

This is to certify that the curriculum documents

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

Parts A, B & C

have been accredited under Part 3 of the VQA Act 2000
Victorian Registration and Qualifications Authority.

The courses have been entered on the *State Register of Accredited Courses and Recognised Qualifications* and the *National Training Information Service*.

Version One: December 2007

Accredited for the period:

01/01/2008 – 31/12/2012



Document Status

This document is an exact copy of the document, which is listed on the *State Register of Accredited Courses and Recognised Qualifications* and the *National Training Information Service*.

Version 1, December 2007: Accredited from 01/01/2008 to 31/12/2012

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Version 1

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General Manager, Training Operations Division

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SECTION A

General Information

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

Section A: General Information

- 1. COURSE DEVELOPER**

Service Industries Curriculum Maintenance Manager – General Studies and Further Education

Victoria University
CMM id : 5131 on behalf of the Crown
- 2. ADDRESS**

Victoria University
PO Box 14428
Melbourne VIC 8001
sicmm.generalstudies@vu.edu.au
- 3. CONTACT DETAILS FOR COURSE DEVELOPER**


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Email: sicmm.generalstudies@vu.edu.au
PO Box 14428
Melbourne VIC 8001
- 4. TYPE OF SUBMISSION**

The courses are submitted for re-accreditation replacing:
21238VIC Certificate III in Science
21239VIC Certificate IV in Science
- 5. COPYRIGHT INFORMATION**

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The following unit/s of competency are from Training Packages administered by the Commonwealth of Australia © Commonwealth of Australia

Food Processing Industry Training Package (FDF03)
FDFCORWCM2A Present and apply workplace information
Health Training Package (HLT07)
HLTAP301A Recognise healthy body systems in a health care context
Laboratory Operations (PML04)
PMLOHS302A Participate in laboratory/field workplace safety
PMLTEST305B Perform aseptic techniques
Metal and Engineering Training Package (MEM05)

MEM30012A Apply mathematical techniques in a manufacturing, engineering or related environment

MEM23002A Apply calculus in engineering situations

All Training Package units are located on NTIS (www.ntis.gov.au) administered by the Commonwealth of Australia.

The following units are from the 21770VIC – 21774VIC Certificates in General Education for Adults:

VBQU155 Evaluate pathways options, design a learning plan and compile a portfolio

VBQU157 Engage with a range of complex texts for learning purposes

VBQU161 Create a range of complex texts for learning purposes

6. LICENSING AND FRANCHISE

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OR purchased from:

Service Industries Clearinghouse

Victoria University

PO Box 14428

Melbourne VIC 8001

Tel: 03 9919 8401

Fax: 03 9919 8301

Email: sicmm.clearinghouse@vu.edu.au

7. COURSE ACCREDITING BODY

Victorian Registration and Qualifications Authority (VRQA)

Level 6, 35 Spring St

Melbourne 3000

Telephone: (03) 9637 2806

Website: <http://www.vrqa.vic.gov.au>

**8. AVETMISS
 INFORMATION**

Classification codes for:

ASCO code: (Australian Standard Classification of Occupations - occupational type)	GEN 19 General Education
ANZSIC code: (Australia and New Zealand Standard Industrial Classification - industry type)	8432 Technical and Further Education
ASCED code – 4 digit (Field of Education)	1201 General Education
National course code	21857VIC Certificate III in Science 21858VIC Certificate IV in Science

**9. PERIOD OF
 ACCREDITATION**

01/01/2008 to 31/12/2012

SECTION B

Course Information

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

Section B: Course Information

- | | |
|---|---|
| 1. NOMENCLATURE | 21857VIC Certificate III in Science |
| 1.1 Name of the qualification | 21858VIC Certificate IV in Science |
| 1.2 Nominal duration of the course | 21857VIC Certificate III in Science 390-555 hours
21858VIC Certificate IV in Science 220-510 hours |

2. DEVELOPMENT OF THE COURSE

2.1 Industry/enterprise/ community needs

Accreditation Standard 27.1

The crown copyright Certificate III in Science and Certificate IV in Science were reaccredited in 2002. These courses were first accredited as the Bridging to Sciences course in 1989, and have been reaccredited at five year intervals since.

The Certificates in Science were designed for adults who have had little or no science education, wishing to pursue further vocational training in mathematics, science and technology, or students who may have completed VCE without a high enough ENTER score to enter the Higher Education science courses of their choice. The course enables students to identify their gaps in skills and knowledge and then meet these needs, according to the proposed destination of the student.

The courses address skills shortages in areas identified in Commonwealth and state reports. For example, the Audit of Science, Engineering and Technology Skills Summary Report (DEST July 2006) commented on areas of skills shortages in the immediate future:

‘Shortages have been identified in specific disciplines, including chemistry, engineering, mathematics/statistics and engineering. With an ageing workforce, shortages are emerging in physics, materials science, plant taxonomy, and plant breeding.

Shortages have also been identified in VET trained engineers, some ICT specialisations, GMP training and technicians trained in clean-room and vacuum technologies’.

These science bridging courses will assist with the skills shortages in these areas, in that they provide students with underpinning skills and knowledge in the sciences. This will enable students to move into employment, other VET courses in the science and technology area, or Higher Education courses in the sciences.

Students may also enter directly into the workforce having completed these courses. Previous employment outcomes have included diagnostic testing in pathology laboratories.

Industry support for the course

Manufacturing Skills Australia supports the development of pathways for students into science based courses that are required for the manufacturing industry. They report that there is no policy or project to meet the needs of bridging students into science based courses within MSA. There are current skills shortages in areas such as engineering and fitting and turning and emerging areas such as nanotechnology which require a strong scientific background.

Student demand

There are ten Victorian RTOs currently delivering the courses. The uptake of the courses has been relatively steady in recent years, and it is expected that enrolments will continue to grow. Enrolments in the Certificate IV have increased by 165% in the period 2003 – 2006.

Enrolments are detailed in the tables below.

Certificate III	2003	2004	2005	2006
Enrolments	66	78	130	92

Certificate IV	2003	2004	2005	2006
Enrolments	175	278	250	288

Membership of the Steering Committee comprised:

John Molenaar	Executive Director, Manufacturing and Engineering Skills Advisory Board
Dr Bronwen Scott	Lecturer, School of Molecular Sciences, Victoria University
Denis Goss	Program Coordinator - Science, Food, Applied Science and Horticulture Department, Chisholm Institute of TAFE
Peter Canavan	Education and Training Adviser, Australian Industry Group

Letters of support for the courses are attached in Appendix D.

Certificate III in Science

Certificate III provides general science training to a level where a student can enter and succeed in a TAFE science / technology course and in some cases undergraduate science courses, for example Health Science. Successful completion of Certificate III in Science provides students with a combination of work and study skills which can lead to employment as well as further study outcomes.

Examples of courses graduates of the Certificate III have gained entry to are:

- PML40104 Certificate IV in Laboratory Techniques
- RTF40103 Certificate IV in Horticulture.

Certificate III in Science graduate destinations for NMIT students in 2006 are given in Appendix C as evidence that there are pathways to both VET and higher education courses from the Certificate III.

Certificate IV in Science

The educational outcomes of the Certificate IV in Science course are to provide general science training to a level where a student can enter and succeed in a TAFE or Higher Education science course. Examples of VET courses graduates of the Certificate IV in Science have gained entry to are:

- PML40104 Certificate IV in Laboratory Techniques
- RTF40103 Certificate IV in Horticulture
- HLT43407 Certificate IV in Nursing
- PML50104 Diploma of Laboratory Technology
- RUV50104 Diploma of Animal Technology
- FDF51007 Food Processing (Diploma of Food Safety Auditing)
- 15696VIC Advanced Diploma of Engineering (Aerospace).
- Special entry into University courses is always at the discretion of the individual Selection Officer for each course, and therefore it is possible that University Selection Officers may select students on the basis of whether the applicant has completed a Certificate III or IV. Students have accessed the following Higher Education courses:
 - Bachelor of Education
 - Bachelor of Electronic Engineering
 - Bachelor of Nursing
 - Bachelor of Science (Applied Physics, Applied Science, Archaeology, Biological, Biomedical, Biotechnology, Environmental Management, Forensic, Forestry, Geology, Pharmaceutical).

The proposed qualifications do not duplicate qualifications covered by a Training Package.

2.2 Review for reaccréditation

The proposed qualifications replace 21238VIC Certificate III in Science and 21239VIC Certificate IV in Science.

Enrolments and destination surveys establish that there is a continuing need for the courses. Appendix C also provides details of research methodology and consultations with providers which support this reaccréditation.

The review for reaccréditation involved research into the following:

- Audit of Science, Engineering and Technology Skills Summary Report DEST July 2006
- Victorian Government Submission to the Commonwealth Government's Audit of science, engineering and technology skills June 2005
- RMIT University response to Audit of Science, Engineering and Technology Skills, RMIT University, June 2005.
- relevant Training Packages
- participation statistics (AVETMISS)

- State policy documents, e.g. Maintaining the Advantage: Skilled Victorians.

A course development advisory committee was established to guide the development of the suite of programs. Membership of this committee is listed in Appendix A.

The review has resulted in a number of modifications which are summarised below:

- clarification of the distinction between Certificate III and IV
- courses are a combination of units, modules and imported Training Package units
- updated content and filling of identified gaps in modules / units
- additional Training Package units from the Metals and Engineering and the Electrotechnology Training Packages included
- removal of the module Biochemistry which was not delivered by any RTO. The PSC agreed that this was not a suitable inclusion
- a mathematics units to assist students wishing to go on to engineering courses included from the Metals and Engineering and the Electrotechnology Training Packages
- electives including units of competency from other destination courses included from the Health Training Package (HLT07), Information and Communications Technology Training Package (ICA05) and Laboratory Operations (PML04) Training Package
- Employability Skills built into each unit / module as appropriate. These include communication, working in a team, initiative and enterprise, problem solving, planning, self management, technology and learning.

Transition arrangements

Students enrolled prior to the expiry date of the 21238VIC Certificate III in Science and 21239VIC Certificate IV in Science (30 June 2008) are able to complete the qualifications or modules in which they are enrolled.

After the expiry of the accreditation period there must be no new enrolments in

21238VIC Certificate III in Science

21239VIC Certificate IV in Science

The transition tables below show the relationship between units / modules in the old courses and the proposed courses. This will assist RTOs moving to the new qualifications.

Mapping former to reaccredited courses:

Previous Course		New Course		Credit Transfer or recognition in part
21238VIC Certificate III in Science		21857VIC Certificate III in Science		
VBM049	Introduction to Science	VPAU072	Conduct and present simple scientific research	Equivalent
VBM050	Occupational Health & Safety	PMLOHS302A	Participate in laboratory/field workplace safety	Equivalent
VBM060	Introductory Mathematics	VPAU073	Use a range of techniques to solve mathematical problems	Equivalent
VBD740	Mathematics 1			
VBD745	Study skills	VBQU155	Evaluate pathways options, design a learning plan and compile a portfolio	Equivalent
VBM063	Reading and Writing for Science	VBQU157	Engage with a range of complex texts for learning purposes	Equivalent
		VBQU161	Create a range of complex texts for learning purposes	
VBD725	Atomic Structure	VPAM082	Atomic structure and bonding	Equivalent
VBM051	Stoichiometry and Solution Chemistry	VPAM083	Stoichiometry and solution chemistry	Equivalent
VBD727	Organic Chemistry and Properties	VPAM084	Organic chemistry and properties of materials	Equivalent
VBM054	Waves and Optics	VPAM085	Waves and optics	Equivalent
VBD731	Kinematics	VPAM086	Kinematics	Equivalent
VBD734	Cell Biology	VPAM087	Cell biology	Equivalent
		VPAU075	Conduct simple activities in a science laboratory	
VBM057	Human Anatomy and Physiology	HLTAP301A	Recognise healthy body systems in a health care context	Partially equivalent: VBM057 covered 3 body systems; HLTAP301 A covers 7 systems

21857VIC Certificate III in Science
21858VIC Certificate IV in Science

Previous Course		New Course		Credit Transfer or recognition in part
21238VIC Certificate III in Science		21857VIC Certificate III in Science		
		VPAM088	Anatomy and Physiology	Equivalent
		VPAU076	Conduct simple dissections	
PMXTES T305A	Perform aseptic techniques	PMLTEST305B	Perform aseptic techniques	Equivalent

21857VIC Certificate III in Science
21858VIC Certificate IV in Science

Previous Course		New Course		Credit Transfer or recognition in part
21239VIC Certificate IV in Science		21858VIC Certificate IV in Science		
VBD741	Mathematics 2	VPAU077	Apply mathematical techniques in scientific contexts	Equivalent
VBD745	Study Skills	VBQU226	Apply essential further study skills	Equivalent
NCS015	Presenting reports	FDFCORWCM2A	Present and apply workplace information	Equivalent
VBM064	Introduction to scientific computing	ICAU1130A	Operate a spreadsheet application	Equivalent
		ICAU1131A	Operate a database application	
		ICAU2006A	Operate computing packages	
VBB223	Introduction to the internet	ICAU1133A	Send and receive information using web browsers and email	Equivalent
VBM052	Ionic Theory	VPAM089	Chemical reactions	Equivalent
VBM053	Biochemistry	Not replaced		
VBM055	Dynamics and Energy	VPAU078	Apply dynamics and conservation principles	Equivalent
VBD733	Electricity	VPAU074	Conduct routine electrical tests	Equivalent
VBM056	Analogue & Digital Electronics	VPAU079	Operate simple analogue and digital electronic circuits	Equivalent
VBM058	Introductory Genetics	VPAM090	Introductory genetics	Equivalent
VBM059	Ecology	VPAM091	Ecology	Equivalent

3. COURSE OUTCOMES

Accreditation Standards 28.1.a & 28.1.c

3.1 Qualification level 21857VIC Certificate III in Science

On successful completion of Certificate III in Science a participant will be able to:

- demonstrate knowledge and skills of scientific experimentation, method and theories
- communicate using mathematical language
- solve a range of mathematical problems
- apply data processing, algebra, trigonometry and indices skills
- use computers to perform a range of activities
- develop a career plan, and document a portfolio independently
- research and present in writing and verbally scientific information
- use a range of study skills
- demonstrate knowledge and skills of two branches of science
- demonstrate a number of work skills including the application of Occupational Health and Safety independently and working with others.

