	Science TLOs http://www.acds-tlcc.edu.au/		Biology http://www.vibenet.edu.au/home/draft-btlos	Biomedical science http://www.cubenet.org.au/cubenet-groups/assessing-student-learning/janets-new-page/	Chemistry (as published on the Chemnet site) http://www.chemnet.edu.au/?q=node/83	Mathematics	Physics http://www.aip.org.au/info/?q=content/physics-education group-peg	Agriculture (as published Dec 2014) http://www.aqtas.edu.au/	Environment and Sustainability (as published Mar 2015) http://environmenttlos.gradschool.edu.au/uploads/content/drafts/TLOs_for_ES_v0.9.1_November_2014.pdf
1	Understanding science	Demonstrate a coherent understanding of science by:	Understanding biology	Understanding science	*Understanding the culture of chemistry* Understand ways of scientific thinking by:		Demonstrate a coherent understanding of the nature of physics by:	*Understanding agriculture* Demonstrate an integrative understanding of agriculture by:	*Transdisciplinary Knowledge* Demonstrate broad and coherent knowledge of:
	1.1	articulating the methods of science and explaining why current scientific knowledge is both contestable and testable by further inquiry.	1.1 Demonstrate a coherent understanding of biology by articulating the methods of biology and explaining why current biological knowledge is both contestable and testable through further inquiry	1.1 articulating the methods of science and explaining why current scientific knowledge is both contestable and testable by further inquiry.	1.1 recognising the creative endeavour involved in acquiring knowledge, and the testable and contestable nature of the principles of chemistry.		1.1 Articulating how physics uses observations of relationships between measurable quantities to create conceptual frameworks which can be used to explain, interpret and predict other observations.	1.1 Explaining the role and relevance of agriculture and its related sciences, and agribusiness in society.	1.1 environments at various scales, interdependencies between human societies and environments, and sustainability
	1.2	explaining the role and relevance of science in society.	1.2 Demonstrate a coherent understanding of biology by explaining the role and relevance of biology in society	1.2 explaining the role and relevance of biomedical science [to] society including the translation of biomedical science to clinical and medical outcomes	1.2 recognising that chemistry plays an essential role in society and underpins many industrial, technological and medical advances		1.2 Identifying the role of fundamental physics concepts (such as laws of conservation) in a variety of different contexts.	1.2 Understanding the major biophysical, economic, social and policy drivers that underpin agricultural practice and how they contribute to practice change	1.2 key environmental and sustainability challenges and their drivers
			1.3 Recognise that biological knowledge has been acquired by curiosity and creativity, and demonstrate creativity in thinking and problem solving.		1.3 understanding and being able to articulate aspects of the place and importance of chemistry in the local and global community.		1.3 Acknowledging that there are physical reasoning processes characteristic of the discipline	1.3 Understanding how information is adopted and the context within which producers, processors and consumers, make decisions.	1.3 holistic systems thinking and complexity
			1.4 Recognise and appreciate the significant role of biodiversity in sustaining life on our planet.				1.4 Explaining the role and relevance of physics in society.		
