Transdisciplinary Science

LEVEL 3	15 TCE CREDIT POINTS
COURSE CODE	TDS315123
COURSE SPAN	2023 — 2027
READING AND WRITING STANDARD	NO
MATHEMATICS STANDARD	NO
COMPUTERS AND INTERNET STANDARD	YES

This course is current for 2024.

Transdisciplinary Science Level 3 enables learners to discover applications of science that are significant in the Tasmanian context

They apply scientific skills and knowledge to independently investigate an individual inquiry question of personal interest, guided by the provider, in response to the world around them. Learners design, plan and conduct scientific investigations drawing on multiple scientific disciplines. They use accepted scientific processes and practices to communicate their findings, including a scientific paper and poster presentation. Learners develop skills in collaboration, critical thinking, observation and synthesis relevant to both technical and academic careers and further study. Through this process they will be prepared for an increasingly broad range of contemporary tertiary pathways.

Focus Area

Transdisciplinary projects

Courses aligned to the Years 9 to 12 Curriculum Framework belong to one of the five focus areas of Discipline-based study, Transdisciplinary projects, Professional studies, Work-based learning and Personal futures.

Transdisciplinary Science Level 3 is a Transdisciplinary projects course.

Transdisciplinary projects courses require learners to integrate, transfer and reflect on their prior knowledge, skills, attitudes and values in transdisciplinary ways. Learners will engage critically and creatively to integrate the learning and ways of working from multiple disciplines. Learners will produce outcomes that are only possible through the intersection between disciplines. Learners will share the outcomes of Transdisciplinary projects as appropriate to their methodology, and their exhibition of work will form a major element of their assessment. Learners will reflect upon their learning by evaluating their project outputs, the effectiveness of their methodology and the implications of their work on the pre-existing body of knowledge.

Transdisciplinary projects courses have three key features that guide teaching and learning:

- engage and ideate
- connect and apply
- exhibit and reflect.

Figure 1: Transdisciplinary Project Cycle of Learning, adapted from OECD Learning Compass 2030.

For the purposes of this document, the term discipline is used to describe a recognised field of study or body of knowledge in a well-planned structure. Disciplines are defined by specialist knowledge, theories, concepts, methodology and terminology.

For the purposes of this document, transdisciplinary is used to describe an approach to teaching and learning which enables students to use learning or ways of working from multiple disciplines to explore a relevant concept, issue, or problem. It integrates the perspectives of a range of disciplines, resulting in a new and deeper understanding of the concept, issue or problem.

In this course learners will do this by:

- analysing their prior learning and the Tasmanian community to engage with an area of inquiry
- identifying, generating and analysing their inquiries by considering approaches across disciplines
- practising complex methodologies that span across disciplines of science
- iteratively analysing these methodologies and applying them to their chosen area of inquiry
- reflecting on and analysing their learning and inquiries to evolve their practice and understanding
- showcasing their inquiries and evaluation.

Rationale

Science provides a rational and empirical way of answering interesting and important questions about the biological, physical and technological world. The knowledge it produces has proved to be a reliable basis for action in our personal, social and broader lives.

Innovative and critical thinking in the world of science underpins a cohesive understanding of the natural world and the discovery of new ways of doing and thinking. Science is continually refining and expanding knowledge and stimulating new questions for future investigation.

Transdisciplinary Science Level 3 is one component in a proposed suite of flexible science courses and provides a powerful platform to prepare learners for many pathways, and to develop their capabilities; in particular, thinking creatively, working collaboratively and being innovative. In practice, most modern and applied science flows between scientific disciplines and is transdisciplinary by nature.

Learners undertaking *Transdisciplinary Science* Level 3 will apply inquiry-based approaches to design, plan and undertake investigations across scientific disciplines, which respond to local and global situations. Both collaboratively and individually, learners will employ a scientific approach to collecting, representing, analysing data and using technological tools effectively. After critically evaluating their procedures or models, learners communicate scientifically to draw evidence-based conclusions that may lead to further testing, exploring more effective methods or solutions, or raising new questions. They will be equipped to navigate, understand and adapt to what we experience as 21st century learners.

The purpose of Years 9 to 12 Education is to enable all learners to achieve their potential through Years 9 to 12 and beyond in further study, training or employment.

Years 9 to 12 Education enables personal empowerment, cultural transmission, preparation for citizenship and preparation for work.

This course is built on the principles of access, agency, excellence, balance, support and achievement as part of a range of programs that enables learners to access a diverse and flexible range of learning opportunities suited to their level of readiness, interests and aspirations.

Learning Outcomes

On successful completion of this course, learners will be able to:

1. collaborate with others and monitor, critically analyse and manage their own learning within a scientific inquiry
2. design and conduct ethical and safe collection and analysis of data within a specific application of science to inquire into a system
3. analyse and discuss concepts and processes from scientific theories and models to inquire into a system
4. communicate data and information using standard scientific conventions for qualitative and quantitative representation, and evaluate their reliability
5. apply the context of their inquiry locally, nationally and globally and explore relationships between technology, science and the broader community for a particular scientific application
6. analyse information they have researched to implement and adapt processes and trial methodologies while inquiring into a system
7. analyse, refine and finalise experimental design for an inquiry as they collect and analyse data, undertake further research and monitor progress, underpinned by an iterative approach
8. collate and analyse the key data and findings from an extended scientific inquiry and make recommendations for further study.

Pathways

- *Transdisciplinary Science* Level 3 builds on Australian Curriculum: Science F–10, other TASC accredited Science courses and is a potential pathway from TASC accredited HASS, HPE, Technologies and Mathematics courses.
- *Transdisciplinary Science* Level 3 may be undertaken the year after completing *Transdisciplinary Science* Level 2 or through another pathway.
- *Transdisciplinary Science* Level 3 provides a clear pathway to other science courses at levels 3 and 4, in addition to a range of other senior secondary courses and a wide range of tertiary and vocational learning.

Integration of General Capabilities and Cross-curriculum Priorities

The general capabilities addressed specifically in this course are:

- Critical and creative thinking
- Ethical understanding
- Literacy
- Numeracy
- Personal and social capability

The cross-curriculum priorities enabled through this course are:

- Aboriginal and Torres Strait Islander histories and cultures
- Sustainability

Course Size And Complexity

This course has a complexity level of 3.

For a full description of courses at a complexity level of 3, please refer to the Levels of Complexity - Tasmanian Senior Secondary Education document.

This course has a size value of 15. Upon successful completion of this course (i.e., a Preliminary Achievement (PA) award or higher), a learner will gain 15 credit points at Level 3 towards the Participation Standard of the Tasmanian Certificate of Education (TCE).

Course Structure

This course consists of three 50-hour modules.

Module 1: Research, trial and plan

Module 2: Conduct, monitor and refine

Module 3: Review, represent and recommend

Course Delivery

The three modules must be delivered in sequential order, 1, 2 and 3. Depending on the nature of the inquiry there may be some overlap between the modules.

In module 1, providers are responsible for ensuring that any inquiry focus considered by learners can be supported by the discipline expertise, equipment and other resources available, follows health and safety regulations and is of an appropriate size and level of demand to allow the learner to successfully carry it out within the learning environment provided. During this process the ‘Module 1: Learner inquiry project plan checklist’ will be completed for each learner.

See Appendix 7 – Inquiry project approval procedures.

At the beginning of module 1, providers will communicate to learners the range of scientific disciplines, that can be addressed within their context. Providers can define the scope of inquiry by listing a range of scientific applications or industry areas available for investigation. See Appendix 6 for the full list.

During module 1, learners will use the skills and knowledge they acquire to plan and document an inquiry proposal that can be successfully completed in modules 2 and 3.

Course Requirements

Access

Learners enrolled in this course are required to be able to work responsibly and safely in practical situations.