These outcomes are consistent with the distinguishing features of a Certificate III under the Australian Qualifications Framework in that they enable an individual to:

- demonstrate some relevant theoretical knowledge
- apply a range of well developed skills
- apply known solutions to a variety of predictable problems
- perform processes that require a range of well developed skills where some discretion and judgement is required
- interpret available information, using discretion and judgement
- take responsibility for own outputs in work and learning
- take limited responsibility for the output of others.

21858VIC Certificate IV in Science

On successful completion of Certificate IV in Science a participant will be able to:

- apply mathematical skills in arrange of contexts and for different purposes
- present and apply workplace information
- apply computing skills to a range of tasks
- develop a career plan, and document a portfolio independently
- demonstrate depth of knowledge and skills in two branches of science
- locate for a variety of sources, analyse and evaluate scientific knowledge

- demonstrate a number of work skills including the application of Occupational Health and Safety independently and working with others.

These outcomes are consistent with the distinguishing features of a Certificate IV under the Australian Qualifications Framework in that they enable an individual to:

- demonstrate a broad knowledge base incorporating some theoretical concepts
- apply solutions to a defined range of unpredictable problems
- identify and apply skills and knowledge areas to a wide variety of contexts with depth in some areas
- identify, analyse and evaluate information from a variety of sources
- take responsibility for own outputs
- take limited responsibility for the quantity and quality of the output of others.

3.2 Competency standards

This curriculum document contains units and modules written specifically for the Certificate III and Certificate IV in Science:

The unit format has been used where the outcomes are a combination of skills and knowledge.

Modules have been used when the content is knowledge based. There are a number of modules as the courses focus on gaining scientific knowledge.

The courses also contain the following endorsed units of competency from Training Packages:

Food Processing Industry Training Package (FDF03)

FDFCORWCM2A Present and apply workplace information

Health Training Package (HLT07)

HLTP301A Recognise healthy body systems in a health care context

Information and Communications Technology Training Package (ICA05)

ICAU1128A Operate a personal computer

ICAU1130A Operate a spreadsheet application

ICAU1131A Operate a database application

ICAU2006A Operate computing packages

ICAU1133A Send and receive information using web browsers and email

Laboratory Operations (PML04)

PMLOHS302A Participate in laboratory/field workplace safety

PMLTEST300B Perform basic tests

PMLTEST303B Prepare working solutions

PMLTEST305B Perform aseptic techniques

PMLTEST308A Perform microscopic examination

Metal and Engineering Training Package (MEM05)

MEM12024A Perform computations

MEM12023A Perform engineering measurements

MEM30012A Apply mathematical techniques in a manufacturing, engineering or related environment

MEM23002A Apply calculus in engineering situations

The following units are from the 21770VIC – 21774VIC Certificates in General Education for Adults:

VBQU155 Evaluate pathways options, design a learning plan and compile a portfolio

VBQU157 Engage with a range of complex texts for learning purposes

VBQU161 Create a range of complex texts for learning purposes

The following unit is from 21793VIC Certificate IV in Liberal Arts:

VBQU226 Apply essential further study skills

The following module is from 21625VIC Certificate I in Vocational Preparation:

VB047 Job Seeking

3.3 General competencies

Each course has been mapped to the national Employability Skills. A summary of the Employability Skills that are reflected in the courses is included as Appendix B.

3.4 Recognition given to the course

Not applicable

Licensing/ regulatory requirements

Not applicable

4. COURSE RULES

Accreditation Standard 28.1.d & 28.1.g

4.1 Course structure

21857VIC Certificate III in Science

To be eligible for the award of Certificate III, learners must successfully complete:

- 6 Core units / modules
- 2 Science Streams (2 units / modules in each stream, except in the Biology stream where 3 units / modules must be selected)
- 2 Elective units / modules.

21858VIC Certificate IV in Science

To be eligible for the award of Certificate IV in Science, learners must successfully complete the Certificate III in Science and the following additional requirements:

- 2 Core units / modules
- 2 Science Streams (2 units / modules not undertaken as part of the Certificate III in Science in each stream)
- 2 Elective units / modules not undertaken as part of the Certificate III in Science

When selecting elective units of competency imported from a Training Package, the RTO does not need to have on their Scope of Registration the

parent Training Package, unless they are advertising and delivering them separately. When delivering and assessing Training Package units, RTOs must follow the assessment guidelines in the parent Training Package.

Registered Training Organisations may select as additional units / modules from any endorsed Training Package and/or accredited curriculum.

Learners exiting prior to meeting the full course requirements will be issued with a Statement of Attainment identifying only those units of competency, which have been successfully completed.

21857VIC Certificate III in Science

Unit of competency/ module code	Field of Education code (6-digit)	Unit of competency/module title	Pre-requisite	Nominal hours
CORE UNITS / MODULES Complete all 6 units / modules				
VPAU072	120105	Conduct and present simple scientific research	Nil	20
PMLOHS302A		Participate in laboratory/field workplace safety	Nil	40
VPAU073	120183	Use a range of techniques to solve mathematical problems	Nil	110
VBQU155	120103	Evaluate pathways options, design a learning plan and compile a portfolio	Nil	10
VBQU157	120103	Engage with a range of complex texts for learning purposes	Nil	25
VBQU161	120103	Create a range of complex texts for learning purposes	Nil	25
TOTAL				230
SCIENCE STREAMS – SELECT <u>TWO</u> STREAMS from				
CHEMISTRY				
PHYSICS				
BIOLOGY				
CHEMISTRY STREAM - SELECT TWO UNITS /MODULES				
VPAM082	010501	Atomic structure and bonding	Nil	50
VPAM083	010501	Stoichiometry and solution chemistry	VPAM082 Atomic structure and bonding	45
VPAM084	010501	Organic chemistry and properties of materials	VPAM082 Atomic structure and bonding	20

PHYSICS STREAM -- - SELECT TWO UNITS /MODULES				
VPAM085	010301	Waves and optics	Nil	40
VPAM086	010301	Kinematics	Nil	40
VPAU074	031301	Conduct routine electrical tests	Nil	40

BIOLOGY STREAM – STUDENTS MUST COMPLETE THE UNIT ‘CONDUCT SIMPLE ACTIVITIES IN A BIOLOGICAL SCIENCE LABORATORY’ PLUS SELECT TWO ADDITIONAL UNITS /MODULES				
VPAU075	010901	Conduct simple activities in a biological science laboratory	Nil	10
VPAM087	010901	Cell biology	Nil	30
VPAU076	010901	Conduct simple dissections	Nil	10
VPAM088	010913	Anatomy and Physiology	VPAU075 Conduct simple activities in a biological science laboratory	30
HLTAP301A		Recognise healthy body systems in a health care context	Nil	70

ELECTIVE UNITS –select two units / modules*

*Registered Training Organisations may select as additional units / modules from any endorsed Training Package and/or accredited curriculum. Units / modules selected should provide opportunities to support and enhance vocational and education pathways.

PMLTEST303B		Prepare working solutions	Nil	50
PMLTEST308A		Perform microscopic examination	Nil	40
PMLTEST300B		Perform basic tests	Nil	60
VBN047	120503	Job seeking	Nil	30
ICAU1128A		Operate a personal computer	Nil	20
ICAU1130A		Operate a spreadsheet application	Nil	30
ICAU1131A		Operate a database application	Nil	40
ICAU2006A		Operate computing packages (incorporates ICAU1130A & ICAU1131A)	Nil	60
ICAU1133A		Send and receive information using web browsers and email	Nil	25
MEM12023A		Perform engineering measurements	Nil	30
MEM12024A		Perform computations	Nil	30
TOTAL CERTIFICATE HOURS				390-555

21858VIC Certificate IV in Science

Unit of competency/ module code	Field of Education code (6- digit)	Unit of competency/module title	Pre-requisite	Nominal hours
CORE UNITS – Complete both units				
VPAU077	010199	Apply mathematical techniques to scientific contexts	Nil	50
FDFCORWCM2A		Present and apply workplace information	Nil	30
TOTAL				80
SCIENCE STREAMS – CHOOSE TWO STREAMS				
CHEMISTRY STREAM – SELECT TWO UNITS /MODULES NOT UNDERTAKEN AS PART OF CERTIFICATE III IN SCIENCE				
VPAM082	010501	Atomic structure and bonding	Nil	50
VPAM083	010501	Stoichiometry and solution chemistry	Nil	45
VPAM084	010501	Organic chemistry and properties of materials	VPAM082 Atomic structure and bonding	20
VPAM089	010501	Chemical reactions	VPAM082 Atomic structure and bonding VPAM083 Stoichiometry and solution chemistry VPAM084 Organic chemistry and properties of materials	45
PHYSICS – SELECT TWO UNITS /MODULES NOT UNDERTAKEN AS PART OF CERTIFICATE III IN SCIENCE				
VPAM085	010301	Waves and optics	Nil	40
VPAM086	010301	Kinematics	Nil	40
VPAU078	010301	Apply dynamics and conservation principles	VPAM086 Kinematics	50
VPAU074	031301	Conduct routine electrical tests	Nil	40
VPAU079	031303	Operate simple analogue and digital electronic circuits	VPAU074 Conduct routine electrical tests	40

BIOLOGY - SELECT TWO UNITS /MODULES NOT UNDERTAKEN AS PART OF CERTIFICATE III IN SCIENCE (VPAU075 Conduct simple activities in a biological science laboratory must be completed with Biology stream units if not already undertaken as part of the Certificate III in Science)				
VPAU075	010901	Conduct simple activities in a biological science laboratory	Nil	10
VPAM087	010901	Cell biology	Nil	20
VPAM088	010913	Anatomy and Physiology	VPAU075 Conduct simple activities in a biological science laboratory	30
HLTAP301A		Recognise healthy body systems in a health care context	Nil	70
VPAU076	010901	Conduct simple dissections	Nil	10
VPAM090	010909	Introductory genetics	Nil	40
VPAM091	010905	Ecology	Nil	30
VPAU080	010907	Conduct routine water quality tests	Nil	10
PMLTEST305B		Perform aseptic techniques	Nil	40
MATHEMATICS STREAM – SELECT 2 UNITS / MODULES NOT UNDERTAKEN AS PART OF CERTIFICATE III IN SCIENCE				
MEM30012A		Apply mathematical techniques in a manufacturing, engineering or related environment	Nil	80
MEM23002A		Apply calculus in engineering situations	MEM30012A Apply mathematical techniques in a manufacturing, engineering or related environment	80
VPAU081	010101	Work mathematically with statistics and calculus	Nil	50
ELECTIVE MODULES -Select two units / modules*				
*Registered Training Organisations may select units / modules from any endorsed Training Package and/or accredited curriculum. Units / modules selected should provide opportunities to support and enhance vocational and education pathways.				
ICAU1130A		Operate a spreadsheet application	Nil	30
ICAU1131A		Operate a database application	Nil	40
VBQU226		Apply essential further study skills	Nil	90
VBN047	120503	Job Seeking	Nil	30
ICAU2006A		Operate computing packages (incorporates ICAU1130A & ICAU1131A)	Nil	60
ICAU1133A		Send and receive information using web browsers and email	Nil	25
TOTAL CERTIFICATE HOURS				220-510

4.2 Entry requirements

21857VIC Certificate III in Science

Entry points for the Certificate III would normally be determined by an assessment of a student's skills and determination of their learning and pathway needs. There are no limitations to entry based on age, gender, physical ability, social or educational background.

