course.
2. The academic staffing profile for each course of study provides the level and extent of academic oversight and teaching capacity needed to lead students in intellectual inquiry suited to the nature and level of expected learning outcomes.
3. Staff with responsibilities for academic oversight and those with teaching and supervisory roles in courses or units of study are equipped for their roles, including having:
    a. knowledge of contemporary developments in the discipline or field, which is informed by continuing scholarship or research or advances in practice
    b. skills in contemporary teaching, learning and assessment principles relevant to the discipline, their role, modes of delivery and the needs of particular student cohorts, and
    c. a qualification in a relevant discipline at least one level higher than is awarded for the course of study, or equivalent relevant academic or professional or practice based experience and expertise, except for staff supervising doctoral degrees having a doctoral degree or equivalent research experience.
4. Teachers who teach specialised components of a course of study, such as experienced practitioners and teachers undergoing training, who may not fully meet the standard for knowledge, skills and qualification or experience required for teaching or supervision (3.2.3) have their teaching guided and overseen by staff who meet the standard.
5. Teaching staff are accessible to students seeking individual assistance with their studies, at a level consistent with the learning needs of the student cohort.

3.3 Learning Resources and Educational Support
1. The learning resources, such as library collections and services, creative works, notes, laboratory facilities, studio sessions, simulations and software, that are specified or recommended for a course of study, relate directly to the learning outcomes, are up to date and, where supplied as part of a course of study, are accessible when needed by students.
2. Where learning resources are part of an electronic learning management system, all users have timely access to the system and training is available in use of the system.
3. Access to learning resources does not present unexpected barriers, costs or technology requirements for students, including for students with special needs and those who study off campus.
4. Students have access to learning support services that are consistent with the requirements of their course of study, their mode of study and the learning needs of student cohorts, including arrangements for supporting and maintaining contact with students who are off campus.

Appendix C
Mapping of the AIP requirements for accreditation of a degree with a major in Physics (or equivalent) to Threshold Learning Outcomes



Learning and Teaching Academic Standards

Physics Standards Statement

December, 2012

This document has been prepared by adapting the work of the ALTC-supported projects on academic standards in Science[1] and in Chemistry[2], with the active input of:

Institution	
Australian Council of Deans of Science	John Rice
Australian Defence Force Academy	David Low
Australian National University	Hans Bachor, Anna Wilson
Curtin University of Technology	Bob Loss, Mario Zadnik
Flinders University	Maria Parapilly
James Cook University	Peter Ridd
Macquarie University	Deb Kane
Monash University	Theo Hughes
Murdoch University	Chris Creagh, David Parlevliet
Newcastle University	John Holdsworth
RMIT	Johan du Plessis
University of Adelaide	Judith Pollard, Peter Veitch
University of Melbourne	Chris Chantler, Lloyd Hollenberg, David Jamieson, Michelle Livett, Andrew Melatos, Ray Volkas
University of Queensland	Matthew Davis, Michael Drinkwater, Tim McIntyre, Anton Rayner, Margaret Wegener
University of Sydney	Helen Georgiou, John O'Byrne, Ian Sefton, Manju Sharma
University of Western Sydney	Ragbir Bhathal
University of Wollongong	Bill Zealey
UNSW	Elizabeth Angstmann
UTS	Michael Ford, Les Kirkup
Victoria University	Stephen Collins

Physics Standards Statement

This Physics Standards Statement contains a description of the nature and extent of Physics, a statement of the Physics Standards expressed as threshold learning outcomes (TLOs), and some descriptive Notes that provide a framework for understanding, interpreting, and applying the TLOs. In conjunction with the Science Standards Statement[1], it provides a foundation for the evaluation of current physics degree programs, and for future curriculum development.

Nature and extent of physics

Physics is a science that explores the fundamental laws that govern the universe. It addresses issues such as the ultimate structure of matter, the origin of the universe, and the underpinnings of new technologies.

It aims to understand the physical world by:

- using observed properties and relationships to identify integrating concepts,
- building models that incorporate those concepts,
- using the resultant conceptual frameworks to make predictions about new phenomena or observations, and
- using observations to test the predictions and, if necessary, modify the conceptual frameworks.