The work submitted for assessment in *Transdisciplinary Science* Level 3 must be produced over the duration of one calendar year, be unique to this course and not be work submitted for assessment in any other course.

Work submitted for assessment in other studies cannot be used for assessment in this course. Therefore, a student cannot use work including, but not limited to, an independent study, folio, project or assignment presented for assessment for a TASC-accredited course or recognised formal learning qualification including VET studies.

This course requires learners to collaborate with others.

Resource requirements

Providers offering this course will need equipment, materials and a suitable space to carry out the practical component of the course effectively and safely.

Module 1: Research, trial and plan

Science is indispensable in Tasmania – now and into our future. Module 1 of *Transdisciplinary Science* Level 3 taps into a wide range of fields where science is applied in our state, and draws on the prior knowledge of learners, to engage with and ideate a focus that is relevant to our community. Learners will discover that, in practice, science draws from many scientific disciplines.

Learners will research, make connections and iteratively inquire into their focus area. They will begin to understand its place in Tasmania, nationally and globally, and analyse the theories, models and methodologies that are key to creating knowledge. This may include interrelationships with First Nations Peoples' understanding.

The application of science through inquiry, evaluation and refinement of understanding at every stage is key to this module. Learners should always be prepared to analyse their work, and return to previous work, to ensure that they build their knowledge. In this module, trialling and analysing processes and methodologies is crucial to prepare for further inquiry. Scientific communication is a key component of this course. Learners should be provided with opportunities to develop and practise a range of written and oral scientific communication skills.

Through this process possible lines of inquiry will emerge to be further refined in module 2. Learners will have the opportunity to demonstrate their plans and findings through an externally assessed folio.

Module 1 learning outcomes

The following learning outcomes are a focus of this module:

1. collaborate with others and monitor, critically analyse and manage their own learning within a scientific inquiry
2. design and conduct ethical and safe collection and analysis of data within a specific application of science to inquire into a system
3. analyse and discuss concepts and processes from scientific theories and models to inquire into a system
4. communicate data and information using standard scientific conventions for qualitative and quantitative representation, and evaluate their reliability
5. apply the context of their inquiry locally, nationally and globally and explore relationships between technology, science and the broader community for a particular scientific application
6. analyse information they have researched to implement and adapt processes and trial methodologies while inquiring into a system.

Module 1 content

Within this module learners will discover where science is of particular significance within the Tasmanian context. As they engage and ideate, they will choose one area to investigate and analyse in detail. They will understand the development and limitations of this application of science and its interrelationships with technology and sustainability within Tasmania. They will broadly explore the transdisciplinary nature of this science, the knowledge required and how this science is applied. In parallel with this, learners will become familiar with and iteratively practise methodologies for this application of science. Learners will then analyse their understanding and experience to choose a focus and plan for further investigation in module 2.

Further guidance on the scope and nature of work demanded of learners can be found within the two module 1 work requirements and Appendix 7.

Additional advice on the interrelationships between the key knowledge and skills, and their complexity can be found in Appendix 8.

Key knowledge

Science as a human endeavour

Within science that is of particular significance, applied or researched in Tasmania, learners will research and analyse the interrelationships between the broad context and the scientific inquiry focus, referring to instances where:

- theories have been refined or replaced as new evidence, models or theories have emerged locally, nationally or globally
- technology has assisted in greater understanding
- social, economic, cultural or sustainability considerations are a factor in Tasmania
- First Nations Peoples' knowledge is valuable.

Science understanding

Within their chosen focus, learners will research and apply:

- the specialist knowledge required across more than one scientific discipline, not restricted to Australian Curriculum Senior Secondary: Science course content
- the inter-relationships between models, theories, phenomena, systems and concepts that need to be referenced and analysis of their limitations
- science understanding at a similar level of complexity to other TASC accredited Level 3 Science courses.

Key skills

Science inquiry skills – design and implementation of inquiry

Learners will have to discover what is possible to measure and analyse within their scientific inquiry. They will have to explore data collection, analysis and representation methodologies together with practical and logistical concerns. This will require a process of trials to examine what can be achieved.

Within science that is of particular significance in the Tasmanian context, learners will:

- identify, research and construct questions for a complex investigation
- design, implement, trial, evaluate and refine methodologies to collect valid and reliable primary data and to evaluate and refine procedures
- analyse and mitigate against risk and ethical issues
- trial, analyse and refine ways to meaningfully organise and represent interrelationships within data in mathematically and statistically appropriate ways
- trial, analyse and refine other processes to support inquiry; for example, the logistics of field work.

Science inquiry skills – evaluation of inquiry

What is found to be possible for a scientific inquiry through trial and error will have to be further analysed for additional limitations and possibilities. This analysis will ensure that valid conclusions will be reached through what is planned for the extended inquiry. Through this process the inquiry question will be resolved enough to proceed with module 2 and will likely change as the extended inquiry progresses.

Within science that is of particular significance in the Tasmanian context, learners will:

- analyse the limitations of primary and secondary data to find interrelationships and how critical issues can be addressed
- research and analyse the interrelationships between processes, claims, conclusions and other relevant information within a field of science
- draw valid and reasoned conclusions through analysing the interrelationships between data, systems, concepts, theories and models

- analyse processes, data and conclusions, and plan to conduct the inquiry.

Module 1 work requirements

This module includes the following work requirements:

- one logbook investigation
- one research and plan investigation.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 1 assessment

This module has a focus on criteria 1, 2, 3, 4, 5 and 6.

Module 2: Conduct, monitor and refine

As the inquiry progresses, all aspects should be monitored and refined. Module 2 of *Transdisciplinary Science* Level 3 will provide an opportunity for the learner to engage more deeply with their chosen focus. Through further targeted research, analysis and investigation into this focus, learners will finalise their inquiry question and the processes they will use to pursue it. By applying theories, models and methodologies, they will be able to refine and analyse the connections they have already made to support their extended inquiry.

The application of science through inquiry, evaluation and refinement of understanding at every stage is key to this module. Learners should always be prepared to analyse their work, and return to previous work, to ensure that they are able to build their knowledge and narrow the focus of their inquiry. Scientific communication is a key component of this course. Learners should be provided with opportunities to develop and practise a range of written and oral scientific communication skills.

Through the inquiry process, learners will largely finish conducting data collection and prepare to complete the remainder of their inquiry in module 3. Learners will have the opportunity to demonstrate their plans and findings through a folio.

Module 2 learning outcomes

The following learning outcomes are a focus of this module:

1. collaborate with others and monitor, critically analyse and manage their own learning within a scientific inquiry
2. design and conduct ethical and safe collection and analysis of data within a specific application of science to inquire into a system
3. analyse and discuss concepts and processes from scientific theories and models to inquire into a system
4. communicate data and information using standard scientific conventions for qualitative and quantitative representation, and evaluate their reliability
5. apply the context of their inquiry locally, nationally and globally and explore relationships between technology, science and the broader community for a particular scientific application
7. analyse, refine and finalise experimental design for an inquiry as they collect and analyse data, undertake further research and monitor progress, underpinned by an iterative approach.

Module 2 content

Within this module learners will investigate and analyse their chosen focus, refining the context explored in module 1 to only the most relevant background and connections with science as a human endeavour. They will investigate and analyse the transdisciplinary nature of this focus to target the knowledge required and how it is applied. In parallel with this, learners will implement, evaluate and iteratively refine methodologies identified for their extended inquiry to ensure data and information is valid and reliable. This will allow learners to finalise their inquiry question and plan for evaluation, presentation and recommendations in module 3.

Further guidance on the scope and nature of work demanded of learners can be found within the three module 2 work requirements.

Additional advice on the interrelationships between the key knowledge and skills, and their complexity can be found in Appendix 8.