As a general guide to entry, participants wishing to enter the Certificate III in Science should have literacy and numeracy skills at approximately Level 3 of the *National Reporting System (NRS)* © Commonwealth of Australia.

<http://www.nrs.dest.gov.au>

For example, entrants will be able to

- read and interpret texts of some complexity and which may contain data in graphic form
- prepare reports and written content including graphic information
- use a range of strategies to solve mathematical problems such as calculating with fractions and percentages as appropriate, or using common measuring instruments to measure length, capacity, time or temperature

21858VIC Certificate IV in Science

- Participants wishing to enter the Certificate IV will require the following skills and knowledge as included in Certificate III:
 - scientific experimentation, method and theories
 - ability to communicate using mathematical language
 - ability to solve a range of mathematical problems
 - application of data processing, algebra, trigonometry and indices skills
 - use of computers to perform a range of activities
 - ability to develop a career plan, and document a portfolio independently
 - research and presentation of scientific information skills (written and verbal)
 - a range of study skills
 - knowledge and skills of two branches of science
 - a number of work-related skills including the application of Occupational Health and Safety independently and working with others.
- Please note the information about pre-requisites included in the Course structure table (Section 4.1)

RTOs delivering these courses should ensure appropriate support with English language, literacy and numeracy skills is provided for participants who require this.

4.3 Pathways

Pathways through the courses may include:

- full-time or part-time study with a registered training organisation (RTO)
- flexible delivery using electronic resources and a tutor

- recognition of Prior Learning (RPL)
- national recognition of imported endorsed units gained elsewhere
- combination of any of the above.

4.4 Customisation

These courses cannot be customised. The courses may be adapted to reflect various needs through the elective and stream structure as described in Section 4.1.

Contextualisation of units / modules is possible under the following rules:

- Contextualisation of any unit drawn from a Training Package must be consistent with the guidelines of that Training Package
- Contextualisation must not remove or add to the number and content of elements and performance criteria
- Contextualisation of the units and modules developed specifically for these courses
- May add specific industry terminology to performance criteria where this does not distort or narrow the competency outcomes
- May make amendments and additions to the range statement as long as such changes do not diminish the breadth of application of the competency and reduce its portability, and/or
- May add detail to the evidence guide in areas such as the critical aspects of evidence or resources and infrastructure required where these expand the breadth of the competency but do not limit its use.

5. ASSESSMENT

5.1 Assessment strategy

Accreditation Standard 28.1.b

Course assessment should be consistent with the requirements of Standard 1 of the *AQTF 2007 Essential Standards for Registration*.

Assessment methods should be flexible, valid, reliable and fair. Assessment of units requires evidence of satisfactory performance being sought for each element of competency and its performance criteria through a variety of tasks depending on the criteria specified. Assessment of modules requires evidence of satisfactory performance being sought for each learning outcome and its assessment criteria through a variety of tasks depending on the criteria specified.

The following principles should be used as a guide to the assessment approach:

- assessment tasks/activities should be grounded in a relevant context and not be culturally biased
- students should be assessed across a wide range of tasks integrated into practice, in order to increase reliability and validity of assessment. One-off assessment tasks do not provide a reliable and valid measure of competence
- instructions for assessment tasks should be clear, explicit and ordered. Students must know what is expected and the criteria by which they will be judged
- time allowed to complete a task should be reasonable and specified, and should allow for preparation and re-drafting as appropriate to the task
- assessment should be validated. Moderation is likely to be a critical tool in validation. A range of validation strategies should be used, for example, mentoring, client satisfaction surveys, peer review and co-assessments
- appropriate reference materials should be available to students during assessment, e.g. personal word lists, dictionaries, thesaurus, calculators.

(adapted from *National Reporting System*, © Commonwealth of Australia & ANTA, 1994-1995)

Assessment tools must meet the rules of evidence. To meet the rules, evidence must be:

- valid, for example, address the Elements and Performance Criteria (or Learning Outcomes and Assessment Criteria), reflect the skills and knowledge described in the unit of competency / module, show application in the context described in the Range Statement
- current, for example, demonstrate the candidate's current skills and knowledge
- sufficient, for example, demonstrate competence over a period of time, demonstrate repeatable competence, not inflate the language, literacy and numeracy requirements beyond those required in performing the task and
- authentic, for example: be the work of the learner, be corroborated / verified.

A variety of assessment methods and evidence gathering techniques may be

used with the overriding consideration being that the combined assessment must stress demonstrable performance by the student. Assessment tools must take into account the requirements of the unit or module in terms of skills, knowledge and performance. Assessment tools should also take into account the proposed destination of students, e.g., it may not be appropriate for a student with employment as a major goal to be assessed on the basis of writing an essay, if the competency could be assessed using a more appropriate means such as writing a report using typical industry reporting criteria.

The Critical Aspects of Evidence section of each unit / module provides essential guidance on acceptable evidence.

Assessment methods and tools may include:

- oral or written questioning
- verbal presentations
- multi-media presentations
- folios
- solving problems
- student self-assessment
- on going assessment by the teacher / s

Evidence may include:

- interview records / checklists
- assessment records
- reports
- laboratory reports / field notes / observation logbooks
- student folios of completed tasks

The evidence collected must relate to a number of performances assessed at different points in time, and, in a learning and assessment pathway, these must be separated by further learning and practice.

Please note: evidence requirements are specified in units and modules in each certificate. Where appropriate, training providers are encouraged to take a holistic approach to assessment, by assessing more than one element or learning outcome concurrently, or combining the final assessment for more than one unit.

When assessing units of competency from Training Packages, the evidence gathering and assessment must be carried out in accordance with the relevant Training Package guidelines. The assessment guidelines include the necessary qualifications for those conducting assessments and provide for situations where more than one person may contribute to the assessment and where the required technical and assessment competencies may not all be held by any one person.

5.2 Assessor competencies

Staff involved in the assessment of the courses must meet the assessment requirements of Essential Element 1.4 of the *AQTF 2007 Essential Standards for Registration*, that is:

Assessors must hold:

(a) TAASS401A Plan and organise assessment

TAASS402A Assess competence

TAASS 404A Participate in assessment validation.

or demonstrate equivalent competencies to the competencies in the TAA04;
and

(b) the relevant vocational competencies at least to the level being delivered or assessed. It is recommended that those assessing the science and mathematics units / modules (with the codes beginning VPAU or VPAM) in this curriculum document have tertiary qualifications in the relevant area; and

(c) continue to develop their vocational and training and assessment competencies to support continuous improvements in the delivery of RTO services.

If an assessor does not meet these requirements, they may work under the supervision of a qualified assessor.

5.3 Workplace assessment

Workplace assessment is not a mandatory requirement of course assessment although assessment of the units of competency could be conducted where possible within the context of a workplace or simulated environment.

Training providers must ensure that any workplace assessment requirements within imported units/modules are complied with.

5.4 Recognition of Prior Learning (RPL)

All participants can seek recognition through the RPL process for any competencies held and for any relevant qualifications or experience. RPL assessment decisions are based on the principles of assessment and rules of evidence as defined in the *AQTF 2007 Essential Standards for Registration: Essential Standard 1.5*.

6. DELIVERY

Accreditation Standard 28.1.e

6.1 Delivery modes

All units of competency / modules in the courses may be delivered in a variety of modes: classroom delivery, workplace projects, practical work, self-paced learning and case studies.

Delivery options, including grouping of learners and learning activities, should recognise the varying learning needs, educational backgrounds, preferred learning styles and constraints of the individual learner and the specific requirements of each unit or module.

Some areas of content may be common to more than one unit and therefore integration may be appropriate, e.g., *PMLOHS302A Participate in laboratory/field workplace safety* may be co-delivered with any unit involving working in a laboratory. Delivery strategies should actively involve the learner and learning should be experiential, relevant and age appropriate.

6.2 Resources

Physical and human resources necessary for delivery should be in accordance with *AQTF 2007 Essential Standards for Registration*.

Physical resources for these courses should provide

- fully equipped laboratory
- an environment conducive to learning
- computer facilities with Internet access where this is appropriate
- appropriate computer software
- access to a range of knowledge sources.

Requirements to meet individual needs of learners should also be provided as required. These may include support services, such as language and literacy

support.

Any specialist resources required for delivery of individual units / modules are listed in the specific Unit of Competency.

Human Resources:

Staff involved in the training of the program must meet the requirements of Essential Element 1.4 of the *AQTF 2007 Essential Standards for Registration*.

1.4 Training and assessment are conducted by trainers and assessors who:

(a) have the necessary training and assessment competencies as determined by the National Quality Council or its successors. Currently this is TAA40104 Certificate IV in Training and Assessment or equivalent.

(b) have the relevant vocational competencies at least to the level being delivered or assessed. It is recommended that those teaching the science and mathematics units / modules (with the codes beginning VPAU or VPAM) in this curriculum document have tertiary qualifications in the relevant area.

(c) continue developing their vocational and training and assessment competencies to support continuous improvements in delivery of the RTO's services.

If a teacher does not meet these requirements, they may work under the supervision of someone who holds the TAA40104 Certificate IV in Training and Assessment .

7. ARTICULATION AND CREDIT TRANSFER

Accreditation Standard 28.1.f

There is no formal articulation or credit transfer arrangement. Due to the bridging nature of the program, there are a range of potential destination courses that students can access.- refer to 2.1 and Appendix C. Learners seeking articulation or credit transfer to Higher Education courses will need to apply on an individual basis to institutions offering relevant courses. RTOs should be able to advise students of any relationships they have with Higher Education providers and the processes for pursuing articulation.

As the course includes units of competency from other Training Packages, participants who complete these units may apply for recognition of these units in the relevant source qualifications.

8. ONGOING MONITORING AND EVALUATION

Accreditation Standard 28.1.h

Ongoing monitoring and evaluation of the Certificate III and IV in Science is the responsibility of the General Studies and Further Education Curriculum Maintenance Manager (CMM).

The CMM will consult with key stakeholders during the accreditation period to seek and provide ongoing advice on the following:

- permissible changes to the Training Package units contained in the course
- unit updates resulting from Training Package reviews which have implications for the course
- delivery and/or assessment issues
- changes in government policy which impact on the content or delivery of the course.

A formal review of 21857VIC Certificate III in Science and 21858VIC Certificate IV in Science will take place midway during its period of

accreditation. The review will be conducted by the CMM who will convene a representative advisory group. The review will include student destination data and learner course evaluations where these are available.

All monitoring and consequent recommendations will be fully documented. Any recommended changes to the course structure, additional units or modifications to existing units will be forwarded to the Victorian Registration and Qualifications Authority for approval.

Changes that would be reported to the VRQA include changes to:

- the course structure, by adding or deleting units from the core or electives, whether to reflect local industry needs or to reflect changes to Training Packages and the availability of new or revised nationally endorsed units of competency
- required pre-requisites and/or co-requisites
- the nominal duration of the course and of units
- copyright ownership
- articulation and/or credit transfer arrangements
- legislation such as OHS/ licensing.

Changes may also include the addition of further streams or specialisations.

Course maintenance and review procedures may indicate that the course in total should be expired if a suitable national qualification becomes available through the development or review of a Training Package.

APPENDIX A: Project Steering Committee and Working Party

Membership of the Project Steering Committee

Name	Title	Organisation	Role in Relation to PSC
John Molenaar	Executive Director	Manufacturing and Engineering Skills Advisory Board	Chair
Dr Bronwen Scott	Lecturer	School of Molecular Sciences Victoria University	Higher Education Molecular Sciences
Denis Goss	Program Coordinator - Science	Food, Applied Science and Horticulture Department Chisholm Institute of TAFE	VET Course Coordinator Previous course development and accreditation
Peter Canavan	Education and Training Adviser	Australian Industry Group	Industry
Project team			
Lynne Fitzpatrick	Curriculum Maintenance Manager	Service Industries – General Studies & Further Education	Project Manager / Curriculum Writer
Liz Davidson	Curriculum Maintenance Manager	Service Industries – General Studies & Further Education	Project Manager / Curriculum Writer

APPENDIX B: Employability Skills Summary

What are the Employability Skills?