Bachelor Level Threshold Learning Outcomes for Physics

	Upon completion of a Major in physics, graduates will:
Understanding Science	1. *Demonstrate a coherent understanding of the nature of physics by:* 1.1 Articulating how physics uses observations of relationships between measurable quantities to create conceptual frameworks which can be used to explain, interpret and predict other observations. 1.2 Identifying the role of fundamental physics concepts (such as laws of conservation) in a variety of different contexts. 1.3 Acknowledging that there are physical reasoning processes characteristic of the discipline 1.4 Explaining the role and relevance of physics in society.
Scientific knowledge	*2. Exhibit depth and breadth of scientific knowledge by:* 2.1 Demonstrating well-developed knowledge in the subject areas of the physics discipline. 2.2 Demonstrating knowledge in the related disciplinary area of mathematics.
Inquiry and problem solving	*3. Critically analyse physical situations by:* 3.1 Gathering, documenting, organising, synthesising and critically evaluating information from a range of sources. 3.2 Designing, planning, carrying out and refining a physics experiment or investigation. 3.3 Selecting and critically evaluating practical, computational and/or theoretical techniques or tools in order to conduct an investigation. 3.4 Applying appropriate physics concepts to the interpretation of experimental or observational data and the drawing of conclusions from that data.
Communication	*4. Be effective communicators of physics by:* 4.1 Communicating physics data, results and analysis, to a range of audiences, for a range of purposes, and using a variety of modes. 4.2 Understanding and interpreting arguments or opinions based on physics, presented by others.
Personal and professional responsibility	*5. Be accountable for their own learning and scientific work by:* 5.1 Being independent and self-directed learners. 5.2 Working effectively, responsibly and safely in an individual or team context. 5.3 Exhibiting intellectual integrity and practising ethical conduct.

Notes on The Threshold Learning Outcomes

These Notes are intended to offer guidance on how to interpret the TLOs.

These threshold learning outcomes have been developed to describe a pass level graduate from a bachelor degree. A **bachelor degree** is defined according to the Australian Qualifications Framework.

The TLOs are not intended to be equally weighted across the degree program, nor does the numbering imply a hierarchical order of importance. However, the numbering may be used to provide easy reference to a specific TLO.

Understanding physics

A coherent understanding: Graduates will have developed an appreciation of physics as a discipline which seeks a unified understanding of physical phenomena. They will have a general understanding of how physics operates by abstracting the common features from various observations.

TLO 1.1

Observations of relationships: Graduates will understand that physics attempts to describe the physical world and so physical theories are constructed from and tested by observational data. In physics, data typically concern relationships, i.e. the way that one parameter varies as a result of variations in another parameter. Data include, but are not limited to, the results of controlled experiments, observation of uncontrolled physical objects and processes.

Measurable quantities: Graduates will recognise that a key characteristic of physics is a focus on measurable quantities, with relationships between them that can be expressed in mathematical form.

Creation of conceptual frameworks: Although physics is an empirical science, its primary goal is to create conceptual frameworks, consistent with specific observations, through a process of generalisation, inference and abstraction. The aim of physics is to create a coherent picture of the physical world that can be reliably used to explain past and current observations and predict new ones.

TLO 1.2

Fundamental physics concepts: Manifesting in a variety of contexts are underpinning concepts, such as conservation laws, the concept of potential, and the idea that all physical phenomena are the result of a limited number of interactions. Graduates will be able to identify and describe how the same concepts can be used to analyse a diverse range of contexts. For example, graduates will understand how conservation of energy and momentum can be used to describe the interactions of atomic radiation with matter, as well as macroscopic processes such as projectile motion. Similarly, they will understand how the concept of energy is critical in analysing thermal processes, fluid motion, mechanics and more.

TLO 1.3

Physical reasoning processes: First, this emphasises that graduates will look for physical causes of phenomena that they encounter. Second, there is a characteristic problem-solving or reasoning process used by physicists. This involves identifying key elements in a physical situation, focussing on them to create a simpler problem which can be solved, and subsequently making corrections or adjustments to account for the factors initially neglected. Graduates will be able to approach problems in this way, for example by initially neglecting air resistance in a projectile motion question, by treating extended objects as point masses, or by making order of magnitude estimates to use in a self-checking process.

TLO 1.4

Role and relevance of physics:

Physics graduates will have an overarching understanding of the role of physics - its impact, significance, and relevance. A physics graduate will understand that society includes one's fellow students and academic colleagues, the local community, the social, environmental, technological, and industrial sectors, and the worldwide community of scholars and others.