Key knowledge

Science as a human endeavour

Within the focus of the inquiry, learners will independently investigate, analyse and evaluate the interrelationships between the local, national and global context and the scientific focus. They will investigate where it can be refined and finalised to best support the inquiry. This includes instances where:

- focuses of interest have been refined or replaced as new evidence, models or theories which have emerged
- there are opportunities to refine the inquiry focus, gather more data or question the interpretation of data
- improved technology has assisted in greater scientific understanding
- social, economic, cultural or sustainability considerations are a factor
- there is collaboration to improve knowledge
- First Nations Peoples' knowledge is valuable.

Science understanding

Within the focus of the inquiry, learners will independently research, refine and apply:

- specialist knowledge required across more than one scientific discipline and not restricted to Australian curriculum senior secondary: Science course content
- the interrelationships between the models, theories and concepts being used, including mathematical modelling, and analysis of their limitations
- the different methodologies and specific terminology used in different scientific disciplines
- science understanding at a similar level of complexity to other TASC accredited science courses at Level 3.

Key skills

Science inquiry skills – design and implementation of inquiry

Within the focus of the inquiry, learners will independently conduct and refine investigations to develop and support an extended inquiry. This process of analysing methodologies for continual improvement of data collection, analysis and representation within the extended scientific inquiry ensures that there will be sufficient evidence for evaluation of the inquiry in module 3. These processes include:

- scientific inquiry practice
- analysing, refining and finalising the inquiry question
- analysing, adapting and refining methodologies to collect valid and reliable primary data
- monitoring to improve procedures and adapt risk assessment and ethical documentation including mitigation strategies
- analysing and refining mathematically and statistically appropriate ways to usefully organise and represent interrelationships within data.

Science inquiry skills – evaluation of inquiry

Within the focus of the inquiry learners will independently analyse and refine investigations to develop and support the extended inquiry.

This requires consistent and repeated analysis of the quality of the data and what can be interpreted to determine further actions.

This includes:

- analysing the limitations of primary and secondary data to find interrelationships and how critical issues can be addressed
- drawing valid and reasoned conclusions through analysing the interrelationships between data, theories and models

- analysing processes, data and conclusions for interrelationships and gaps to finalise plans to complete the inquiry.

Module 2 work requirements summary

This module includes the following work requirements:

- one logbook investigation
- one finalised inquiry question and context product
- one poster and future plans presentation.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 2 assessment

This module has a focus on criteria 1, 2, 3, 4, 5 and 7.

Module 3: Review, represent and recommend

Extended inquiry requires significant time to reflect, analyse, communicate and recommend. Module 3 of *Transdisciplinary Science* Level 3 will provide an opportunity to finalise any data collection and focus on completing the inquiry. By engaging with this module effectively, learners can complete any further investigation or research required to support answering their inquiry question and recommending further research and analysis. By evaluating and applying only the most relevant theories, models and methodologies, they will be able to make the connections and undertake the analysis required to come to valid and supported conclusions.

As with previous modules, the application of science through inquiry, analysis and refinement of understanding at every stage is key. At this stage, learners should do this to ensure that their analysis, communication and presentation reflect their inquiry question. Through this process, learners will be able to discuss and evaluate possible conclusions to their inquiry question. Learners will have the opportunity to demonstrate their findings through a folio, a poster and a presentation.

Module 3 learning outcomes

The following learning outcomes are a focus of this module:

1. collaborate with others and monitor, critically analyse and manage their own learning within an inquiry
2. design and conduct ethical and safe collection and analysis of data within a specific application of science to inquire into a system
3. analyse and discuss concepts and processes from scientific theories and models to inquire into a system
4. communicate data and information using standard scientific conventions for qualitative and quantitative representation, and evaluate their reliability
8. collate and analyse the key data and findings from an extended scientific inquiry and make recommendations for further study.

Module 3 content

Within this module, learners will inquire into the development and limitations specific to their extended investigation and its interrelationships with technology and sustainability. They will then evaluate their understanding and experience to produce a poster and a folio representing their work and what they have found.

Further guidance on the scope and nature of work demanded of learners can be found within the module 3 work requirements detailed in Appendix 3.

Additional advice on the interrelationships between the key knowledge and skills and their complexity can be found in Appendix 8.

Science understanding

In response to their inquiry question, learners will independently conclude their extended inquiry, applying and analysing:

- specialist knowledge across more than one scientific discipline and not restricted to Australian Curriculum Senior Secondary Science course content
- the interrelationships between theories and concepts that are used, including mathematical modelling, and analysis of their limitations
- the different methodologies and specific terminology used
- science understanding at a similar level of complexity to other TASC-accredited science courses at level 3.

Key skills

Science inquiry skills – design and implementation of inquiry

In response to their inquiry question, learners will finalise and document with sufficient detail to enable replication of their inquiry:

- a summary of the analysis of findings
- representation of the data collected in mathematically and statistically appropriate ways
- an analysis of the design, data and procedures used
- analysis of the risk assessments, ethical considerations and mitigation strategies applied.

Science inquiry skills – evaluation of inquiry

In response to their inquiry question, learners will finalise and document with sufficient detail to enable replication of their inquiry:

- the limitations of primary and secondary data for interrelationships and how critical issues were addressed
- evaluation of the research and analysis processes, claims and conclusions
- valid and reasoned conclusions through evaluation of the interrelationships between data, theories and models
- an evaluation of processes, data and conclusions, recommending further investigation to verify interrelationships identified and gaps within the inquiry.

Module 3 work requirements summary

This module includes the following work requirements:

- one logbook investigation
- one scientific paper
- one poster.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 3 assessment

This module has a focus on criteria 1, 2, 3, 4 and 8.

Assessment

Criterion-based assessment is a form of outcomes assessment that identifies the extent of learner achievement at an appropriate endpoint of study. Although assessment as part of the learning program is continuous, much of it is formative and is done to help learners identify what they need to do to attain the maximum benefit from their study of the course. Therefore, assessment for summative reporting to TASC will focus on what both teacher and learner understand to reflect endpoint achievement.

The standard of achievement each learner attains on each criterion is recorded as a rating 'A', 'B', or 'C', according to the outcomes specified in the standards section of the course.

A 't' notation must be used where a learner demonstrates any achievement against a criterion less than the standard specified for the 'C' rating.

A 'z' notation is to be used where a learner provides no evidence of achievement at all.

Internal assessment of all criteria will be made by the provider. Providers will report the learner's rating for each criterion to TASC.

TASC will supervise the external assessment of designated criteria which will be indicated by an asterisk (*). The ratings obtained from the external assessments will be used in addition to internal ratings from the provider to determine the final award.

Quality Assurance Process

The following processes will be facilitated by TASC to ensure there is:

- a match between the standards of achievement specified in the course and the skills and knowledge demonstrated by learners
- community confidence in the integrity and meaning of the qualification.

Process

TASC gives course providers feedback about any systematic differences in the relationship of their internal and external assessments and, where appropriate, seeks further evidence through audit and requires corrective action in the future.

This process will be scheduled by TASC using a risk-based approach.

To ensure academic integrity, schools must demonstrate that consideration has been given to the contribution of others to an individual's work. This includes referencing the work of others and identifying members of peer teams.

Providers must retain electronic copies of each learner's major folio in a centralised storage system for three (3) years. TASC may require these to monitor the integrity of folios produced in other courses in subsequent years.

External Assessment Requirements

The external assessment for this course will comprise:

- one folio assessing criteria 3, 4, 5, 7 and 8
- one oral exam assessing criteria 3, 4 and 8.

For further information, see the current external assessment specifications and guidelines for this course available in the Supporting documents below.

Criteria

The assessment for *Transdisciplinary Science* Level 3 will be based on the degree to which the learner can:

1. work independently and collaboratively to set and achieve goals
2. collect, analyse and evaluate data within a scientific inquiry
3. analyse concepts, processes and interrelationships between scientific models and theories*
4. analyse and communicate scientific data and information*
5. analyse interrelationships between local, national and global contexts within a scientific inquiry*
6. research, trial, analyse and refine within the process of an inquiry
7. analyse and adapt experimental design within an inquiry*
8. synthesise scientific inquiry*

*denotes criteria that are both internally and externally assessed.