The skills now referred to as Employability Skills have previously been described as generic skills, life skills, key competencies and lifelong learning skills. These skills are now recognised as essential skills for employment, study, and community participation. It is also recognised that these skills are best developed in a context, be it a vocational outcome, further study or through language acquisition. The Employability Skills have now been integrated into all vocational education and training, including General Studies and Further Education courses.

The key skills that make up the Employability Skills Framework are:

- communication
- team work
- problem solving
- initiative and enterprise
- planning and organising
- self-management
- learning
- technology

How these skills have been integrated into the Certificate III in Science and Certificate IV in Science is outlined in the Summaries which follow. It is expected that these skills are developed and assessed as part of the course; separate delivery or assessment is not required.

For further information on Employability Skills, see:

http://www.dest.gov.au/NR/rdonlyres/4E332FD9-B268-443D-866C-621D02265C3A/2212/final_report.pdf

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Employability Skill	Requirements for this qualification include:
Communication	<ul style="list-style-type: none"> - read and interpret scientific documents, including charts, laboratory reports - record data using scientific formats - make verbal presentations to a group - discuss and share information and ideas related to scientific knowledge and investigations - explain in writing and verbally procedures in a science laboratory - prepare technical documents related to scientific procedures - conduct research into areas of science - use scientific terminology - use numeracy effectively
Teamwork	<ul style="list-style-type: none"> - conduct experiments in a laboratory as part of a group - support others in group tasks - present scientific information as part of a group - assist others in responding in an emergency
Problem-solving	<ul style="list-style-type: none"> - conduct tests using scientific theory - use mathematics to solve problems - develop hypotheses
Initiative and enterprise	<ul style="list-style-type: none"> - prepare specimens - conduct experiments and field work - discuss options with colleagues - amend own practices based on feedback - develop strategies for self improvement
Planning and organising	<ul style="list-style-type: none"> - pathway planning - collect, analyse and organise information - develop research projects and complete reports - confirm the purpose and process of scientific experiments
Self-management	<ul style="list-style-type: none"> - complete tasks - compile a portfolio - evaluate and monitor own performance
Learning	<ul style="list-style-type: none"> - develop study and academic skills - access learning opportunities to extend own skills and knowledge - plan own skills development - identify own study pathway
Technology	<ul style="list-style-type: none"> - use a range of communications technology - use a range of scientific technology - operate scientific tools and equipment

21858VIC Certificate IV in Science

Employability Skill	Requirements for this qualification include:
Communication	<ul style="list-style-type: none"> - read, analyse and interpret scientific documents, including charts, laboratory reports - record and interpret data using scientific formats - prepare and deliver verbal presentations - discuss and share information and ideas related to issues in science - explain in writing and verbally procedures in a science laboratory - prepare technical documents related to scientific procedures and experiments - conduct research into fields of science - use scientific terminology - apply mathematical skills and knowledge effectively
Teamwork	<ul style="list-style-type: none"> - conduct experiments in a laboratory as part of a group - support others in group tasks - present scientific information as part of a group - assist others in responding in an emergency
Problem-solving	<ul style="list-style-type: none"> - conduct tests using scientific theory - apply mathematics to solve problems - develop hypotheses - show independence and initiative in identifying problems and solving them
Initiative and enterprise	<ul style="list-style-type: none"> - prepare specimens - lead experiments and field work - discuss options with colleagues - amend own practices based on feedback - identify opportunities not obvious to others - develop strategies for self improvement
Planning and organising	<ul style="list-style-type: none"> - pathway planning - collect, analyse and organise information - develop research projects and complete reports - confirm the purpose and process of scientific experiments
Self-management	<ul style="list-style-type: none"> - complete tasks - compile a portfolio - evaluate and monitor own performance
Learning	<ul style="list-style-type: none"> - develop study and academic skills - access learning opportunities to extend own skills and knowledge - plan own skills development - identify own study pathway
Technology	<ul style="list-style-type: none"> - use a range of communications technology - use a range of scientific technology - operate scientific tools and equipment

APPENDIX C: Research and Consultation

Consultations:

The following individuals provided advice on the need for the courses.

Organisation	Name	Position
Bendigo Regional Institute of TAFE	Jennie Turnbull	
Box Hill Institute of TAFE	Sue McInnes	Co-ordinator Certificate IV in Science
Central Gippsland Institute of TAFE	Tony Dell	Team leader
Chisholm Institute of TAFE	Denis Goss *	Program Co -ordinator Science
Holmesglen Institute of TAFE	Catherine McLennan	Co-ordinator
Northern Metropolitan Institute of TAFE	Penny Halliday	Cert IV Co-ordinator
Royal Melbourne Institute of Technology TAFE Division	Namrita Kaul	Program Co-ordinator
Swinburne University of Technology TAFE	Betty Key	Maths teacher
Swinburne University of Technology TAFE	Kath White	Manager Industrial Sciences Department
Victoria University	Rozalia Cook	Head of Department of Science and Biotechnology
Metals and Engineering Skills Advisory Board	John Molenaar *	
Manufacturing Skills Australia	Barbara Wallace	Project Manager
Community Services & Health Industry Skills Council	Robin Flynn	Policy Manager
Innovation and Business Services Industry Skills Council	Lesley Shaw	Project Consultant
Innovation and Business Services Industry Skills Council	Cherry Cole	General Manager
Royal Melbourne Institute of Technology University	Dr Tony Bush *	Senior Lecturer Division of Nursing and Midwifery
Victoria University	Dr Bronwen Scott *	Lecturer Department of Molecular Sciences
Swinburne University of Technology	Associate Professor Ian Harding	Life and Social Sciences - Biotechnology

*PSC Members Feedback on the draft courses was gathered from a range of RTOs via the Project Steering Committee. This is documented in the Minutes of the PSC meetings.

Destinations for students

Almost all students go on to other vocational or higher education courses, although a few students find employment as a result of their courses and continue their education part time. Courses that students have gained entry to include:

- Advanced Diploma of Computer Science
- Advanced Diploma of Engineering (Aerospace)
- Bachelor of Education (Science teaching)
- Bachelor of Electronic Engineering
- Bachelor of Nursing
- Bachelor of Science (Applied Physics, Applied Science, Archeology, Biological, Biomedical, Biotechnology, Environmental Management, Forensic, Forestry, Geology, Pharmaceutical)
- Certificate III, IV and Diploma from PML04 Laboratory Operations
- Certificate IV in Forensic Science
- Certificate IV in Health (Nursing) – from Certificate III
- Pathology collection
- Certificate IV in Horticulture
- Chinese medicine
- Diploma of Animal Technology
- Diploma of Environmental Management
- Diploma of Fire Technology
- Diploma of Food Technology
- Diploma of Massage Therapy
- Diploma of Natural Therapies
- Diploma of Technology (computing)
- Podiatry
- Myotherapy
- Speech Pathology.

Some Universities e.g. Monash have the Cert IV listed in their handbooks as an entry pathway. So articulation arrangements are becoming more formal and demand is rising as a result.

Some TAFE Institutes e.g. Victoria University have automatic entry into the Diploma of Laboratory Operations for Certificate IV in Science graduates.

Demand for the courses is expected to rise as more articulation pathways become available, for example Box Hill Institute of TAFE is expected to begin delivery of a Bachelor of Nursing in 2008 and the Bachelor of Biotechnology and Innovation commenced in 2006 and is expected to be a pathway.

Feedback on the need for the courses:

“Really good preparation for other courses” (RTO)

“Basically the course is quite good. The core modules are balanced and include maths and computing – we give advice to students on which electives to take to suit the courses they want to enter” (RTO)

“This course is tailor made for most of our students, the feedback we get is excellent and we expect numbers to increase” (RTO)

“Science content is reasonably good – we’re keen to see the maths content being maintained as students with analytical skills do better with the quantitative aspects of the course” (Higher Ed)

“Employers want discipline specific skills” (Higher Ed)

Entry and credit into other courses

“We automatically take Certificate IV students with Distinction level results” (Higher Ed)

“As a selection officer my strong advice is to provide grades otherwise we cannot automatically select students” (Higher Ed)

“We quite like the Certificate IV students as an entry and we find they do well. It is a terrific pathway for students who do not have a high enough ENTER score to gain entry” (Higher Ed)

“We view people with the Certificate IV as being in the top 10% of applicants for our course” (Higher Ed)

Industry need

The following are quotes from the Audit of Science, Engineering and Technology Skills Summary Report DEST July 2006:

Australia’s productivity and success in the highly competitive global market is increasingly reliant on science, engineering and technology (SET) skills. Our abilities in research and development, innovation and discovery are dependent upon the availability of suitably skilled scientists and engineers.

The Audit of Science, Engineering and Technology Skills report raises a number of issues: skills shortages in many engineering and some science disciplines; a static or declining proportion of participation in the enabling sciences and advanced mathematics in schools and in post-school settings; concerns about the quality of science education; and the increasing need for SET graduates to have enabling and cross-disciplinary skills.

The adequacy of SET skill supply is an ongoing concern for Australian industry, governments, and the scientific research community and gaps in SET skill supply have been identified. This concern is shared by many Organisation for Economic cooperation and Development (OECD) countries, which are experiencing declines in the SET share of higher education enrolments in their countries, coupled with a seeming decline in youth interest in SET study and careers.

Australia’s recent strong economic growth has resulted in a substantial increase in the demand for skilled workers including persons with science, engineering and technology skills. Strong growth in demand for SET skills has led to labour supply issues in many SET occupations.

The audit found that the proportion of domestic students in SET study across all education and training sectors has remained static or declined in Australia over the past decade. This was particularly apparent for enabling sciences, which include advanced and intermediate mathematics, physics and chemistry.

The result of the downward trend in domestic school enrolments and vocational training and higher education SET commencements/enrolments and completions is a decreasing pool of applicants for SET positions in industry and the scientific research sector.

Feedback from audit submissions and consultations undertaken as part of the audit highlighted a perception among industry and the vocational and technical education and higher education sectors that many students leaving school were ill-prepared for tertiary study and employment in SET fields.

...sectoral labour supply issues were evident, particularly in respect to engineering skills. There has been strong recent growth in demand for some SET skills, reflecting growth in the resources sector, defence needs and infrastructure development and renewal. This has led to significant recruitment difficulties with respect to certain SET skill sets, particularly in engineering disciplines, and in sciences such as earth sciences, chemistry, spatial information sciences and entomology. High level mathematical skills are also in strong demand.

Current and projected industry and scientific research community skill needs suggest that a larger pool of students with quantitative skills is needed to fill VTE and higher education places in SET courses. Unfortunately, the share of participation in SET across all Australian education and training sectors has

remained static or declined, particularly in the enabling sciences (advanced and intermediate mathematics, chemistry and physics) over the decade to 2003.

Skill shortages remain in several SET skill sets, particularly in engineering at professional and trade levels and in occupation areas such as earth scientists, chemists and spatial information sciences.

During consultations and through submissions, the higher education and VTE sectors and industry groups consistently raised concerns regarding the preparedness of SET students for university study and employment.

From the Victorian Government Submission to the Commonwealth Government's Audit of science, engineering and technology skills June 2005.

The Victorian Government has a strong commitment to innovation and emerging technologies as drivers of economic prosperity, growth and development across Victoria, and as key providers of economic, social and environmental benefits to all Victorians.

Along with the rest of Australia, Victoria must develop a pool of highly talented and skilled workers to underpin the growth of our research base and our science and technology-reliant industries in areas such as ICT, new manufacturing technologies, biotechnology, design and environmental technologies. The development of this skilled workforce needs to address:

- the skill and human resource requirements of new and emerging industries;
- the commercialisation and entrepreneurial skills necessary to turn scientific research into commercial products, processes and services;
- encouraging school-age students to take up and maintain studies in sciences and technology;
- leveraging the skills, expertise and connections of Australians living and working overseas; and
- attracting talented workers and leading researchers to Victoria.

The long term decline in the number of Year 12 students in Victoria studying enabling sciences has had an impact on the number of talented students able to study SET at university and TAFE.

The gross number of domestic students studying SET has not grown since 1996 and has declined as a proportion of all enrolments.

The VET and TAFE sectors have grown significantly over the last decade. However, while enrolments in science and technology VET courses have increased, they are not increasing at the same rate as total course enrolments in VET.

These trends raise significant concerns about the adequate future supply of SET skills to Victoria's and Australia's science, innovation and technology industry sectors.