Physics has connections with and input into many fields of pure research, as well as applied fields such as technology development, engineering and medicine, and real-world situations. Physics graduates will appreciate the fundamental role of physics in connecting and underpinning the sciences. They will be able to place current scientific issues within the context of their understanding of physics. They will also be able to appreciate how physics is a continually evolving discipline and will be able to identify critical points in the development of physics as it is understood today.

Graduates will be able to identify specific ways in which physics has contributed to, and continues to contribute to, society and its development through both its own outputs and its support for other activities. They will understand that physics creates both challenges and opportunities for the community. Physics graduates will be able to contribute to society by using their scientific literacy to understand and explain physics-related issues. For some graduates this might involve being an advocate for physics; however, all physics graduates should have some appreciation of physics in the larger context of society.

Scientific knowledge

This is the currently accepted body of facts and theories that has arisen from a systematic study of the physical world. Physics graduates will have acquired a coherent body of knowledge in physics (which may be equivalent to a major in a science degree).

TLO 2.1

Depth and breadth: Physics graduates will have command of the core knowledge of physics. They will have an understanding of the fundamental laws that govern the universe. Physics graduates will have a depth of knowledge in most of the identifiable traditional areas in physics such as mechanics, thermodynamics, optics, quantum physics and electromagnetism. Physics graduates will be able to understand how these subject areas relate to each other, and integrate their knowledge across the various physics areas in which they have studied. In addition, physics graduates will have a basic knowledge of closely-related fields of application. It is also expected that a Physics graduate will have some working knowledge of non-traditional physics areas such as biophysics or nanotechnology.

TLO 2.2

Mathematics: A Physics graduate will be expected to have at least a basic foundation of knowledge in one or more other related disciplinary areas. A graduate's knowledge of physics will be underpinned by a good foundation in mathematics, and he/she will have facility with mathematical techniques relevant to the disciplinary area of physics.

Inquiry and Problem solving

Approach: Graduates will be able to use critical thinking skills and a quantitative approach to analyse physical situations and solve complex problems.

Domain: Graduates will be able to apply physical principles in a range of contexts. They will have the skills to solve problems that lie within the domain of traditional physics, as well as tackle more open-ended research questions.

TLO 3.1

Gathering, documenting, organising and synthesising information: Physics graduates will be able to identify, access, record in appropriate format, collate and integrate information.

Critically evaluating information: Physics graduates will be able to assess the soundness of the information that they gather against the criteria of their knowledge and understanding of physics.

Range of sources: It is recognised that information about the physical world is available from a variety of sources, such as books, refereed and non-refereed journal articles, conference presentations, seminars, lectures, peers and the internet. Information processing also deals with data generated as a consequence of experimentation or observation, or the analysis of existing data.

TLO 3.2

Designing, planning and problem-solving: Physics graduates will be able to devise a sequence of data acquisition and analysis using methods based on accepted physical principles. They will be able to form hypotheses and then design activities or experiments to test these hypotheses. Physics graduates will use a systematic approach to problem-solving using the laws of physics. In addition, physics graduates will have an appreciation of how to frame a problem so that it might be solved in a creative or innovative way.

Refining: Physics graduates will be able to review the effectiveness of the methods they have used so as to improve their approaches and to acquire qualitatively and quantitatively superior data.

TLO 3.3

Techniques and tools: Physics graduates will be able to use a range of the tools of physics, including instruments, apparatus, mathematical and statistical approaches, including modelling, and information and communication technologies. They will be able to use a range of measurement and data analysis tools to collect data with appropriate precision. Through their undergraduate learning experiences, physics graduates will be knowledgeable of techniques used to solve different types of problems. Physics graduates will be able to use appropriate (combinations of) practical, theoretical and computational tools to solve problems in their discipline, and will have an appreciation of the techniques used in other areas of science.

TLO 3.4

Applying appropriate physics concepts: Physics graduates will be able to identify the physical concepts that apply to a particular situation or phenomenon being investigated. They will recognise the limits and boundaries of models.

Interpretation of experimental or observational data: Physics graduates will be able to analyse data to yield justifiable conclusions. They will evaluate quantitative evidence, to judge the quality of data and results, using one or more of the techniques of measurement uncertainty, reproducibility, precision, or statistical analysis.