	Module 1	Module 2	Module 3
Criteria focus	1,2,3,4,5,6	1,2,3,4,5,7	1,2,3,4,8

Standards

Criterion 1: work independently and collaboratively to set and achieve goals

This criterion is only internally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Self-managements	uses a range of relevant planning and self-management strategies to ensure the effective completion of tasks within agreed time frames	uses relevant planning strategies to ensure successful completion of tasks within agreed time frames	uses relevant planning strategies to ensure completion of tasks within agreed time frames
E02 - Timelines	evaluates timelines and explains modifications to improve outcomes	analyses timelines and describes modifications to improve outcomes	explains timelines and identifies minor modifications to improve outcomes
E03 - Collaborative activities†	evaluates tasks to complete individual activities and guides others to ensure the completion of collaborative activities	analyses tasks to ensure the completion of individual and collaborative activities	explains tasks to ensure the completion of individual and collaborative activities
E04 - Own contribution	evaluates own and other learners' contributions to the successful completion of collaborative activities.	analyses own and other learners' contributions to the successful completion of collaborative activities.	explains own and other learners' contributions to the successful completion of collaborative activities.

†Collaborative activities include any activities such as planning, collecting data or information and experimenting undertaken with peers, teachers, mentors, lab technicians or other individuals identified by the teacher

Criterion 2: collect, analyse and evaluate data within a scientific inquiry

This criterion is only internally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Safety and ethical issues	evaluates and adjusts progress to effectively mitigate safety and ethical issues within investigations	analyses and adjusts progress to mitigate safety and ethical issues within investigations	plans and monitors progress to mitigate safety and ethical issues within investigations
E02 - Investigations	effectively designs, conducts and improves investigations to collect valid, reliable data in response to a complex question or problem	appropriately designs, conducts and improves investigations to collect valid, reliable data in response to a question or problem	designs and conducts investigations to collect valid data in response to a question or problem
E03 - Valid and reliable data	effectively organises and represents data to correctly identify trends, patterns or relationships, and evaluates the validity and reliability of data	appropriately organises and represents data to correctly identify trends, patterns or relationships, and analyses the validity and reliability of data	organises and represents data to correctly identify trends, patterns or relationships and explains the validity or reliability of data
E04 -Evidence to support arguments	evaluates and uses a range of evidence to make justify valid scientific arguments.	analyses and uses a range of relevant evidence to make and justify valid scientific arguments.	uses evidence to make and justify valid scientific arguments.

Criterion 3: analyse concepts, processes and interrelationships between scientific models and theories*

This criterion is both internally and externally assessed.

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Interrelationships between system components	analyses interactions between objects, materials or processes in scientific systems and explains their function and relationship	explains the interactions between objects, materials or processes in scientific systems and describes their functions	describes interactions between objects, materials or processes in scientific systems and identifies their functions
E02 - Analyses theories and models	evaluates theories or models using supporting evidence and analyses limitations and assumptions	analyses theories or models using supporting evidence and explains limitations	discusses parts of a theory or model using supporting evidence and identifies limitations
E03 - Analyses observable change	evaluates processes and observable changes to systems in experimental investigations	analyses processes and observable changes to systems in experimental investigations	explains processes and observable changes to systems in experimental investigations
E04 - Applies theories and models	uses relevant theories and models to analyse scientific processes and problems to make reasoned and valid predictions	uses relevant theories and models to explain scientific processes and problems to make valid predictions	uses theories or models to describe scientific processes and problems to make predictions
E05 - Analyses mathematical modelling	evaluates and uses effective mathematical modelling to support experimental investigations.	analyses and uses appropriate mathematical modelling to support experimental investigations.	uses relevant mathematical modelling to support experimental investigations.

Criterion 4: analyse and communicate scientific data and information*

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Representation of data	represents data and information to clearly and effectively communicate concepts and ideas	represents data and information to clearly communicate concepts and ideas	represents data and information to communicate concepts and ideas
E02 - Reliability of data	evaluates the validity and reliability of data and information used	analyses the validity and reliability of data and information used	discusses the validity and reliability of data and information used
E03 - Formats, units and terminology	uses effective scientific formats and appropriate units to accurately and concisely communicate data and information	uses appropriate scientific formats, units and terminology to clearly communicate data and information	uses scientific formats, units and terminology to communicate data and information
E04 - Differentiating the work of others and referencing	clearly differentiates the work of others from the learner's own†. Referencing conventions and methodologies are followed including a high degree of accuracy in individual entries‡ and well-structured reference lists and bibliographies§.	clearly differentiates the work of others from the learner's own†. Referencing conventions and methodologies are followed accurately‡, including appropriate, structured reference lists and bibliographies§.	differentiates the work of others from the learner's own†. Referencing conventions and methodologies are followed‡, including the use of reference lists and bibliographies§.

†This includes, but is not limited to, ideas, images, information, data or words

‡This includes, but is not limited to, alphabetising the surnames of authors, and use of an abbreviation key for journal titles

§This includes but is not limited to, grouping by publication dates, source types (books, internet, personal communications).

Criterion 5: analyse interrelationships between local, national and global contexts within a scientific inquiry*

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Context of science	evaluates relationships between local, national and/or global contexts of a scientific inquiry	analyses relationships between local, national and/or global contexts of a scientific inquiry	explains relationships between local, national and/or global contexts of a scientific inquiry
E02 - Development of scientific knowledge	evaluates the contributions of individuals or groups to development of specific scientific knowledge over time	analyses the contributions of individuals or groups to development of specific scientific knowledge over time	explains the contributions of individuals or groups to development of specific scientific knowledge over time
E03 - Technologies in science	evaluates the role of technologies in development of scientific knowledge	analyses the role of technologies in development of scientific knowledge	explains the role of technologies in development of scientific knowledge
E04 - Science meets needs in society	evaluates ways in which science meets specific needs in society and explains the impact of the scientific solution.	analyses ways in which science meets specific needs in society and describes the impact of the scientific solution	explains ways in which science meets specific needs in society and identifies the impact of the scientific solution.

Criterion 6: research, trial, analyse and refine within the process of an inquiry

This criterion is only internally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Analyses information	evaluates, selects and effectively adapts relevant information in an enquiry	analyses, selects and appropriately adapts relevant information in an inquiry	appropriately adapts and uses relevant information in an inquiry
E02 - Analyses methodologies	evaluates relevant methodologies chosen to plan an inquiry	analyses relevant methodologies chosen to plan an inquiry	explains methodologies chosen to plan an inquiry
E03 - Refines methodologies	trials, evaluates and refines methodologies and processes while undertaking an inquiry	trials, analyses and refines methodologies and processes while undertaking an inquiry	trials, compares and refines methodologies and processes while undertaking an inquiry

Criterion 7: analyse and adapt experimental design within an inquiry

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Relevance of information	evaluates the relevance of a range of information used and conducts further research needed to enhance development of an inquiry	analyses the relevance of a range of information used and conducts further research needed to support development of an inquiry	explains the relevance of a range of information used and identifies further research needed to support development of an inquiry

E02 - Informs experimental design	uses combinations of data collected, theories and models to make a range of informed and valid connections that enhance experimental design	uses combinations of data collected, theories and models to make a range of valid connections that inform experimental design	uses combinations of data collected, theories and models to make connections that inform experimental design
E03 - Refines experimental design	analyses a range of issues and suggests valid improvements in further trial methods	explains a range of issues and suggests valid improvements in further trial methods	describes a range of issues and suggests valid improvements in further trial methods