Shortages have been identified in specific disciplines, including chemistry, engineering, mathematics/statistics and engineering. With an ageing workforce, shortages are emerging in physics, materials science, plant taxonomy, and plant breeding.

Shortages have also been identified in VET trained engineers, some ICT specialisations, GMP training and technicians trained in clean-room and vacuum technologies.

Industry is increasingly demanding that science and technology workers have skills in teamwork, project management, communication, business awareness and industry awareness to enable them to work in multidisciplinary teams.

There is a shortage of nurses – the Victorian Nurses Board has published a report

Industry Skills Councils

Manufacturing Skills Australia reports that there is no policy or project to meet the needs of bridging students into science based courses within MSA. MSA supports the development of pathways for students into science based courses that are required for the manufacturing industry. There are current skills shortages in areas such as engineering and fitting and turning and emerging areas such as nanotechnology require a strong scientific background. MSA has coverage of PML04 Laboratory Operations Training Package which

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is a cross industry package that may have useful units of competency such as PMLOHS302A Participate in laboratory/field workplace safety.

The Community Services & Health Industry Skills Council (CS&H ISC) reports that as the Certificates III and IV in Science are pre-academic preparation courses which do not represent a vocational outcome/job they wouldn't be included in Training Packages. The CS&H ISC has developed the HLT07 Health Training Package which was endorsed on 15 February 2007. This package has useful generic units of competency such as HLTAP301A Recognise healthy body systems in a health care context.

SECTION C

Unit Information

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

Section C: Unit Information

Section	Unit Code	Unit Title
21857VIC Certificate III in Science		
C1	VPAU072	Conduct and present simple scientific research
C2	PMLOHS302A	Participate in laboratory / field workplace safety
C3	VPAU073	Use a range of techniques to solve mathematical problems
C4	VBQU155	Evaluate pathways options, design a learning plan and compile a portfolio
C5	VBQU157	Engage with a range of complex texts for learning purposes
C6	VBQU161	Create a range of complex texts for learning purposes
C7	VPAM082	Atomic structure and bonding
C8	VPAM083	Stoichiometry and solution chemistry
C9	VPAM084	Organic chemistry and properties of materials
C10	VPAM085	Waves and optics
C11	VPAM086	Kinematics
C12	VPAU074	Conduct routine electrical tests
C13	VPAU075	Conduct simple activities in a biological science laboratory
C14	VPAM087	Cell biology
C15	VPAU076	Conduct simple dissections
C16	VPAM088	Anatomy and Physiology
C17	HLTAP301A	Recognise healthy body systems in a health care context

Section	Unit Code	Unit Title
21858VIC Certificate IV in Science		
C18	VPAU077	Apply mathematical techniques in scientific contexts
C19	FDFCORWCM2A	Present and apply workplace information
C20	VPAM089	Chemical reactions
C21	VPAU078	Apply dynamics and conservation principles
C22	VPAU079	Operate simple analogue and digital electronic circuits
C23	VPAM090	Introductory genetics
C24	VPAM091	Ecology
C25	VPAU080	Conduct routine water quality tests
C26	PMLTEST305B	Perform aseptic techniques
C27	MEM30012A	Apply mathematical techniques in a manufacturing, engineering in related environment
C28	MEM23002A	Apply calculus in engineering situations
C29	VPAU081	Work mathematically with statistics and calculus

SECTION **C1**

VPAU072

Conduct and present simple scientific research

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Unit Code VPAU072

Unit Title Conduct and present simple scientific research

Unit Descriptor The purpose of this unit is to provide learners with the knowledge and skills to undertake, analyse, and report on simple scientific experiments and investigations.

Employability Skills The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).

Application of the Unit The experiments/observations can be in a number of areas of Science (Chemistry, Physics or Biology) according to the intended destinations of the learners and the streams they are enrolled in.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

1 Conduct a simple scientific experiment

2 Conduct a simple investigation of a scientific issue

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement. Assessment of performance is to be consistent with the evidence guide.

1.1 Identify a *scientific concept/model/theory* for investigation

1.2 Identify a *scientific method* to investigate the scientific concept/model/theory

1.3 Perform a *simple experiment* relating to the scientific concept/model/theory

1.4 Record and analyse the results of the experiment

1.5 *Present the findings of the experiment* using *appropriate scientific terminology*

2.1 Identify *an issue of scientific interest* which has contributed to society, the environment or an individual

2.2 Identify the *area of science* which underpins the *issue*

2.3 *Investigate the impact* of the *issue* on society, the environment or an individual

2.4 Record the results of the investigation using *appropriate scientific terminology*

2.5 Present the *findings of the investigation* using appropriate scientific terminology

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

- ability to use scientific keys to measure or observe and record results in simple experiments
- ability to present information in tabular and graphical form
- ability to use simple graphs or information in a table to interpret data
- ability to gather, select and organise information effectively
- communication skills to discuss and present research findings
- terminology to describe scientific issues and the impact of scientific issues.

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

Scientific concept/model/theory may include:

- internal combustion engine
- electricity
- solar system
- classification of living things
- astronomy
- periodic classification of the elements
- radioactivity.

Scientific method may include:

- observation
- classification
- experimentation
- construction of hypotheses
- testing of hypotheses.

Simple experiments may include:

- reading a scale and/or colour matching
- reading linear scales e.g. burette or thermometer
- reading dials on meters e.g. multi-range milliammeter
- reading digital displays e.g. pH meter
- colour matching e.g. universal indicator, nitrate tester
- observing simple chemical reactions
- observing biological samples using a microscope

- classifying simple living things
- classifying common substances using indicators or appropriate key.

Presentation may:

- be a written report following required format
- incorporate graphs and tables
- be an oral presentation.

Findings of an experiment may:

- be a summary of issues of key issues/observations
- address the impact on personal experience or the community and lessons learned
- address social, cultural or ethical factors relating to the area of science underpinning the issue of scientific interest.

Appropriate scientific terminology may include:

- language associated with scientific method such as evidence, observe, aim, hypothesis, results, conclusions, recommendations, ethics, field or activity report, laboratory report
- terminology appropriate to the area of science being investigated
- general terms such as cell, atomic, nuclear, solar, heredity, genetic, energy, ergonomic, experimental subjects, placebo.

Issues may include:

- carbon dioxide, greenhouse effect and temperature rises
- ergonomics in the workplace
- use and abuse of medications
- technology and artificial intelligence
- bio-chemistry and immunisation
- Minimal Intervention Models being introduced in modern medical treatment regimes
- sound technology and MRI decreasing our dependence on X-rays
- space stations and future travel
- weapons research including biological and chemical weapons
- drug testing on humans and sportspeople
- transplant technologies
- advancement in movie cameras or 3D virtual reality

- genetic connection to an illness
- cloning
- stem cell research
- genetic engineering
- impact of diet on specific health issues.

Area of science may include:

- a branch of science e.g. archaeology, astronomy, biochemistry, biology, biotechnology, chemistry, cosmology, meteorology, physics, virology
- combinations of areas of science in an application e.g. biological and psychological understanding of human endurance applied to occupational health and safety in working environments
- principles of science e.g. conservation, achievement of equilibrium/balance, transfer and transformation of energy, levers/inclined plane applied to simple machines/toys
- applications of science e.g:
 - technology such as telecommunications, electricity, calculators, plastics, flight and aviation
 - substance such as drugs (insulin, Ventolin, antibiotics, morphine) catalysts in industry
 - processes such as desalination, water purification and waste management.

Investigation:

- should not be too complex or time-consuming. The aim is to provide the learner with an opportunity to develop research, analytic and presentation skills within the context of scientific research
- may be undertaken by a team.

Impact may be beneficial or harmful and may include:

- cultural
- economic
- environmental
- ethical
- financial
- health and well being
- industrial
- physical
- political

- psychological
- religious
- social
- sport
- technological.

Simple scientific concepts may include:

- whether substances are acidic or basic and associated pH
- Ohm's or Hooke's Law.

Main principles of the scientific method may include:

- observation
- classification
- experimentation
- construction of hypotheses
- testing of hypotheses.

Appropriate scientific terminology may include:

- language associated with scientific method such as evidence, observe, aim, hypothesis, results, conclusions, recommendations, ethics, field or activity report, laboratory report
- terminology appropriate to the area of science being investigated and an understanding of specific terms
- general terms such as cell, atomic, nuclear, solar, heredity, genetic, energy, ergonomic, experimental subjects, placebo.

Findings of an investigation may include:

- summary of issues of key scientific importance
- impact of the issue of scientific interest on personal experience or the community and lessons learned
- impact of factors e.g. ethical guidelines, which may shape or constrain the scientific development which underpins the issue of scientific interest
- relevance of issue to daily lives
- progression from the change in scientific knowledge to its application in practice, including possible elements which affect the implementation or application of the change
- social, cultural or ethical factors relating to the area of science underpinning the issue of scientific interest.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

The learner must be able to:

- perform a simple scientific (chemistry, physics or biology) experiment
- record and analyse the results of the experiment
- undertake a simple investigation of the impact of a scientific issue on society, the environment or an individual
- record and analyse the results of the investigation
- present findings using appropriate scientific terminology.

Context of and specific resources for assessment

- Fully equipped laboratory.

Method of assessment

- Oral or written questioning
- Oral presentation
- Practical demonstration
- Research assignment
- Written or verbal report.

SECTION C2

PMLOHS302A

Participate in laboratory / field workplace safety

21858VIC Certificate IV in Science

21858VIC Certificate IV in Science
Version 1, December 2007

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PML04 Laboratory Operations Training Package (Version 1)
Date Acquired from NTIS: 05 August 2006



Unit Code	PMLOHS302B
Unit Title	Participate in laboratory / field workplace safety
Unit Descriptor	<p>This unit of competency covers the ability to apply enterprise OHS policies and procedures dealing with the identification and control of hazards, working safely at all times, emergency response and contributing to the maintenance of workplace safety. It is expected that personnel will be provided with clear directions, information, training and appropriate supervision. Responses are restricted to a first response' approach, including the notification of appropriate enterprise personnel.</p> <p>This unit of competency is based on the Generic Competency A in the National Guidelines for Integrating Occupational Health and Safety into National Industry Competency Standards [NOHSC: 7025 (1998) 2nd Edition]. It is equivalent to PMLOHS300A Work safely in accordance with defined policies and procedures in PML99.</p> <p>This unit of competency has no prerequisites.</p> <p>This unit of competency is applicable to all workers in all industry sectors with laboratory/field operations, including induction/entry level, school-based and trainee technicians. Workers with supervisory responsibilities should be assessed against the units PMLOHS400A Maintain laboratory/field enterprise safety and/or PMLOHS601A Implement and monitor OHS and environmental management systems.</p> <p>Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These are found at the end of this unit of competency under the section This competency in practice'.</p>

Unit Sector No sector assigned.

ELEMENT PERFORMANCE CRITERIA

Elements describe the essential outcomes of a unit of competency. Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

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|--|--|
| 1 Identify, control and report OHS and environmental hazards | <ul style="list-style-type: none"> 1.1 Routinely check immediate work area for hazards prior to commencing and during work 1.2 Address hazards within area of responsibility 1.3 Report hazards and incidents to designated personnel according to enterprise policies and procedures |
|--|--|

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|---|---|-----|--|
| 2 | Conduct work safely | 2.1 | Select, fit and use appropriate personal protective clothing and equipment |
| | | 2.2 | Keep all work areas clean and free from obstacles |
| | | 2.3 | Perform transfer while minimising opportunities for contamination and cross-infection |
| | | 2.4 | Maintain enterprise standards of personal hygiene |
| | | 2.5 | Safely store, transport and dispose of hazardous materials and dangerous goods |
| 3 | Follow incident and emergency response procedures | 3.1 | Identify incident and emergency situations |
| | | 3.2 | Report and record incident and emergency situations according to enterprise procedures |
| | | 3.3 | Follow incident and emergency procedures as appropriate to the nature of emergency, using emergency equipment according to enterprise procedures. |
| 4 | Contribute to OHS in the workplace | 4.1 | Raise OHS and environmental issues with designated personnel in accordance with enterprise procedures and legislated rights and obligations of employees |
| | | 4.2 | Participate in OHS activities within scope of responsibilities. |

KEY COMPETENCIES

The seven key competencies represent generic skills considered for effective work participation. The bracketed numbering against each of the key competencies indicates the performance level required in this unit. These are stand-alone levels and do not correspond to levels in the Australian Qualifications Framework (AQF).

Level (1) represents the competence to undertake tasks effectively

Level (2) represents the competence to manage tasks

Level (3) represents the competence to use concepts for evaluating and reshaping tasks.

