



SCIENCE

LEARNING AREA SUMMARY

Learning Area Summary - Senior Secondary Learning Areas

SCIENCE

A. CURRENT CONTEXT OF TASMANIAN COURSES

Science is a way of answering questions about the biological, physical and technological world. The body of knowledge is a dynamic, collaborative and creative human endeavour that is built upon questioning, observing, gathering evidence, which may be revised, refined and extended as new evidence arises (*Australian Curriculum*, V7.3).

Through studying science, learners develop a curiosity and an understanding of their environment and their place in the living, material and physical world. A science framework needs to provide for the development of learners' scientific literacy so that they can function in a scientifically and technologically advancing society, enabling them to make personal and societal decisions on the basis of evidence and reason.

A science curriculum also needs to meet the needs of learners who will become scientists or employed in science-related industries or services. Study of Year 11 and 12 science opens up a wide range of careers in engineering, technology, medical and health professions, as well as careers in science and education.

Nationally and internationally, there is increasing interest in developing curriculum around the integrated subjects in STEM (Science, Technology, Engineering and Mathematics). The Big History project, which integrates disciplines across the three large domains of the physical world, the biological world, and the human world, is also being piloted in a number of jurisdictions.

1. Existing Year 11 and 12 courses

Re-developed Tasmanian Year 11/12 science courses have had a staged implementation from 2013 to 2016. Five of the developed courses (*Chemistry, Physics, Physical Sciences, Biology and Life Science*) align with content units from the relevant senior secondary Australian Curriculum subject, while *Environment and Nature, Physical Sciences – Foundation* and *Environmental Science and Society* are Tasmanian- developed courses.

2. Links to Australian Curriculum

Tasmania has adopted the Australian Curriculum F to 10 with Science being implemented progressively over a three-year period from 2012. The Australian Curriculum senior secondary Science subjects build on student learning in the Foundation to Year 10 Science curriculum and include Biology, Chemistry, Physics and Earth and Environmental Science.

Australian Curriculum course documents for *Biology, Chemistry and Physics* have been used to define expectations concerning course learning outcomes and course content in five Tasmanian Year 11/12 science courses: *Life Sciences level 2, Biology level 3, Physical Science level 3, Chemistry level 4* and *Physics level 4*.

Year 11 and 12 science course development in Tasmania that relates to the implementation of the Australian Curriculum is in the last phase of development. The final course to be developed

is Biology. The interim Biology course BIO315114 will be replaced by a new course in 2016 that has greater alignment with the Australian Curriculum.

The process of aligning Tasmanian Year 11/12 courses with the Australian Curriculum has been largely centred on changing course content to include contemporary science and the use of the Australian Curriculum's construct of three interrelated stands: *Science Understanding*, *Science Inquiry Skills* and *Science as a Human Endeavour*.

There are no content statements developed by ACARA relevant to three Tasmanian Year 11/12 science courses: *Environmental Science and Society* level 3, *Physical Sciences – Foundation* level 2 and *Environment and Nature* pre level 1.

3. Pathways

In Tasmania there are clear pathways from Year 10 science to the Year 11/12 courses. There are two Year 11 foundation courses – in Life Sciences and Physical Sciences – that provide pathways to pre-tertiary study in Year 12. The absence of level 1 science courses means there is no pathway to level 2 courses for some students.

The pathways map in **Appendix 2** shows the study pathways from Year 10 through Years 11/12 to tertiary study at university.

4. Enrolment data

The data shows that enrolments in the sciences have been steady with no significant changes to the percentages of candidates studying science from 2011 to 2014. During this period the proportion of candidates in the two level 2 courses has significantly increased. Overall, the sciences are undertaken by approximately equal percentages of males and females however Physics is studied by significantly more males (82%) than females.