Drawing conclusions Physics graduates will have the capacity to develop defensible arguments based on evidence and draw valid conclusions based on their interpretation of data. They will be able to explain the influence of theoretical or empirical models and measurement uncertainties when drawing conclusions from experimental, simulated or observational data.

Communication

Physics graduates will have developed skills in the communication of physics, both in the specialised forms characteristic of the discipline, and in the wider context.

TLO 4.1

Appropriate documentation: Physics graduates will be able to keep clear, accurate records of their work, including all relevant data and observations. Documentation should be of sufficient detail that the procedure could be replicated. Graduates will use appropriate formats such as notebooks, journals and databases, ranging from traditional media to emerging information technologies.

Presentation: Physics graduates will be able to convey their message in a clear and understandable manner. They will show clear evidence to support their arguments or from which conclusions are drawn.

They will be able to present quantitative and qualitative data in a variety of scientific formats, including tables, graphs, diagrams and symbols. They will use scientific language correctly and appropriately. They will be able to follow the conventions of discipline-specific nomenclature, such as the use of standard symbols, units, or key terms. Physics

graduates will be aware of the need to communicate the details of their investigations according to conventions that are usually specific to their sub-discipline, and which may be defined by publishers, editors or professional associations.
A range of audiences: Physics graduates will be able to communicate with their peers, scientific non-experts, and the general community.
A range of purposes: Physics graduates will be able to present their findings in both a technical and non-technical manner.
A variety of modes: Physics graduates will communicate using a range of media, including both written and oral, and a variety of other techniques. They will be able to communicate physics in a range of formats (such as technical report, newspaper or journal article, poster presentation, and new media such as wikis, blogs and podcasts).

TLO 4.2
Understanding and interpreting: Physics concepts and laws are used to explain or make arguments about physical situations. Physics graduates will be able to recognise those concepts and laws (in whatever mode they are presented), understand their significance and interpret their relevance to a particular position or argument.
Arguments and opinions presented by others: Communication is a two-way activity that involves an ability to listen to and understand others.

Personal and professional responsibility

Physics graduates will be capable of taking responsibility for themselves and for others they interact with in physics-related activities.

TLO 5.1
Independence and self-directed learning: Physics graduates will be able to take responsibility for their own learning. This involves an ability to work autonomously and evaluate their own performance. Because physics knowledge is continually evolving, it is important that they are motivated to continue to learn after graduation.

TLO 5.2
Working effectively, responsibly and safely: Physics graduates will understand how to take responsibility for themselves and others during the conduct of physics investigations. This includes adhering to the relevant occupational/environmental health and safety and risk assessment requirements. It also includes an understanding of time management, and the onus on individuals to fulfil their role as part of team projects.
Relevant regulatory frameworks: Physics graduates will have an awareness of the regulatory frameworks that apply to their sub-disciplinary area, and the reasons for them. These might be the legal frameworks for experimentation and data collection, quality control procedures, appropriate safety procedures, or the necessity to obtain government permits for certain types of activity. They will be prepared to abide by these regulatory frameworks as they move into professional employment, and understand the consequences if they do not.
Individual context: Physics graduates will be able to work independently with limited supervision.
Team context: Physics graduates will have gained the skills to function effectively as members or leaders of physics or multidisciplinary teams. They will appreciate that physics is primarily a collaborative activity.

TLO 5.3
Intellectual integrity and ethical conduct: Physics graduates will recognise the ethical frameworks within which physics is practised. They will have learned to behave in an ethical manner during their undergraduate study, and are equipped to do so in the future. Aspects of ethics that graduates meet might include accurate data recording, secure data storage, proper referencing of the work of others, intellectual integrity, having an awareness of the impact on the environment of their activities, animal ethics, or human ethics. It is important that physics graduates have some understanding of their social and cultural responsibilities as they investigate the physical world.

References:
[1]Jones S, Yates B, and Kelder, J-A, (2011) *Learning and Teaching Academic Standards: Science Standards Statement, June 2011*, ALTC report.
[2]Buntine M, Price W, Separovic F, Brown T, and Twaites R, (2011) *Learning and Teaching Academic Standards: Chemistry Academic Standards Statement Consultation Paper, February, 2011,* ALTC report.