Criterion 8: synthesise a scientific inquiry*

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Scientific arguments	synthesises connections between experimental data and theoretical models to make justified and valid scientific arguments	evaluates connections between experimental data and theoretical models to make valid scientific arguments	analyses connections between experimental data and theoretical models to make plausible scientific arguments
E02 - Conclusions	makes justified conclusions based on relevant scientific arguments presented in an inquiry that make reference to the hypothesis	makes valid conclusions based on relevant scientific arguments presented in an inquiry that make reference to the hypothesis	makes conclusions based on scientific arguments presented in an inquiry that make reference to the hypothesis
E03 - Recommendations	makes justified evidence-based and valid recommendations based on detailed and logical connections to broader contexts†	makes relevant evidence-based and valid recommendations based on logical connections to broader contexts†	makes evidence-based and plausible recommendations based on connections to broader contexts†

†Broader contexts include local, national and global connections as well as social, ethical, legal and environmental impacts

Qualifications Available

Transdisciplinary Science Level 3 (with the award of):

EXCEPTIONAL ACHIEVEMENT

HIGH ACHIEVEMENT

COMMENDABLE ACHIEVEMENT

SATISFACTORY ACHIEVEMENT

PRELIMINARY ACHIEVEMENT

Award Requirements

The final award will be determined by the Office of Tasmanian Assessment, Standards and Certification from 13 ratings (8 from the internal assessment, 5 from external assessment).

The minimum requirements for an award in this course are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)
10 'A' ratings, 3 'B' ratings (3 'A' ratings, 2 'B' rating from external assessment)

HIGH ACHIEVEMENT (HA)
5 'A' ratings, 5 'B' ratings, 3 'C' ratings (1 'A' ratings, 3 'B' ratings, 1 'C' rating from external assessment)

COMMENDABLE ACHIEVEMENT (CA)
6 'B' ratings, 6 'C' ratings (2 'B' ratings, 3 'C' ratings from external assessment)

SATISFACTORY ACHIEVEMENT (SA)
11 'C' ratings (3 'C' ratings from external assessment)

PRELIMINARY ACHIEVEMENT (PA)
6 'C' ratings

A learner who otherwise achieves the ratings for a CA (Commendable Achievement) or SA (Satisfactory Achievement) award but who fails to show any evidence of achievement in one or more criteria ('z' notation) will be issued with a PA (Preliminary Achievement) award.

Course Evaluation

Years 9-12 Learning will develop and regularly review and revise the curriculum. Course evaluation is informed by the experience of the course's implementation, delivery and assessment. More information about course evaluation can be found on the Years 11 & 12 website.

Course Developer

This course has been developed by the Department of Education's Years 9-12 Learning Unit in collaboration with Catholic Education Tasmania and Independent Schools Tasmania.

Accreditation

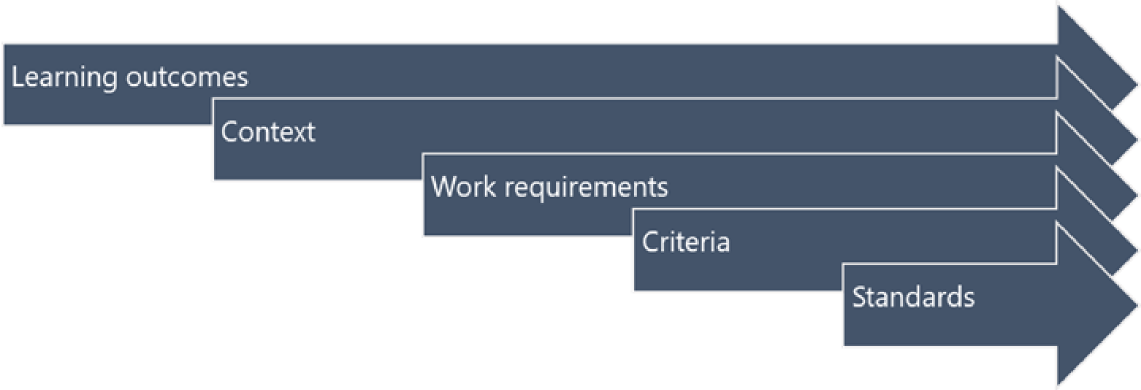
Accredited on 31 March 2022 for use from 1 January 2023 to 31 December 2027.

Version History

Version 1

Accredited on 31 March 2022 for use from 1 January 2023 to 31 December 2027.

Line of sight



Learning outcomes	Course content: module	Work requirements: module	Criterion	General capabilities
1. collaborate with others and monitor, critically analyse and manage their own learning within a scientific inquiry	1, 2, 3	1, 2, 3	1	Literacy; Numeracy; Critical and creative thinking
2. design and conduct ethical and safe collection and analysis of data within a specific application of science to inquire into a system	1, 2, 3	1, 2, 3	2	Literacy; Numeracy; Critical and creative thinking; Ethical understanding
3. analyse and discuss concepts and processes from scientific theories and models to inquire into a system	1, 2, 3	1, 2, 3	3	Literacy; Critical and creative thinking
4. communicate data and information using standard scientific conventions for qualitative and quantitative representation, and evaluate their reliability	1, 2, 3	1, 2, 3	4	Literacy; Numeracy; Critical and creative thinking
5. apply the context of their inquiry locally, nationally and globally and explore relationships between technology, science and the broader community for a particular scientific application	1, 2	1, 2, 3	5	Literacy; Critical and creative thinking
6. analyse information they have researched to implement and adapt processes and trial methodologies while inquiring into a system	1	1	6	Literacy; Numeracy; Critical and creative thinking

7. analyse, refine and finalise experimental design for an inquiry as they collect and analyse data, undertake further research and monitor progress, underpinned by an iterative approach	2	2	7	Literacy; Numeracy; Critical and creative thinking
8. collate and analyse the key data and findings from an extended scientific inquiry and make recommendations for further study	3	3	8	Literacy; Numeracy; Critical and creative thinking

Alignment to curriculum frameworks

Links to Foundation to Year 10

Progression from the F-10 Australian Curriculum: Science

This course component continues to develop student understanding and skills from across the three strands of the F-10 Australian Curriculum: Science. The science understanding strand draws on knowledge and understanding from across the four sub-strands of biological, physical, chemical, and Earth and space sciences.

Mathematical skills expected of students studying *Transdisciplinary Science*

This course component requires students to use the mathematical skills they have developed through the F-10 Australian Curriculum: Mathematics, in addition to the numeracy skills they have developed through the Science Inquiry Skills strand of the Australian Curriculum: Science.

Within the science inquiry skills strand, students are required to gather, represent and analyse numerical data to identify the evidence that forms the basis of scientific arguments, claims or conclusions. In gathering and recording numerical data, students are required to make measurements using appropriate units to an appropriate degree of accuracy.

Students may need to be taught when it is appropriate to join points on a graph and when it is appropriate to use a line of best fit. They may also need to be taught how to construct a straight line that will serve as the line of best fit for a set of data presented graphically.

It is assumed that students will be able to competently:

- perform calculations involving addition, subtraction, multiplication and division of quantities
- perform approximate evaluations of numerical expressions
- express fractions as percentages, and percentages as fractions
- calculate percentages
- recognise and use ratios
- transform decimal notation to power of ten notation
- change the subject of a simple equation
- substitute physical quantities into an equation using consistent units so as to calculate one quantity and check the dimensional consistency of such calculations
- solve simple algebraic equations
- comprehend and use the symbols and notations $<$, $>$, Δ, $\approx$, $\leq$, $\geq$, $\sum$
- translate information between graphical, numerical and algebraic forms
- distinguish between discrete and continuous data and then select appropriate forms, variables and scales for constructing graphs
- construct and interpret frequency tables and diagrams, pie charts and histograms
- describe and compare data sets using mean, median and inter-quartile range
- interpret the slope of a linear graph
- calculate areas of right-angled and isosceles triangles, circumference and area of circles, areas and volumes of rectangular blocks, cylinders and spheres
- use Pythagoras' theorem, similarity of triangles and the angle sum of a triangle.