B. APPROACHES IN OTHER JURISDICTIONS

National

- The *Shape of the Australian Curriculum: Science paper* in 2009 identified that as well as providing a foundation for specific learning pathways leading to science and engineering courses at university and technical and vocational education and training, science courses should also prepare students to use science for life and active citizenship.
- The Review of the Australian Curriculum Science (2014) recommends that there needs to be a balance between constructivist approach and explicit teaching.
- All states will have courses that align with the Year 11 and 12 Australian Curriculum in Biology, Chemistry and Physics and most have an Earth and Environmental Science course.
- Most states (but not Tasmania) have a general science course at Year 11/12 which is interdisciplinary and inquiry based e.g. *Integrated Science* in WA, *Scientific Studies* in SA, *Senior Science* in NSW but the future of these courses is not known.
- Some states offer additional science courses which are relevant to their local contexts such as Agriculture/Horticulture (Qld, SA, WA), Marine Science (WA, Qld) and Aviation (WA)

- In some states Psychology is included in the Science learning area (WA, SA, Vic).
- ACARA is currently working collaboratively to identify inter-relationships between STEM disciplines in the Australian Curriculum. The materials and findings from the project will be published on the ACARA website throughout 2015.
- The NSW Board of Studies, Teaching and Standards (BOSTES) has endorsed Stage 5 and Stage 6 *Big History* offerings (from 2015-2018) and an online *Big Science* (based on *Big History*) course for Years 9 and 10 Science is available to Tasmanian schools from 2015.

International

- Internationally, there is a focus on enhancing student engagement in science K-12 through 21st century pedagogies as many jurisdictions experience declining enrolments in the sciences at senior level.
- International senior secondary curricula are characterised by the provision of courses in the traditional science disciplines (Biology, Chemistry, Physics and Earth Sciences) to enable students to undertake tertiary study, as well as courses to develop scientific literacy.
- Globally, inquiry based science education is generally acknowledged as one of the most effective teaching approaches for science for any year level.
- A survey in the United Kingdom (UK) in 2008 revealed that a focus on developing learners' investigative skills increases learner motivation and understanding. Learners in these schools were enthusiastic about the subject and had the confidence and skills to plan investigations and collect, present and evaluate evidence (*Ostfed 2008, p. 11*).
- Internationally, countries successful in retention and achievement in science education generally have a common belief in the importance of education and their societies afford high status to teachers.
- Many countries including the US are looking at integrated courses in STEM (Science Technology Engineering and Maths).
- The Big History on-line curriculum which integrates disciplines across the three large domains of the physical world, the biological world, and the human world is also being piloted in a number of jurisdictions.

C. FUTURE DIRECTIONS FOR THE TASMANIAN CONTEXT

- Students should experience continuous progression in their learning from K-12 and the pathways and progression in Year 11/12 Science courses should be clear.
- The Tasmanian Year 11/12 courses should build on the F-10 *Australian Curriculum: Science* and enable the senior secondary *Australian Curriculum: Science* subject rationales, aims, standards and content.
- The standards of the Tasmanian Year 11/12 courses must be comparable to Science courses nationally and the relationship with corresponding courses in other jurisdictions should be obvious.
- There needs to be a focus on enhancing student engagement in science F-12 through the use of a science inquiry approach and 21st century pedagogies.

- The Year 11/12 Science learning area should provide a range of pathways to cater for all post-schooling destinations.
- The senior secondary curriculum focus in science has been on the ‘disciplines’ within science and consideration needs to be given to broadening the offerings to include a level 1 course and integrated or cross disciplinary science courses.
- The inclusion of general science courses in other jurisdictions needs to be monitored to inform Tasmanian Year 11/12 science course development.
- The development of a practical general science course at Year 11/12 which is inquiry based and which reflects a progression of the learning in science from Year 10 needs to be considered.
- Consideration may be given to the development of ‘bundles’ of Year 11/12 courses that are specific to the economic needs of Tasmania and which directly link to further studies at the University of Tasmania or TasTAFE e.g. Marine and Antarctic Science, Agriculture.
- Nationally and internationally, there is increasing interest in developing curriculum around the integrated subjects in STEM (Science, Technology, Engineering and Mathematics) and this needs to be considered in the Tasmanian context.

D. FOCUS QUESTIONS

1. Are the pathways from Year 10 through Years 11 and 12 clear for learners and are there appropriate entry points?
2. Does the current suite of courses meet the needs of all learners?
3. Are there gaps and/or duplication in this learning area?
4. With reference to the issues highlighted in section C above, what are the new and emerging areas of learning that need consideration?