Key Competency	Performance Level
Communicating ideas and information	1
Collecting analysing and organising information	1
Planning and organising activities	1
Working with others and in teams	1
Using mathematical ideas and techniques	1
Solving problems	1
Using technology	1

RANGE STATEMENT

The range of variables relates to the unit of competency as a whole. It allows for different work environments and situations that will affect performance.

Where reference is made to industry Codes of Practice, and/or Australian/international standards, it is expected the latest version will be used.

Personnel work in accordance with work instructions and standard operating procedures which incorporate all relevant aspects of OHS legislation and the codes, guidelines, regulations and Australian standards applying to environmental hazards and dangerous goods.

Industry standards, codes and guidelines include

- AS 2243 Safety in laboratories
- AS 2982 Hand washing facilities
- AS 2243.8 Fume hoods
- AS 2252 Biological safety cabinets
- SAA HB9 Occupational personal protection, and other relevant standards for protective, clothing (for example, AS 2161, AS 2210, AS 1337 and AS 1338)
- AS 1678 Emergency procedures guide for hazardous materials
- AS 2500 Storage of goods
- AS 2503 Safety storage and handling of information cards
- AS 1940 Storage and handling of flammable and combustible liquids
- AS 3780 Storage and handling of corrosive liquids
- AS 4452 Storage and handling of toxic substances standards for the segregation of wastes, such as AS 2243.3 and AS 2243.4
- AS/NEC/ISO 14000
- Australian Dangerous Goods Code
- Australian Code for Transport of Dangerous Goods
- guidelines for the operation of classes of laboratories
- Australian Quarantine Inspection Service guidelines for the importation of biological products
- National Code of Practice for the labelling of workplace substances (NOHSC:2012)
- Office of the Gene Technology Regulator (OGTR) guidelines for working with genetically altered organisms.

Routine checks may include

- general housekeeping checks, such as obstructions which may cause trip hazards
- checking of safety equipment, such as eye wash stations

- checking reagents and equipment are safe to use
- checking availability of emergency equipment
- checking functionality of personal protective equipment.

A hazard is a source or situation with a potential for harm in terms of human injury or ill health, damage to property, the environment or a combination of these. Physical hazards may be considered to be sources of energy that, if not controlled may cause injury or damage.

Hazards may include

- electric shock
- microbiological organisms and agents associated with soil, air, water, blood and blood products, human or animal tissue and fluids
- solar radiation, dust, noise
- chemicals, such as acids, heavy metals, pesticides, hydrocarbons
- aerosols from broken centrifuge tubes, pipetting
- radiation, such as alpha, beta, gamma, X-ray, neutron
- sharps, broken glassware and hand tools
- flammable liquids
- cryogenics, such as dry ice and liquid nitrogen
- fluids under pressure, such as steam, hydrogen in gas liquid chromatography, acetylene in atomic absorption spectrometry
- sources of ignition
- high temperature ashing processes
- disturbance or interruption of services
- occupational overuse syndrome, slips, trips and falls
- manual handling, working at heights and in confined spaces
- crushing, entanglement, cuts associated with moving machinery or falling objects
- pedestrian and vehicular traffic
- vehicle and boat handling.

Addressing hazards may include

- hazard and incident reporting and investigation procedures
- elimination
- substitution, such as review of nature of substances or processes used
- isolation, such as:
 - use of appropriate equipment, such as biohazard

containers, laminar flow cabinets, Class I, II and III biohazard cabinets

- Class PCII, PCIII, and PCIV physical containment laboratories
- engineering
- administrative procedures, such as:
 - ensuring access to service shut off points
 - recognising and observing hazard warnings and safety signs
 - labelling of samples, reagents, aliquoted samples and hazardous materials
 - handling and storage of all hazardous materials and equipment in accordance with labelling, materials safety data sheets and manufacturer's instructions
- identifying and reporting operating problems or equipment malfunctions
- cleaning and decontaminating equipment and work areas regularly using recommended procedures
- applying containment procedures
- following established manual handling procedures for tasks involving manual handling
- use of appropriate equipment and procedures to avoid
- personal contamination and contamination of others
- following risk control measures to minimise environmental hazards
- use of practices which minimise waste
- reporting to appropriate personnel of abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, vapour, fumes, odour and particulates
-
- minimising exposure to radiation, such as lasers, electromagnetic and ultraviolet
- use of material safety data sheets (MSDS)
- use of signage, barriers and service isolation tags
- use of personal protective equipment, such as hard hats, hearing protection, sunscreen lotion, gloves, safety glasses, goggles, face guards, coveralls, gown, body suits, respirators and safety boots.

Factors, such as inadequate work practices, lack of training or fatigue are not hazards but are conditions that may result in the

loss of control of the hazard and cause injury or damage.

Designated personnel may include the laboratory manager, supervisor, OHS coordinator and OHS representative.

Enterprise policies and procedures may include instructions for

- all OHS specific procedures, such as for hazard and incident reporting, communication, consultation and issue resolution and risk management
- controlling known hazards
- minimising environmental threats
- minimising and disposing of waste
- responding to safety, emergency, fire and incidents
- selecting/using personal protective clothing and equipment.
- workplace injury and accidents - cutting, stabbing, puncturing, crushing, immersion in water, suffocation, hypothermia, burns, heat stress, animal bites, allergic reactions, assaults
- biological, chemical or radioactive spills; fire; bomb threat; security threat; explosion.

An incident is an event that has cause or has the potential for injury, ill-health or damage.

Incidents and emergencies may include

Emergency equipment may include first aid equipment, eye wash kit or shower and fire extinguisher.

Participating in OHS activities include

- seeking assistance to clarify obligations and procedures
- clarifying work instructions that impact on safety and legal liability.

OHS and environmental issues which may need to be raised by employees with designated personnel may include

- identification of hazards not otherwise addressed
- assessment of risk and decisions on measures to control risk
- risk reduction measures
- problems with implementation of controls
- problems with recycling, by-product collection and waste disposal
- investigation of injury and incidents
- clarification of understanding of OHS policies and procedures.

Health, safety and environment

All operations to which this unit applies are subject to stringent health, safety and environmental (HSE) requirements, which may be imposed through State or Federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between performance criteria and HSE requirements, the HSE requirements take precedence.

All operations assume the potentially hazardous nature of samples and require standard precautions to be applied. Users should access and apply current industry understanding of

infection control issued by the National Health and Medical Research Council and State and Territory Departments of Health. All operations are performed in accordance with standard operating procedures.

EVIDENCE GUIDE

The Evidence Guide describes the underpinning knowledge and skills that must be demonstrated to prove competence.

Critical aspects of competency

Competency must be demonstrated in the ability to perform consistently at the required standard. In particular, assessors should look to see that the candidate:

- demonstrates the ability to recognise potential incidents and take appropriate corrective action
- can demonstrate workplace fire drill, incident, first aid and emergency evacuation procedures
- follows OHS and environmental policies and procedures for hazard identification and risk control, including the use, storage and maintenance of personal protective equipment
- follows enterprise instructions and procedures relating to storage, transport and disposal of dangerous goods
- follows instructions designed to ensure the correct labelling of samples and reagents
- uses equipment to protect health and safety
- communicates health and safety and environmental issues promptly with designated personnel.

Underpinning knowledge

Competency includes the ability to apply and explain:

- roles, rights and responsibilities of self and employer
- signage, symbols and signals relating to OHS
- hazards commonly found in own job and work area and standard risk controls
- location and purpose of personal protective equipment and emergency/hazard control equipment in the work area, including first aid facilities and personnel
- use, care and storage requirements for personal protective clothing and equipment used
- location of advice and information on OHS issues, including Material Safety Data Sheets (MSDSs)
- requirements and procedures for reporting OHS hazards and incidents, including injuries, illness and near misses
- the processes for raising a health and safety issue or concern
- safe work practices, including handling, storage and disposal of hazardous substances and requirements for labelling of hazardous substances
- work practices for use of handling equipment and any task-specific manual handling techniques as required by work role, according to enterprise procedures
- standard operating procedures for equipment used and key safety elements of the procedures.
- environmental impacts and effects of interaction with hazards in the work area
- enterprise procedures and instructions that govern personal work, incidents and emergencies
- reporting requirements for OHS issues and potentially hazardous situations.

Knowledge is also required of the:

- site layout, including emergency exits, location and use of safety alarms, emergency response system, procedures and personnel
- enterprise OHS and environmental policies and procedures.

Assessment context and methods

This unit of competency is to be assessed in the workplace or simulated workplace environment. The following assessment methods are suggested:

- observation of the candidate preparing for and undertaking a range of work tasks
- written and/or oral questioning to assess underpinning knowledge and likely reactions in hazardous/emergency situations
- feedback from peers and supervisors
- review of candidate's responses to case studies, scenarios and/or 'what ifs'.

In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly. Questioning techniques should suit the language and literacy levels of the candidate.

Interdependent assessment of unit

This unit of competency may be assessed with any other technical units in the context of the need to perform all work safely.

Resource implications

Resources may include:

- laboratory/field work environment, equipment and materials
- personal protective equipment
- enterprise procedures.

This competency in practice

Manufacturing

A laboratory assistant working in a laboratory was asked to produce a particular solvent-borne paint. Because of the hazardous nature of the task, the assistant referred to the material safety data sheets (MSDSs) which specified that a particular respirator and gloves be used. The assistant followed the requirements and safely prepared the batch of paint.

Food and beverage processing

One task of a laboratory assistant in a food processing company is the determination of total nitrogen in food samples by the Kjeldahl method. The assay involves digestion of the food with an aliquot of 30% hydrogen peroxide and several other reagents at more than 400°C. The assistant is familiar with the materials safety data sheets (MSDSs) for hydrogen peroxide and uses this chemical with appropriate caution and personal protective equipment. Small spills of

hydrogen peroxide sometimes occur. The assistant knows to clean these up immediately by liberally diluting the spill with water, mopping it up with a cloth and washing the hydrogen peroxide from the cloth into a sink with copious amounts of water. This attention to cleanliness is essential to minimise the risk of injury because 30% hydrogen peroxide has the appearance of water. Unlike water, it is corrosive to skin and presents a serious fire or explosion hazard if it should come into contact with many of the chemicals used in the laboratory.

Biomedical

After performing and verifying cell counts of plated samples, a technical assistant proceeded to dispose of the waste. The wastes were placed in a biohazard bag. The bag was sealed with a sterilisation indicator sticker that was clearly visible, and placed in the autoclave. The assistant checked the colour of the indicator sticker to ensure that the waste was correctly processed before disposing of the bag in accordance with standard operating procedures.

SECTION C3

VPAU073

Use a range of techniques to solve mathematical problems

21857VIC Certificate III in Science

Unit Code	VPAU073
Unit Title	Use a range of techniques to solve mathematical problems
Unit Descriptor	The purpose of this unit is to provide learners with the knowledge and skills to use a range of specialist techniques and concepts to solve mathematical problems.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Application of the Unit	The unit may apply to a number of science streams.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement.

Assessment of performance is to be consistent with the evidence guide.