2	Scientific knowledge	Exhibit depth and breadth of scientific knowledge by:	Biological knowledge	Scientific knowledge	*Scientific knowledge* Exhibit depth and breadth of chemistry knowledge by:	1 *Mathematical thinking* (Understanding the ways of thinking in the mathematical sciences including different approaches in different areas)	Exhibit depth and breadth of scientific knowledge by:	*Knowledge of agriculture* Exhibit depth and breadth of knowledge of agriculture by:	*Systemic Understanding* Demonstrate understanding of diverse approaches to environment and sustainability, including:
	2.1	demonstrating well-developed knowledge in at least one disciplinary area.	2.1 Exhibit depth and breadth of biological knowledge by demonstrating well-developed understanding of identified core concepts in biology	2.1 demonstrating well-developed knowledge in at least one disciplinary area in the biomedical sciences.	2.1 demonstrating a knowledge of, and applying the principles and concepts of chemistry	1.1 knowledge of the principles and concepts of a broad range of areas in the mathematical sciences with depth in at least one area	2.2 Demonstrating well-developed knowledge in the subject areas of the physics discipline.	2.1 Demonstrating knowledge of the core sciences in the context of agriculture.	2.1 disciplinary and transdisciplinary approaches to identifying and conceptualising environmental and sustainability challenges
	2.2	demonstrating knowledge in at least one other disciplinary area.	2.2 Exhibit depth and breadth of biological knowledge by demonstrating that these 'core concepts' have interdisciplinary connections with other sciences	2.2 demonstrating knowledge in other disciplinary areas contributing to the biomedical sciences	2.2 recognising that chemistry is a broad discipline that impacts on, and is influenced by, other scientific fields	1.2 understanding of the breadth of the discipline, its role in other fields, and the way other fields contribute to development of the mathematical sciences	2.3 Demonstrating knowledge in the related disciplinary area of mathematics.	2.2 Demonstrating broad generalist knowledge of relevant agricultural production systems and their value chains, with specialist knowledge in at least one area.	2.2 different frameworks for knowing
				2.3 demonstrating integration of knowledge from across the disciplines contributing to biomedical science.		1.3 ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.		2.3 Understanding how knowledge from different sub-disciplines within agriculture is integrated and applied into practice.	2.3 their own and others' values, knowledge, perspectives and interests
								2.4 Demonstrating a basic knowledge of economics, business and social science as they apply to agriculture.	2.4 the particular values, knowledge, perspectives and interests of indigenous peoples
3	Inquiry and problem solving	Critically analyse and solve scientific problems by:	Inquiry and problem solving	Inquiry and problem solving	*Inquiry, problem solving and critical thinking* Investigate and solve qualitative and quantitative problems in the chemical sciences by:	2 *Discovery and problem solving* (Investigating and solving straightforward problems using mathematical and/or statistical methods)	Critically analyse physical situations by:	Inquiry and problem-solving Critically analyse and address dynamic complex problems in agriculture by:	*Skills for Environment and Sustainability* Demonstrate well-developed cognitive , technical and communciation skills through:
	3.1	gathering, synthesising and critically evaluating information from a range of sources.	3.1 Gather, synthesise and critically evaluate information about biological phenomena from a range of sources.	3.1 gathering, synthesising and critically evaluating information from a range of sources.	3.1 synthesising and evaluating information from a range of sources, including traditional and emerging information technologies and methods	2.1 ability to formulate and model practical and abstract problems in mathematical and/or statistical terms using a variety of methods	3.1 Gathering, documenting, organising, synthesising and critically evaluating information from a range of sources.	3.2 Gathering, critically evaluating and synthesising information from a range of relevant sources and disciplines.	3.1 addressing research questions by identifying, synthesising and applying appropriate knowledge and evidence from diverse sources
	3.2	designing and planning an investigation.	3.3 Design and conduct field, laboratory based, or virtual biological experiments.	3.3 designing and planning an investigation	3.2 formulating hypotheses, proposals and predictions and designing and undertaking experiments	2.2 application of mathematical and/or statistical principles, concepts, techniques and technology to solve practical and abstract problems.	3.2 Designing, planning, carrying out and refining a physics experiment or investigation		3.2 thinking critically and creatively in envisioning, designing and evaluating sustainable alternatives and envisioning sustainable futures
	3.3	selecting and applying practical and/or theoretical techniques or tools in order to conduct an investigation.	3.4 Select and apply practical and/or theoretical techniques.	3.4 selecting and applying practical and/or theoretical techniques or tools in order to conduct an investigation.	3.3 applying recognised methods and appropriate practical techniques and tools, and being able to adapt these techniques when necessary		3.3 Selecting and critically evaluating practical, computational and/or theoretical techniques or tools in order to conduct an investigation.	3.3 Selecting and applying appropriate and/or theoretical techniques or tools in order to conduct an investigation	3.3 applying tools, methods, skills and theoretical knowledge for environment and sustainability practice