Relationship to the Senior Secondary Australian Curriculum: Science achievement standards

The criteria and standards for this course have been aligned with the Senior Secondary Australian Curriculum: Science achievement standards.

There is explicit alignment with science as a human endeavour and science inquiry skills achievement standards which are identical across all Senior Secondary Australian Curriculum Science units 1 to 4.

The science understanding in *Transdisciplinary Science* Level 3 is dependent on the nature of the inquiry the learner undertakes. Where possible they have been aligned with units 3 and 4 achievement standards from across the Senior Secondary Australian Curriculum courses with content specific references removed.

Work requirements

The work requirements of a course are processes, products or performances that provide a significant demonstration of achievement that is measurable against the course's standards. Work requirements need not be the sole form of assessment for a module.

Work requirement products that constitute part or all of the external assessment for this course are marked with an asterisk.*

Module 1 work requirements specifications

Work requirement 1 of 2

Title of work requirement: Logbook

Mode or format: investigation

Description: Learners will use a logbook, or an electronic equivalent, to document:

- research notes and progress
- emerging interrelationships and system analysis with reference to the scientific disciplines applied
- ongoing evaluation
- planning
- observations and data
- time on tasks
- peer and self-assessment of progress
- their contribution to collaboration with others.

During module 1 learners must complete the "Module 1 – Learner inquiry project plan checklist" to be signed off by a teacher. See the Supporting documents including external assessment material section of this course for the proforma.

Learners should spend approximately 10 hours throughout module 1 organising this information in preparation for the Research and plan work requirement.

By the end of this module the Logbook will contain a completed 'Module 1: Learner inquiry project plan checklist'.

Size: approximately 10 hours

Timing: throughout module

External agencies: Engagement with scientists and their institutions is optional.

Focus criteria: 1, 2, 3, 4 and 5

Work requirement 2 of 2

Title of work requirement: Research and plan

Mode or format: investigation

Description: Learners will produce an experimental research outline, including:

- an inquiry question justified through analysis
- a valid hypothesis
- analysis of background research with reference to the scientific contexts applied
- an annotated bibliography of the most relevant sources

- an experimental proposal that includes:
    - the experimental model used
    - the system/s they are investigating

- an analysis of trials of experimental design for their extended inquiry
- analysis and evaluation of interrelationships within data collected and the system of study
- a risk management plan with an ethical analysis
- the future focus of experiments including plan for module 2

Size: maximum 1500 words for the research outline

Timing: This is a culminating presentation for module 1.

External agencies: Engagement with scientists and their institutions is optional.

Focus criteria: 1, 2, 3, 4, 5 and 6

Module 2 work requirements specifications

Work requirement 1 of 3

Title of work requirement: Logbook

Mode or format: investigation

Description: Learners will continue their logbook, or electronic equivalent, to document:

- research notes and progress
- emerging interrelationships and system analysis with reference to scientific disciplines applied
- ongoing evaluation
- planning
- observations and data
- time on tasks
- peer and self-assessment of progress
- their contribution to collaboration with others.

Learners should spend approximately 10 hours throughout module 2 organising this information in preparation for the other module 2 work requirements.

Size: approximately 10 hours

Timing: throughout module 2

External agencies: Engagement with scientists and their institutions is optional.

Focus criteria: 1, 2, 3 and 4

Work requirement 2 of 3

Title of work requirement: Finalised inquiry question and context

Mode or format: product

Description: Learners will finalise their inquiry question and context for inclusion in their external assessment portfolio containing:

- the inquiry question justifying their choice with reference to:
    - data collected
    - processes undertaken

    - any other relevant information including, but not limited to, data analysis, and scientific theories or models
- a summary and analysis of local, national and global context to provide an appropriate and relevant background for their inquiry, which may include analysis where:
    - the focuses of interest have been refined or replaced as new evidence, models or theories have emerged
    - technology has assisted in greater understanding
    - social, economic, cultural or sustainability considerations are important
    - there is collaboration
    - First Nations Peoples' knowledge has been applied.

Note: often the use of other scientific representations, such as diagram or charts, in conjunction with concise and precise language, demonstrates a greater level of understanding than a paragraph.

Size: maximum 1500-3000 words or equivalent

Timing: This is a culminating presentation.

External agencies: Engagement with scientists and their institutions is optional.

Focus criteria: 4, 5 and 7

Work requirement 3 of 3

Title of work requirement: Poster and future plans presentation

Mode or format: presentation

Description: Learners will complete an A2 poster referring to the:

- inquiry question and hypothesis
- method
- results
- reasoned conclusions up until the end of module 2 with reference to the scientific disciplines applied.

The poster should be a synthesis of work and contain no more than 120-150 words with appropriate supporting images. The poster is intended as a scientific communication tool to support the oral presentation.

Note: An A2 document can be produced using two A3 or four A4 pages that can be assembled into a A2 document. This matches the structure of a standard poster. Learners will complete a presentation explaining their poster and their plans for module 3.

Size: 5 minute presentation and 5 minutes for questions

Timing: This is a culminating presentation.

External agencies: Engagement with scientists and their institutions is optional.

Focus criteria: 3, 4 and 7

Module 3 work requirements specifications

Work requirement 1 of 3

Title of work requirement: Logbook

Mode or format: investigation

Description: Learners will complete a logbook, or electronic equivalent, to document:

- research notes and progress
- emerging interrelationships and system analysis with reference to scientific disciplines applied
- ongoing evaluation
- planning
- observations and data
- time on tasks
- peer and self-assessment of progress
- their contribution to collaboration with others.

Learners should spend approximately 4 hours throughout module 3 organising this information in preparation for the other module 3 work requirements.

Size: 4 hours

Timing: early in module 3

External agencies: Engagement with scientists and their institutions is optional.

Focus criteria: 1, 2, 3 and 4

Work requirement 2 of 3

Title of work requirement: Scientific paper

Mode or format: inquiry

Description: Learners will finalise and document a scientific paper including:

- an analysis of findings, including changes since the end of module 2
- risk assessments, ethical considerations and mitigation strategies applied
- the design, data and procedures used
- analysis of research, processes and systems
- analysis of the interrelationships between data, theories and models
- the limitations of the primary and secondary data their interrelationships and how critical issues were addressed
- valid and reasoned conclusions with supporting evidence from scientific disciplines applied
- analysis of processes, data and conclusions recommending further investigation to verify interrelationships identified and gaps within the inquiry
- a detailed bibliography with in-text referencing.

Note: often the use of other scientific representations, such as diagrams or charts, in conjunction with concise and precise language, demonstrates a greater level of understanding than a paragraph.

Size: maximum 3000 words or equivalent for the scientific paper

Timing: This is a culminating presentation.

External agencies: Engagement with scientists and their institutions is optional.

Focus criteria: 3, 4 and 8

Work requirement 3 of 3

Title of work requirement: Poster

Mode or format: product

Description: Learners will complete a poster, A1 in size, that represents:

- the inquiry question and hypothesis
- a summary of the findings
- analysis of the interrelationships between data, theories and models with reference to scientific disciplines applied
- the limitations of the primary and secondary data, their interrelationships and how critical issues were addressed
- valid and reasoned conclusions with supporting evidence from scientific disciplines applied
- analysis of processes, data and conclusions and recommending opportunities for further investigation to verify interrelationships identified and gaps within the inquiry
- references and acknowledgement of other sources.

Learners will provide, bring and defend this A1 poster within the external assessment process. It is recommended that text should be minimised, graphs and charts should only be included if directly relevant, and images should be interesting and engaging. The text font should be 16 point or larger. Learners are recommended to summarise the findings of the scientific inquiry to highlight the inquiry in a few key results. Keep any information brief and simple, communicating one or two key findings only with 120-150 words. The poster is evidence alongside the scientific paper and should not attempt to replicate it.

Size: 10 hours

Timing: This is a culminating presentation.