1	Use ratio, proportion and percent to solve problems	1.1	Determine a ratio from information in a practical problem and express it in simplest form
		1.2	Divide a quantity into a given ratio
		1.3	Convert between fractions, decimals and percent forms
		1.4	Calculate a percentage increase or decrease of a quantity
2	Use trigonometry to determine lengths and angles	2.1	Use Pythagoras' Theorem to determine an unknown side of a right angled triangle
		2.2	Use Pythagoras' Theorem and trigonometric ratios to find unknown side lengths and angles in right-angled triangles
3	Use basic indices to solve problems	3.1	Evaluate simple index form expressions
		3.2	Simplify simple exponential expressions using the first two index laws
		3.3	Convert between decimal numbers and numbers expressed in Standard Notation
		3.4	Perform calculations with numbers expressed in Standard Notation, using a calculator

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|---|--|-----|---|
| 4 | Use measurements to solve mensuration problems in two and three dimensions | 4.1 | Determine lengths and perimeters of rectangles, triangles, circles and simple combined shapes using appropriate and correct units |
| | | 4.2 | Determine areas of rectangles, triangles, circles and simple combined shapes using appropriate and correct units |
| | | 4.3 | Determine volumes of prisms and pyramids with rectangular, triangular and circular cross-sections and with simple combined shapes as cross sections using appropriate and correct units |
| 5 | Substitute into and transpose simple equations and formulae | 5.1 | Substitute given values into simple equations and <i>formulae</i> |
| | | 5.2 | Write equations to solve simple problems |
| | | 5.3 | Transpose <i>simple</i> formulae |
| | | 5.4 | Solve <i>simple</i> linear equations |
| 6 | Solve problems by plotting points | 6.1 | Plot given points and points determined from the general formula $y = mx$ on the Cartesian plane |
| | | 6.2 | Determine the gradient of a <i>straight line</i> |
| | | 6.3 | Determine the equation of a straight line, where the equation has the general form $y = mx$, $y = a$ and $x = b$ |
| | | 6.4 | Use interpolation and extrapolation to make predictions from the line of best fit, noting limitations |
| 7 | Present and evaluate statistical information | 7.1 | Collect, organise and graphically represent <i>statistical data</i> |
| | | 7.2 | Interpret, analyse and describe <i>statistical information</i> |
| 8 | Identify connections between formulae and graphical representations | 8.1 | Use <i>graphical techniques</i> to draw linear and <i>simple non-linear graphs</i> |
| | | 8.2 | Develop equations for given linear graphs, including <i>lines of best fit</i> |
| 9 | Use algebraic techniques to analyse and solve problems | 9.1 | Develop formulae to describe relationships between variables and <i>substitute into formulae</i> to find particular values |
| | | 9.2 | Use a <i>range of techniques</i> to solve a <i>range of algebraic problems</i> and perform algebraic manipulations |

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Ability to:

- perform calculations involving fractions and mixed numbers
- perform calculations involving decimals and directed numbers
- round a decimal to a given number of decimal places
- use simple geometry to determine angles in triangles (including non-right angled)
- convert the unit of a quantity to a unit with a different prefix
- write a number correct to a given number of significant figures
- calculate systematic, random and percentage errors
- read off values in a table, chart or graph
- describe the general shape of a given or plotted scatter diagram
- identify general shapes and major characteristics of linear and simple non-linear graphs
- locate embedded information necessary to solve a problem or analyse quantitative information
- estimating skills to check calculations and reasonableness of outcomes
- use mathematical symbolism, charts, diagrams and graphs as appropriate to convey mathematical thinking and processing
- use specialised calculator functions relevant to mathematical needs.

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts. Bold italicised wording in the Performance Criteria is detailed below.

Formulae include:

- simple formulae with powers.

Simple means:

- limited to one- and two-step operations.

Straight line includes:

- line of best fit for empirical data.

Statistical data may include:

- grouped data
- using standard graphing conventions.

Statistical information may include:

- using central tendencies such as mean, median, mode
- percentiles
- measures of spread.

- Graphical techniques** should include:
- sketching from known main features of linear functions.
- Simple non-linear graphs** may include:
- exponential, inverse and quadratic relationships.
- Lines of best fit** may be:
- drawn by eye only for experimental data.
- Substitute into formulae** should include:
- unfamiliar formulae including where the unknown is not necessarily the subject.
- Range of techniques** should include:
- simplifying, expanding, and simple factorisation of polynomial expressions
 - simplification of expressions in index form including negative indices.
- Range of algebraic problems** should include:
- linear (involving multiple operations) and simultaneous linear, and may include quadratic.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

The learner must be able to:

- apply a wide range of strategies and techniques to solve mathematical problems including:
 - using ratio, proportion and percent
 - using trigonometry to determine lengths and angles
 - using basic indices
 - using measurements to solve mensuration problems in two and three dimensions
 - substituting into and transposing simple equations and formulae
 - solving problems by plotting points
 - presenting and evaluating statistical information
 - identifying connections between formulae and graphical representations
 - using algebraic techniques to analyse and solve problems

- demonstrate estimating skills to check calculations and reasonableness of outcomes
- use mathematical symbolism, charts, diagrams and graphs as appropriate to convey mathematical thinking and processing.

Context of and specific resources for assessment

- Access to calculators, computers for word processing or spreadsheets as appropriate. Calculations may be performed using pen and paper or on a calculator
- Access to real/authentic or simulated tasks, materials and texts in context relevant to learners goals
- Access to a computer and internet for information.

Method of assessment

- Oral or written questioning, online responses
- Pictures, diagrams, models created by the learner
- Practical demonstration
- Products or samples compiled by the learner with supporting documentation
- Records of teacher observations of learner's activities, discussions and practical tasks
- Self-assessment sheets, reflections, journal entries
- Written or verbal reports of investigations or problem-solving activities.

SECTION C4

VBQU155

Evaluate pathway options, design a learning plan and compile a portfolio

21857VIC Certificate III in Science

Unit Code	VBQU155
Unit Title	Evaluate pathway options, design a learning plan and compile a portfolio
Unit Descriptor	<p>The focus of the unit is to evaluate pathway options and plan skills development; design, implement and monitor a learning plan; and compile a portfolio of evidence.</p> <p>This unit is designed to meet the needs of learners with personal, learning, employment and community participation goals. Learners needs and expectations require a focus on individual learner objectives such as:</p> <ul style="list-style-type: none"> • improved language, literacy and numeracy skills • new skills and knowledge • specific competencies • target qualifications • new career • career advancement <p>Learner objectives may also include:</p> <ul style="list-style-type: none"> • information and advice on courses, learning programs, qualifications and assessment • individualised learning support systems
Employability skills	<p>The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The qualification's Employability Skills Summary in which this unit is included will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements of the <i>Certificate in General Education for Adults</i> (See Appendix B).</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p>
Application of the Unit	<p>The learning plan documents an agreed program that the learner will undertake during the course to research pathways, plan, document and monitor progress towards achieving learning goals. The program will take into account the learner's learning style and preferences. The portfolio will meet formal requirements of audience.</p> <p>It is also recommended that the application is integrated with other units.</p>

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement.

Assessment of performance is to be consistent with the evidence guide.

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|---|---|--|
| 1 | Identify potential pathways | 1.1 <i>A broad range of options</i> is considered |
| | | 1.2 <i>Sources of information</i> about options are identified |
| | | 1.3 Information about possible options is accessed and noted |
| | | 1.4 Options are evaluated in relation to own interests, skills and knowledge |
| 2 | Clarify learning goals | 2.1 <i>Learning goals</i> are identified and prioritised in relation to identified options |
| | | 2.2 Current skills and knowledge are <i>evaluated</i> against goals |
| | | 2.3 <i>Learning styles</i> are explored |
| | | 2.4 <i>Own personal learning context</i> is discussed in relation to achieving identified goals |
| | | 2.5 <i>Program options</i> to support the learner are discussed. |
| 3 | Design and implement an individual learning plan. | 3.1 <i>The purpose and features</i> of an individual learning plan are determined |
| | | 3.2 <i>The processes</i> for developing an individual learning plan are defined |
| | | 3.3 The individual learning plan is documented |
| 4 | Prepare portfolio of completed work samples | 4.1 <i>Possible audiences and uses</i> for the portfolio are explored |
| | | 4.2 <i>Requirements of the portfolio</i> are confirmed |
| | | 4.3 <i>Types of evidence</i> selected are evaluated |
| | | 4.4 Examples of evidence are <i>evaluated and assembled</i> for portfolio |
| | | 4.5 Feedback on the effectiveness of the portfolio is sought from |

- advisors and responded to
- 5 Monitor and update the individual learning plan.
- 5.1 Progress towards end-of-course goals and objectives is critically evaluated
- 5.2 ***Barriers and factors which contributed to success*** in meeting goals are acknowledged
- 5.3 Learning strategies which can be applied to other contexts are identified
- 5.4 Individual learning plan is evaluated and redrafted as necessary.
- 5.5 Feedback on the effectiveness of the program is provided.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

- communication skills to participate in planning process
- communication skills to participate in the assessment process
- an awareness of register
- ability to use support material effectively
- understanding of the need to proof read and revise drafts
- research skills to locate information relevant to own goals
- literacy skills to read and interpret a range of information
- ability to summarise ideas and information
- ability to comprehend complex relationships between ideas
- ability to understand the importance of documenting learning

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance, e.g. access to resources; regional contexts. Bold italicised wording in the Performance Criteria is detailed below.

A broad range of options may include:

- further study in VET and / or higher education
- employment, including seeking promotion and accessing training opportunities
- industry qualifications
- community participation
- personal development options

Sources of information may include:

- on-line data bases, e.g. for employment options, Training Support Network
- career counsellors
- training organisation materials and open days
- education/ careers sections in newspaper
- VTAC Guide

Learning goals may include:

- improving reading, writing and numeracy skills for a variety of purposes, for example:
 - further study
 - employment
 - community participation
 - health and well being
 - support for others
- new skills and knowledge
- specific competencies
- target qualifications
- new career
- career advancement

Evaluation of current skills and knowledge includes

- researching any additional skills requirements of learning options
- identifying gaps in own underpinning skills and knowledge

Learning styles may include:

- auditory
- visual
- kinaesthetic
- tactile
- left/right brain
- global/analytical
- theoretical
- activist
- pragmatist
- reflective

Own personal learning context

- work experience

can include:

- volunteer or recreational experience
- family responsibilities
- study including formal schooling or informal learning
- health and other personal matters
- any possible barriers to completion

Program options may include:

- participation in whole course or particular units
- choice of electives
- flexible delivery mode
- concurrent assistance
- partnership arrangements with other providers to broaden options

Purposes of a learning plan may include:

- assisting the learner and the provider to plan systematically for the attainment of goals
- as a tool to monitor progress
- to assist the transition of the learner to his/ her preferred options at the end of the course..

The features of an individual learning plan include:

- short term goals and indicators of success
- long term goals and indicators of success
- actions and activities to be undertaken, including monitoring arrangements
- any issues and strategies
- responsibilities
- timeline
- acknowledgement that the document is a working document and is subject to constant change, addition and deletion

Components of individual learning planning process are:

- assessment of learner's needs
- negotiation and development of long term goals
- identifying one or two short term specific objectives
- determination of tasks and progress to achieve goals and objectives
- agreement as to who is responsible for the implementation of each task
- identification of additional support persons, e.g.:
 - _ Community Advocates and Learning

- Partners/Indigenous community members
 - case workers and personal carers
 - career counsellors
 - interpreters
 - community representatives
 - equity officers
 - student services officers
 - library personnel
 - government officers in specialist support services
 - advocates for a person or group
 - peer support
 - note takers
 - technical support
 - human resources personnel
 - administrative personnel
 - family members
- identification of responsibilities for all parties, e.g.: learners (participation, working collaboratively, completing learning tasks), teachers (providing customised programs, using a collaborative approach, awareness of and strategies for dealing with conflicting discourses, ethical standards)

Possible audiences include:

- admissions officers
- employers
- program managers and teachers
- employment agencies
- self
- family

Possible uses include:

- documenting progress towards achievement of goals
- documenting competencies
- building a picture of personal attributes
- recording current competencies
- identifying areas for further skill development
- documenting employability skills
- record what has been achieved in the course
- provide a basis for a claim of RPL at a later stage

- provide support for a CV
- provide opportunity for reflection on progress towards achieving goals
- opportunity to reflect on strategies which have been successful
- document employability skills

Requirements may include:

- portfolio pieces selected and organised logically, e.g. by date, topic area, unit of study
- format of portfolio consistent with audience, purpose and use

Types of evidence may include:

- collections of samples compiled by the learner
- products with supporting documentation
- journal/log book
- certificates

Evidence evaluated and assembled is:

- selected for particular purpose and audience
- proof read for spelling and punctuation
- in logical order

Barriers may include:

- current life circumstances such as physical, mental, emotional or social constraints
- conflict with discourses of education
- cultural differences
- multiple roles and responsibilities

Factors which contribute to success may include:

- extending learner's existing knowledge and skills
- selecting and applying appropriate strategies
- transferring learning from one area to a new area
- practising new skills
- seeking support of teacher, peers, other interested parties when needed

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

- learner has researched a range of pathway options, developed a learning plan in relation to identified goals, assembled a portfolio, and evaluated progress in relation to goals.

Context of and specific resources for assessment

- assessment of performance requirements in this unit is best undertaken over the course of the program
- access to real texts in context
- research facilities

Guidance information for assessment

- A range of assessment strategies or options should be considered to suit the needs of the learner. The needs of the learner will be met by provision of:

- a learning environment appropriate to the assessment task
- appropriate support allowing for full participation
- computer hardware and software, if appropriate.