	3.4	collecting, accurately recording, interpreting and drawing conclusions from scientific data.	3.5 Collect, accurately record, interpret, analyse, and draw conclusions from biological data.	3.5 collecting, accurately recording, analysing, interpreting and drawing conclusions from scientific data.	3.4 collecting, recording and interpreting data and incorporating qualitative and quantitative evidence into scientifically defensible arguments		3.4 Applying appropriate physics concepts to the interpretation of experimental or observational data and the drawing of conclusions from that data.	3.4 Collecting, accurately recording, analysing, interpreting and reporting data.	3.4 working both independently and collaboratively
			3.2 Critically analyse observations of biological phenomena by creating and developing models and/or proposing and testing hypotheses.	3.2 defining a biomedical science problem and formulating a hypotheses	3.5 demonstrating the cooperativity and effectiveness of working in a team environment			3.1 Identifying contemporary issues and opportunities in agriculture	3.5 communicating with diverse groups in various contexts using a range of written, oral and visual means
				3.6 demonstrating creative and innovative approaches to addressing scientific problems.					3.6 engaging with indigenous approaches to environmental and sustainability challenges
4	Communication	Be effective communicators of science by:	Communication	Communication	*Communication* Communicate chemical knowledge by:	3 *Communication* (Communicate mathematical and statistical information, arguments, or results for a range of purposes using a variety of means)	Be effective communicators of physics by:	*Communication* Be effective communicators by:	
	4.1	communicating scientific results, information, or arguments, to a range of audiences, for a range of purposes, and using a variety of modes.	4.1 Effectively synthesise and communicate biological results using a range of modes (including oral, written, and visual) for a variety of purposes and audiences	4.1 communicating scientific results, information and conveying scientifically reasoned arguments, to a range of audiences, for a range of purposes, and using a variety of modes.	4.1 presenting information, articulating arguments and conclusions, in a variety of modes, to diverse audiences, and for a range of purposes.	3.1 appropriate interpretation of information communicated in mathematical and/or statistical form	4.1 Communicating physics data, results and analysis, to a range of audiences, for a range of purposes, and using a variety of modes.	4.1 Understanding methods of effective two-way written and verbal communication with different audiences.	
					4.2 appropriately documenting the essential details of procedures taken, key observations, results and conclusions	3.2 appropriate presentation of information, reasoning and conclusions in a variety of modes, to diverse audiences (expert and non-expert).	4.2 Understanding and interpreting arguments or opinions based on physics, presented by others.	4.2 Communicating with a range of audiences in an agricultural context using a variety of modes.	3.5 communicating with diverse groups in various contexts using a range of written, oral and visual means
5	Personal and professional responsibility	Be accountable for their own learning and scientific work by:	Personal and professional responsibility	Personal and professional responsibility	*Personal and social responsibility* Take personal, professional and social responsibility by:	4 *Responsibility* (Demonstrate personal, professional and social responsibility)	Be accountable for their own learning and scientific work by:	*Personal and professional responsibility* Be accountable for their own learning and professional work by:	Ethical Practice Demonstrate ethical professional, public and personal conduct by having capacity to:
	5.1	being independent and self-directed learners.	5.1 Be accountable for their own learning and biological work by being independent and self-directed learners	5.1 being independent and self-managing learners	5.1 demonstrating a capacity for self-directed learning	4.1 ethical application of mathematical and statistical approaches to solving problems	Being independent and self-directed learners	5.1 Being independent and self-directed learners	4.1 reflect on and direct their own learning and practice in the context of environment and sustainability
	5.2	working effectively, responsibly and safely in an individual or team context.	5.2 Work effectively, responsibly and safely in individual and peer or team contexts	5.2 working effectively, responsibly and safely in an individual and collaborative context .	5 demonstrating a capacity for working responsibly and safely	4.2 ability to work effectively, responsibly and safely in an individual or team context		5.2 Working effectively, responsibly and safely in an individual or team context.	3.4 working both independently and collaboratively
	5.3	demonstrating knowledge of the regulatory frameworks relevant to their disciplinary area and personally practising ethical conduct.	5.3 Demonstrate knowledge of the regulatory frameworks and ethical principles relevant to own disciplinary area and personally practise ethical conduct	5.3 demonstrating knowledge of the ethical and regulatory frameworks relevant to biomedical science and personally practising academic integrity	5.3 recognising the relevant and required ethical conduct and behaviour within which chemistry is practised		5.2 Working effectively, responsibly and safely in an individual or team context.	5.3 Demonstrating knowledge of the regulatory frameworks relevant to their specialist area in agriculture.	4.2 participate constructively in decision-making consistent with principles of sustainable development
							5.3 Exhibiting intellectual integrity and practising ethical conduct.	5.4 Personally practising ethical conduct	