External agencies: Engagement with scientists and their institutions is optional.

Focus criteria: 3, 4 and 8

Relationship to external assessment: The module 2 'Finalised inquiry question and context' and module 3 'Scientific paper' work requirements are to be used as folio-based evidence for external assessment, in conjunction with the module 3 'Poster'[†], as a culminating presentation. This will form the evidence to assess criteria 3, 4, 5, 7 and 8.

[†] A clear photographic image or screenshot of the presentation poster ONLY is required for the folio and will be submitted electronically to TASC.

Individual providers are responsible for providing a physical printed A1 poster that will be referred to as part of the practical external assessment. Learners will be required bring this with them to the practical assessment. As the poster is assessed internally only it is acceptable for the A1 poster to be printed as four A3 or eight A4 pages that can be assembled as an A1 poster.

General capabilities and cross-curriculum priorities

Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the *Alice Springs (Mparntwe) Education Declaration* (December 2019).

General capabilities:

The general capabilities play a significant role in the Australian Curriculum in equipping young Australians to live and work successfully in the twenty-first century.

In the Australian Curriculum, capability encompasses knowledge, skills, behaviours and dispositions. Students develop capability when they apply knowledge and skills confidently, effectively and appropriately in complex and changing circumstances, in their learning at school and in their lives outside school.

The general capabilities include:

- Critical and creative thinking
- Ethical understanding
- Information and communication technology capability
- Intercultural understanding
- Literacy
- Numeracy
- Personal and social capability

Cross-curriculum priorities:

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face, for their own benefit and for the benefit of Australia as a whole. The priorities provide national, regional and global dimensions which will enrich the curriculum through development of considered and focused content that fits naturally within learning areas. Incorporation of the priorities will encourage conversations between students, teachers and the wider community.

The cross-curriculum priorities include:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability

Glossary

adaptation

A physical or behavioural characteristic that is inherited and which results in an individual being more likely to survive and reproduce in its environment.

analyse

To consider in detail for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences.

characteristic

A distinguishing aspect, including features and behaviours, of an object material, living thing or event.

chart

A visual display of information.

classify

To arrange items into named categories in order to sort, group or identify them.

collaborate

To work with others to perform a specific task.

communication

To convey scientific information using a range of modes, conventions, formats and structures.

conclusion

A judgement based on evidence.

contemporary science

New and emerging science research and issues of current relevance and interest.

continuous data

Quantitative data with a potentially infinite number of possible values along a continuum.

controlled variable

A variable that is kept constant, or changed in constant ways, during an investigation.

convention

An agreed method of representing concepts, information and behaviours.

data

The plural of datum; the measurement of an attribute, the volume of gas or the type of rubber. This does not necessarily mean a single measurement; it may be the result of averaging several repeated measurements and these could be quantitative or qualitative.

dependent variable

A variable that changes in response to changes to the independent variable in an investigation.

design

To plan and evaluate the construction of a product or process, including an investigation.

digital technologies

Systems that handle digital data, including hardware and software, for specific purposes.

discrete data

Quantitative data consisting of a number of separate values where intermediate values are not permissible.

environment

All the surroundings, both living and non-living.

evaluate

To examine and judge the merit or significance of something, including processes, events, descriptions, relationships or data.

evidence

In science, evidence is data that is considered reliable and valid, and that can be used to support a particular idea, conclusion or decision. Evidence gives weight or value to data by considering its credibility, acceptance, bias, status, appropriateness and reasonableness.

experiment or experimental investigation

An investigation that involves carrying out a practical activity.

fair test

An investigation where one variable, the independent variable, is changed and all other conditions, controlled variables, are kept the same; what is measured or observed is referred to as the dependent variable.

field study or work

An observational or practical research undertaken in a normal environment of the subject of a study; that is, an investigation can be conducted outside the laboratory.

force

A push or pull between objects, which may cause one or both objects to change speed or direction of their motion; that is, accelerate, or change their shape. all interactions between matter can be explained as an action of one or a combination of forces.

formal measurement

Measurement based on an agreed standard unit; for example, metre, second, gram.

graph

A visual representation of the relationship between quantities plotted with reference to a set of axes.

guided investigation

An investigation partly directed by a teacher.

informal measurement

Measurement that is not based on any agreed standard unit; for example, hand spans, paces, cups.

investigation

A scientific process of answering a question, exploring an idea or solving a problem that requires activities such as planning a course of action, collecting data, interpreting data, reaching a conclusion and communicating these activities.

law

A statement of a relationship based on available evidence.

material

A substance with particular qualities or that is used for specific purposes.

matter

A physical substance; anything that has mass and occupies space.

methodology

Learners will develop and apply the specialised methods of study designed to meet the requirements of a discipline.

Methodologies vary and have to be adapted at every stage of an inquiry; for example, data sampling techniques, data organisation, presentation and tracking sources of error.

model

A representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, system or idea.

natural materials

Products or physical matter that come from plants, animals, or earth and have undergone very little modification by humans.

observable

Something that can be seen, heard, felt, tasted or smelled either directly by an individual or indirectly by a measuring device; for example, a ruler, camera or thermometer.

processed materials

Products of physical matter that have been modified from natural materials by human intervention, or that do not occur at all in the natural environment but have been designed and manufactured to fulfil a particular purpose.

property

An attribute of an object or material, normally used to describe attributes common to a group.

qualitative data

Information that is not numerical in nature.

quantitative data

Numerical information.

relate

To identify connections or associations between ideas or relationships or between components of systems and structures.

relationship

A connection or association between ideas or between components of systems and structures.

report

A written account of an investigation.

represent

Use words, images, symbols or signs to convey meaning.

scientific literacy

An ability to use scientific knowledge, understanding, and inquiry skills to identify questions, acquire new knowledge, explain science phenomena, solve problems and draw evidence-based conclusions in making sense of the world, and to recognise how understandings of the nature, development, use and influence of science help us make responsible decisions and shape our interpretations of information.

senses

Hearing, sight, smell, touch and taste.

system

A group of interacting objects, materials or processes that form an integrated whole.

technology

A development of products, services, systems and environments, using various types of knowledge, to meet human needs and wants.

theory

An explanation of a set of observations that is based on one or more proven hypotheses, which has been accepted through consensus by a group of scientists.

The transdisciplinary nature of science

Scientific disciplines

Science aims to understand the world we experience in an objective way. This world is transdisciplinary and disciplines are a human construct. When we inquire scientifically into our shared world inevitably understanding requires working across disciplines of science and, in practice, within contemporary science almost all research requires elements that span a number of disciplines. This course requires learners to complete an extended inquiry that spans more than one scientific discipline.

According to the Australian and New Zealand Standard Research Classification there are 10 Fields of Research Divisions directly related to science, see below. The Divisions are reflected Australian Curriculum Senior Secondary and TASC-accredited science courses that each span a number of scientific disciplines. Each Division is mapped to 91 Fields of Research Groups, see below, which are considered disciplines within the scientific community. The Groups within the divisions are further split into 577 Fields of Research. Although many of these Fields of Research may be considered disciplines within themselves, for the purposes of this course disciplines are limited to the Groups of Fields of Research.