Appendix D
Sample Schedules for the AIP Accreditation Panel Site Visit

Sample 1

9.00 Welcome by Chair of Department or nominee. Preliminary panel discussion (AIP Accreditation Panel only)

9.30 Meet with Chair of Department, Deputy Chair of Department. Overview of the Department and its teaching programs

10:30 Morning tea with physics students/physics club (informal)

11:00 Meet with undergraduate students (formal)

11:30 View student outputs from all laboratories

12:00 Meet with physics unit convenors

12:45 Lunch with physics staff and physics graduate student tutors/lab demonstrators

1:45 View full, collated profile of student assessment outputs for (minimum) pass, credit, distinction, high distinction (or equivalent grades in institution's system) for units of study. Third year units are particularly important

3:00 Tour of Physics teaching laboratories and learning spaces

4.00 Meeting with Executive Dean (and/or other senior members of the Executive as determined appropriate by Those planning the visit

4.30 Afternoon tea and Panel discussion on report (AIP Panel only)

5.00 Final briefing with Chair of Department.

Sample 2

9:00am-9:30am	Preliminary Accreditation Panel discussion
9:30am-10:00am	Welcome by Head of School and Head of Teaching and Learning
10:00am-10:20am	Morning Tea with Uof Study Co-ordinators
10:20am-11:00am	Meet with Unit of Study Co-ordinators
11:00am-11:45am	Tour – Ist Year Lab
11:45am-12:15pm	Meeting with undergraduate students
12:15pm-12:45pm	Meeting Honours students (and possibly Postgrads)
12:45pm-2:15pm	Lunch – view assessment portfolios
2:15pm-3:45pm	Tour – 2nd Year Lab, Senior Lab, Learning Studio (Comp Lab); Active learning space
3:45pm-4:15pm	Afternoon Tea with teaching staff
4:15pm-4:45	Panel discussion on report
4:45pm-5:15pm	Final briefing with Head of School and Head of Teaching and Learning

Appendix E
https://www.aqf.edu.au/aqf-qualifications

AQF Level 8 criteria for the Bachelor Honours Degree

The purpose of the Bachelor Honours Degree qualification type is to qualify individuals who apply a body of knowledge in a specific context to undertake professional work and as a pathway for research and further learning.

Bachelor Honours Degree qualifications are located at level 8 of the Australian Qualifications Framework.

Bachelor Honours Degree qualifications must be designed and accredited to enable graduates to demonstrate the learning outcomes expressed as knowledge, skills and the application of knowledge and skills specified in the level 8 criteria and the Bachelor Degree descriptor. Full qualification type specification

AQF Level 8 criteria for the Graduate Certificate

The purpose of the Graduate Certificate qualification type is to qualify individuals who apply a body of knowledge in a range of contexts to undertake professional or highly skilled work and as a pathway for further learning. Graduate Certificate qualifications are located at level 8 of the Australian Qualifications Framework.

Graduate Certificate qualifications must be designed and accredited to enable graduates to demonstrate the learning outcomes expressed as knowledge, skills and the application of knowledge and skills specified in the level 8 criteria and the Graduate Certificate descriptor.

Graduate Certificate qualifications are available for accreditation and issuance in both higher education and vocational education and training. Full qualification type specification

AQF Level 8 criteria for the Graduate Diploma

The purpose of the Graduate Diploma qualification type is to qualify individuals who apply a body of knowledge in a range of contexts to undertake professional or highly skilled work and as a pathway for further learning.

Graduate Diploma qualifications are located at level 8 of the Australian Qualifications Framework.

Graduate Diploma qualifications must be designed and accredited to enable graduates to demonstrate the learning outcomes expressed as knowledge, skills and the application of knowledge and skills specified in the level 8 criteria and the Graduate Diploma descriptor. Graduate Diploma qualifications are available for accreditation and issuance in both higher education and vocational education and training.

https://www.aqf.edu.au/aqf-levels

AQF level 8 criteria

Summary

Graduates at this level will have advanced knowledge and skills for professional or highly skilled work and/or further learning.

Knowledge

Graduates at this level will have advanced theoretical and technical knowledge in one or more disciplines or areas of practice

Skills

Graduates at this level will have advanced cognitive, technical and communication skills to select and apply methods and technologies to:

- analyse critically, evaluate and transform information to complete a range of activities
- analyse, generate and transmit solutions to complex problems
- transmit knowledge, skills and ideas to others

Application of knowledge and skills

Graduates at this level will apply knowledge and skills to demonstrate autonomy, well-developed judgement, adaptability and responsibility as a practitioner or learner.