Appendix I

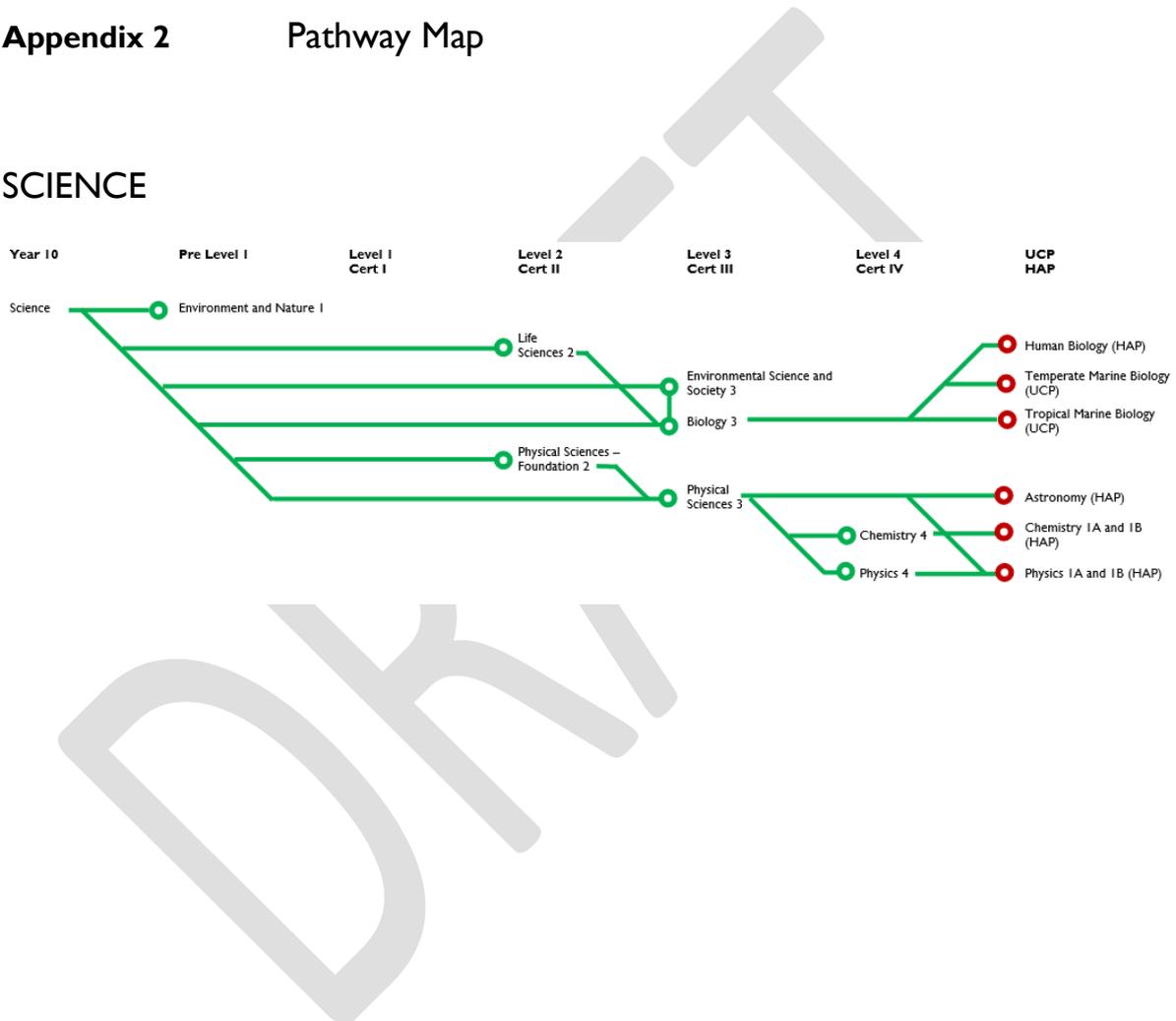
Current Tasmanian Year 11 and 12 Courses in the Sciences Learning Area

- *Environment and Nature* Pre-level 1
- *Life Sciences* Level 2
- *Physical Sciences-Foundation* Level 2
- *Physical Sciences* Level 3
- *Biology* Level 3
- *Environmental Science and Society* Level 3
- *Chemistry* Level 4
- *Physics* Level 4
- *Temperate Marine Biology*, University College Program
- *Tropical Marine Biology*, University College Program

- *Astronomy*, High Achiever Program
- *Chemistry IA*, High Achiever Program
- *Chemistry IB*, High Achiever Program
- *Human Biology*, High Achiever Program
- *Physics IA*, High Achiever Program
- *Physics IB*, High Achiever Program

Appendix 2 Pathway Map

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