Divisions and Groups of Fields of Research that represent scientific disciplines

Divisions	Groups
Agricultural, veterinary and food sciences	Agricultural biotechnology, Agriculture, Land and farm management, Animal production, Crop and pasture production, Fisheries sciences, Food sciences, Forestry sciences, Horticultural production, Veterinary sciences, Other agricultural, Veterinary and food sciences
Biological sciences	Biochemistry and cell biology, Bioinformatics and computational biology, Ecology, Evolutionary biology, Genetics, Industrial biotechnology, Microbiology, Plant biology, Zoology, Other biological sciences
Biomedical and clinical sciences	Cardiovascular medicine and haematology, Clinical sciences, Dentistry, Immunology, Medical biochemistry and metabolomics, Medical biotechnology, Medical microbiology, Medical physiology, Neurosciences, Nutrition and dietetics, Oncology and carcinogenesis, Ophthalmology and optometry, Paediatrics, Pharmacology and pharmaceutical sciences, Reproductive medicine, Other biomedical and clinical sciences
Chemical sciences	Analytical chemistry, Inorganic chemistry, Macromolecular and materials chemistry, Medicinal and biomolecular chemistry, Organic chemistry, Physical chemistry, Theoretical and computational chemistry, Other chemical sciences
Earth sciences	Atmospheric sciences, Climate change science, Geochemistry, Geoinformatics, Geology, Geophysics, Hydrology, Oceanography, Physical geography and environmental geoscience, Other earth sciences
Environmental	Climate change impacts and adaptation, Ecological

sciences	applications, Environmental biotechnology, Environmental management, Pollution and contamination, Soil sciences, Other environmental sciences
Health sciences	Allied health and rehabilitation science, Epidemiology, Health services and systems, Midwifery, Nursing, Public health, Sports science and exercise, Traditional, complementary and integrative medicine, Other health sciences
Mathematical sciences	Applied mathematics, Mathematical physics, Numerical and computational mathematics, Pure mathematics, Statistics, Other mathematical sciences
Physical sciences	Astronomical sciences, Atomic, molecular and optical physics, Classical physics, Condensed matter physics, Medical and biological physics, Nuclear and plasma physics, Particle and high energy physics, Quantum physics, Space sciences, Synchrotrons and accelerators, Other physical sciences
Psychology	Applied and developmental psychology, Biological psychology, Cognitive and computational psychology, Other psychology

Disciplines closely related to science

Other disciplines that are most likely to be used in some Transdisciplinary science inquiries are contained within the following divisions:

- Built environment and design
- Engineering
- Information and computing sciences

Additional disciplines

The remaining divisions are much less likely to contain disciplines related to science and would require justification for inclusion, these are:

- Commerce, management, tourism and services
- Creative arts and writing
- Economics
- Education
- History, heritage and archaeology
- Human society
- Indigenous studies
- Language, communication and culture
- Law and legal studies
- Philosophy and religious studies

Inquiry project approval procedures

All providers are required to have documented procedures in place for approving individual learners' inquiry projects, and to explain how inquiry proposals that are not approved will be managed. During module 1 learners must complete the 'Module 1: learner inquiry project plan checklist' to be signed off by a teacher. See below and in the 'Supporting documents including external assessment material' section of this course for the proforma.

This Inquiry project approval procedure must be provided to learners enrolled in the course and supplied to TASC if requested.

Providers are required to keep a copy of each of the completed 'Module 1: learner inquiry project plan checklist' for three years, to be supplied to TASC if requested.

The approval requirements are the minimum and providers may impose additional requirements. An inquiry project for *Transdisciplinary Science* Level 3 may be approved by the provider if, based on the research plan completed by the learner, all approval requirements including any additional requirements are met.

Approval requirements	**Learner comments**
The inquiry question and inquiry	
The inquiry question involves new ideas and concepts for the learner and for which an answer is not readily and publicly available.	
The inquiry question spans two or more scientific disciplines.	
The inquiry question is capable of being researched and answered in the specified timeframe by the student.	
The inquiry question is sufficiently challenging to provide the evidence described in the work requirements.	
The inquiry identifies the local, national and global context and relevance of the inquiry question.	
The provider has the human and physical resources to support students to gain an understanding of the scientific system components, and aspects of theories and models of the scientific disciplines to be applied in the inquiry.	
The design, data and procedures used	
The design outlines a plan to collect valid data.	
The design includes opportunities to review and refine scientific methodologies.	
The provider has ensured the physical resources are available to implement the proposed collection and analysis of the data.	
Risk assessment and ethical considerations	
The student has undertaken academic integrity learning relevant to the disciplines to be addressed in the inquiry.	
A risk assessment plan approved by the provider has been documented for experimental investigations – identifying, assessing, and managing risks in line with state and national regulations.	
The inquiry proposal explains how ethical	

and safe practices, identified in the risk management plan, will be implemented, and monitored.	
Any investigation involving or impacting on animals is justified, humane and considerate of each animal's needs - avoiding any experimentation on live non-human vertebrate animals and cephalopods.	
Any investigation involving humans is justified, has no negative impact, and informed consent is given by all participants†.	

† Further information to support providers can be found at:

- National Statement on Ethical Conduct in Human Research (2007) - Updated 2018 published by the National Health and Medical Research Council of Australia
- ‘About Human Research Ethics’ on the University of Tasmania’s website

Content and depth of science courses at Level 3

Depth of inquiry at Level 3

Within *Transdisciplinary Science* Level 3 the focus is on exploring, applying, critically analysing and critically evaluating interrelationships and systems within science. These complex interrelationships may be within or between the three interrelated strands, described above, identified within Australian Curriculum: Science F-12 and:

- science understanding
- science as a human endeavour
- science inquiry skills.

Science content

Science understanding is evident when a person selects and integrates appropriate science concepts, models and theories to explain and predict phenomena, and applies those concepts, models and theories to new situations. Models in science can include diagrams, physical replicas, mathematical representations, word-based analogies, including laws and principles, and computer simulations. Development of models involves selection of the aspects of the system or systems to be included in the model, and thus models have inherent approximations, assumptions and limitations.

Learners are guided to engage in scientific investigations that are relevant to Tasmania and may be mandated by providers. Learners develop and extend their knowledge and understanding of key scientific concepts through the contexts they are investigating. Learners may explore and extend their understanding of a range of scientific concepts relevant to the contexts they are studying and investigate and apply their understanding of these concepts through the science inquiry skills. Learners make connections between these key scientific concepts and their influence in society through investigations of science as a human endeavour. These contexts provide the basis for developing, understanding, and investigating key scientific concepts. The contexts must encompass two or more scientific disciplines.

Through a focus on science inquiry skills and scientific ways of observing, questioning, and thinking, learners in *Transdisciplinary Science* actively investigate and respond to authentic, engaging, and complex questions, problems, or challenges.

Learners apply inquiry-based approaches to design, plan, and undertake investigations on a short term and more extended scale, responding to local, national or global situations. Both collaboratively and individually, they employ a scientific approach to collecting, representing, and analysing data, using technological tools effectively. After critically evaluating their procedures or models, learners communicate scientifically to draw evidence-based conclusions that may lead to further testing, exploring more effective methods or solutions, or new questions.

Practical activities may take a range of forms. For example, using or developing models and simulations that enable learners to develop their understanding of particular concepts related to science inquiry skills. The activities include laboratory and field studies, during which learners develop investigable questions or notice a problem or need, formulate a testable inquiry question or propose a solution, and select and use equipment appropriately to collect data. The data may be observations, measurements, or other information obtained during the investigation.

Mathematical analysis

The primary focus of the course is on scientific disciplines. For this course at level 3 complexity, mathematical analysis will be focussed on collection and manipulation of data. From the collection and collation of data, learners are expected to analyse and evaluate:

- patterns or trends
- outliers
- unexpected results
- expected results.

Other mathematical analysis can take place if it is relevant to the inquiry and the skill of the learner.

Supporting documents including external assessment material

- TDS315123 Transdisciplinary Science External Assessment Specifications.pdf (2022-12-07 12:05pm AEDT)
- TASC Student Folio Declaration Forms Information Sheet.pdf (2023-08-29 01:26pm AEST)
- 2023 TDS315123 TASC Student Folio Declaration Form.pdf (2023-02-22 08:55am AEDT)
- TDS315123 Transdisciplinary Science - learner inquiry project plan checklist.docx (2023-04-03 11:53am AEST)
- 2024 TDS315123 TASC Student Folio Declaration Form.pdf (2024-05-22 08:59am AEST)