Appropriate assessment strategies include:

- direct observation, for example:
 - real time activities
- questioning, for example:
 - interviews
 - self-assessment
 - verbal questioning
- portfolios, for example:
 - collections of samples compiled by the learner
 - product with supporting documentation
 - journal/log book
- third party feedback, for example:
 - testimonials/reports from other teachers or support workers
 - interview with peer

SECTION C5

VBQU157

Engage with a range of complex texts for learning purposes

21857VIC Certificate III in Science

Unit Code	VBQU157
Unit Title	Engage with a range of complex texts for learning purposes
Unit Descriptor	<p>The focus of this unit is on interpreting, and critically analysing complex texts. These include intricate, dense and extended text from a variety of print based and electronic texts. This unit recognises the importance of lifelong learning, and is suitable for those wanting to improve their skills in order to access further study.</p> <p>The required outcomes described in this unit relate directly to the <i>National Reporting System (NRS)</i>, © Commonwealth of Australia and ANTA, 1994-1995. They contribute directly to the achievement of NRS indicators of competence at Level Five (Reading).</p>
Employability Skills	<p>The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The qualification's Employability Skills Summary in which this unit is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements of the <i>Certificate in General Education for Adults</i> (See Appendix B).</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p>
Application of the Unit	<p>People seeking to improve their further education participation options will need to develop a range of reading skills. The unit provides the learner with the skills and knowledge necessary to interpret and critically analyse complex texts. These skills will enable the learner to have access to knowledge and skills which will assist them in future educational, employment and community activities.</p> <p>Where application is as part of the Certificate in General Education for Adults, it is strongly recommended that application is integrated with the delivery and assessment of Core Skills writing unit: <i>VBQU161 Create a range of complex texts for learning purposes</i>. The link between reading and writing and the potential overlap between the parallel units encourages co-delivery and assessment.</p> <p>It is also recommended that the application is integrated with other units.</p>

ELEMENT**PERFORMANCE CRITERIA**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement.

Assessment of performance is to be consistent with the evidence guide.

- | | | |
|---|---|--|
| 1 | Select a range of complex texts for learning purposes | 1.1 <i>Learner's purposes</i> for engaging with texts are clarified |
| | | 1.2 <i>A range of complex texts</i> is located |
| | | 1.3 Texts relevant to learner's learning purposes are chosen |
| 2 | Review selected texts for learning purposes | 2.1 <i>Purpose</i> of the text is interpreted |
| | | 2.2 <i>Features of texts</i> are analysed |
| | | 2.3 <i>Reading strategies</i> are used to interpret key ideas and supporting information in texts |
| | | 2.4 Texts are evaluated for relevance and quality of content |
| 3 | Critically interpret a range of texts for learning purposes | 3.1 A range of texts for learning purposes are <i>analysed</i> |
| | | 3.2 <i>Similarities and / or differences</i> are discussed |
| | | 3.3 Judgements about the usefulness of the texts are discussed |

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

- gathers, selects and organises information effectively for specific purposes by defining information requirements both before and during research
- draws on a repertoire of strategies to maintain understanding through structurally complex texts
- uses a range of strategies to analyse texts
- draws on broad vocabulary including idiom, colloquialisms, and cultural references, and specialised vocabulary as appropriate, to support comprehension
- understands how language is used to make hypotheses, to plan and to influence others
- verbal skills to discuss features of texts
- communication skills to undertake assessment

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance, e.g. access to resources; regional contexts. Bold italicised wording in the Performance Criteria is detailed below.

Learner's purposes may include:

- improving reading skills to meet current and future study demands
- summarising key information and supporting material
- comparing and evaluating information from a range of texts
- lifelong learning goals

A range of complex texts may include:

- prose and non-prose, electronic, printed, handwritten and visual texts such as:
 - sources of knowledge and information such as text books, research material
 - instructional materials, e.g., learner resources to support vocational education and training courses, classroom based learning materials
 - procedural manuals / learner guides
 - newspaper articles
 - reports, including technical information

Purposes of texts may be

- knowledge, e.g., subject based such as scientific, environmental, historical, technical
- skills development, e.g., scientific method, conducting a process, technique
- advice, e.g., about career pathways, further education pathways

Features of texts include:

- ***Text structures may include:***
 - complex, dense texts which use a variety of sentence structures
 - may be ambiguous and have implicit meaning
 - a number of text types:
 - complex narrative and expressive texts
 - complex informative texts
 - complex procedural texts
 - complex persuasive texts
 - complex transactional texts
- ***Paragraphs / Sentences, for example:***
 - complex syntactic structures
- ***Words / phrases/ abbreviations, for example:***
 - broad vocabulary including idiom, colloquialisms,

cultural references as appropriate

- vocabulary associated with personally relevant education activities
- slang, non standard Australian English including dialect
- technical terms linked to learning goals / subject areas
- abbreviations associated with further and higher education, e.g., TAFE, VET, VTE, VCE, HE

- *Visual information*

- information and activities presented visually, e.g., in industry toolbox
- charts, tables, graphs of statistical data
- demographic data
- diagrams, cartoons, film documentaries

A range of reading strategies may include:

- meaning-making strategies, for example:

- using a broad range of strategies to maintain understanding
- gathering, selecting and organising information effectively for specific purposes by defining information requirements both before and during research
- analysing how supporting material is used effectively
- using a range of vocabulary of relevance to further learning
- recognising ways in which punctuation conveys a range of emotions or intentions
- making comparisons of information contained in texts

- de-coding strategies, for example:

- using a broad range of word identification strategies, including word derivations and meanings

Analysis may include identifying:

- misleading information
- underlying values
- subtle nuances
- quality of evidence to support judgements
- unclear meaning

Similarities and / or differences may include:

- differing factual accounts of the same information by different writers
- differences in style or substance

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation

submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

- learners will be able to locate personally relevant information in structurally intricate texts, and read, interpret and evaluate complex texts for learning purposes.
- evidence that texts have been accessed on at least three occasions. Each occasion must address a different text type and include evidence of a range of features which are consistent with those described in the Range Statement. Prose texts at this level typically contain a number of linked paragraphs.

In addition to integrated demonstration of the elements and their related performance criteria, look for evidence that confirms:

- the knowledge requirements of this unit
- the skill requirements of this unit

Context of and specific resources for assessment

- assessment of performance requirements in this unit is best undertaken using resources of relevance to the learner's learning needs
- access to real texts in context
- research facilities, e.g., library, computer with internet access

Guidance information for assessment

A range of assessment strategies or options should be considered to suit the needs of the learner. The needs of the learner will be met by provision of:

- a learning environment appropriate to the assessment task
- appropriate support allowing for full participation
- computer hardware and software, if appropriate.

Appropriate assessment strategies include:

- direct observation, recorded in teacher observation schedule, recorded in teacher observation schedule
- questioning, for example:
 - verbal questioning
 - interviews
 - self-assessment
 - online responses

- portfolios, for example:
 - collections of samples compiled by the candidate
 - journal/log book
- third party feedback, for example:
 - reports from other teachers or support workers
 - peer feedback

SECTION **C6**

VBQU161

Create a range of complex texts for learning purposes

21857VIC Certificate III in Science

Unit Code	VBQU161
Unit Title	Create a range of complex texts for learning purposes
Unit Descriptor	<p>The focus of the unit is on writing skills to create complex texts which are relevant to the further study context. Its emphasis is on structured reflective and opinion texts used in a range of study environments.</p> <p>The required outcomes described in this unit of competency relate directly to the National Reporting System (NRS) (© Commonwealth of Australia and ANTA 1994-5). They contribute directly to the achievement of the NRS indicators of competence Level 5 (Writing).</p>
Employability Skills	<p>The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The qualification's Employability Skills Summary in which this unit is included will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements of the <i>Certificate in General Education for Adults</i> (See: Appendix B).</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p>
Application of the Unit	<p>People seeking to develop their literacy skills to a complex level so that they may participate effectively in further study options will need to develop a range of writing and communication skills associated with creating texts. The unit supports the learner to acquire the skills and knowledge necessary to create complex texts of for learning purposes. The unit also develops learners' skills and knowledge to organise and apply content from texts. It will develop the written communication skills to complete a range of reflective and opinion texts as well as the skills to structure texts according to academic requirements. These skills will enable the learner to have access to knowledge and skills which will assist them in future educational activities.</p> <p>Where application is as part of the <i>Certificate in General Education for Adults</i>, it is strongly recommended that application is integrated with the delivery and assessment of <i>VBQU157 Engage with a range of complex texts for learning purposes</i>. The link between Reading and Writing and the potential overlap between the parallel units encourages co delivery and assessment.</p> <p>It is also recommended that application is integrated with other units.</p>

ELEMENT

PERFORMANCE CRITERIA

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement.

Assessment of performance is to be consistent with the evidence guide.

- | | | | |
|---|--|-----|---|
| 1 | Select and plan for texts for learning purposes | 1.1 | Range of <i>complex text options</i> is researched |
| | | 1.2 | The purpose and audience of the texts is analysed |
| | | 1.3 | <i>Structure, style and format</i> requirements are analysed |
| | | 1.4 | <i>Required resources</i> to complete the text are organised or obtained |
| | | 1.5 | Content is gathered, synthesised and arranged |
| 2 | Produce a portfolio of complex texts for learning purposes | 2.1 | Structure, style and format is appropriately applied |
| | | 2.2 | <i>Content and language</i> is appropriate and relevant to the writing purpose |
| | | 2.3 | Texts in chosen option(s) are proof read and edited prior to presentation |
| | | 2.4 | Feedback on effectiveness of texts is elicited |
| | | 2.5 | Completed text is <i>submitted</i> appropriately |

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

- sophisticated control of a range of genres and styles of writing
- established register flexibility
- a broad vocabulary including idiom, colloquialisms and cultural references
- ability to use a range of complex grammatical structures accurately and effectively
- knowledge of a range of organisational conventions
- ability to communicate complex relationships between ideas and purposes

- knowledge and skills to revise writing to enhance meaning and effectiveness

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance, e.g. access to resources; regional contexts. Bold italicised wording in the Performance Criteria is detailed below.

- Complex text options*** may include
- electronic and printed texts across a range of genres
 - answers to specific questions on a text or texts
 - summaries
 - reports
 - analyses of statistical data
 - argumentative texts
 - detailed reflective texts
 - observation notes
 - journal
 - notes taken from a range of sources, both written and aural, e.g. lectures, classroom notes, print based and online texts, journal articles
 - texts based on research
 - applications
 - essays, e.g. descriptive, argumentative
 - paraphrase
 - synopsis
 - bibliography, reference lists
 - speech, e.g. debate, presentation of research

Structure may include

Sophisticated control of structural elements in electronic and ‘paper’ based texts which may include:

- layout features and styles as appropriate for either electronic or “paper based” text
- standard templates e.g. club newsletter, formal meeting notes / minutes, memos
- use of appropriate language for audience and purpose
- ***Text Structure:***
 - clearly structured text displaying logical and transparent organisational structures, a range of conventions
 - variation between public and private writing
 - a number of linked paragraphs

- conventions of paragraph writing development of one major topic in each paragraph, use of topic sentences
 - features of narrative and expressive texts, e.g. chronological sequencing of events; logically sequenced and cohesive prose; identification followed by description; orientation, complication, resolution in narrative texts; use of descriptive language
 - features informative texts, e.g. transparent organisation, such as sequentially ordered dot points, numbered instructions, alphabetical, numerical listings, spacing, headings; structuring writing to move from introduction through several connected ideas / evidence / points of view to a summary / recommendation
 - features of procedural texts, e.g. instructions: statement of the goal, requirements and steps to achieve the goal
 - navigation features, e.g., grids, arrows, dot points
 - information formatted into a table (one or two columns)
 - features of transactional texts, e.g. formal letter format: formal opening, statement of purposes, details, request, confirm, inform or clarify action, formal close
 - consistent use of complex sentence structure
 - effective use of linking devices appropriate to text type
 - use of a range of structures and features
- visual features
 - complex diagrams, for example, flowcharts
 - charts, tables, graphs of statistical data
 - demographic data
 - photographs / illustrations

Style may include

- appropriate register
- effective and appropriate use of words and expressions

Format may include

- appropriateness of layout / media for chosen option
 - word processed
 - html

- email
- letter format, report etc
- presentation
- conventions of formal texts, in particular for study purposes, are used, e.g. footnotes, references
- handwritten

Required resources may include

- word processing program / computer access
- electronic presentation software program
- sample model texts
- written material, research information
- literature, films, documentaries, radio programs
- journal articles
- lecture notes
- handouts
- style guides
- citation / referencing system required
- spoken word resources, e.g. oral history, indigenous narratives

Content and language may include

- incorporate a range of topics, beliefs, issues or experiences
- use literary devices to convey character, setting and/or emotions
- present a range of concepts and facts within a specialist field of knowledge including some abstract or technical concepts
- vocabulary including idiom, colloquialisms, and cultural references as appropriate.
- specialist vocabulary in a variety of situations, e.g. explanations, descriptions, debates.
- a variety of words and grammatical structures to achieve precise meaning
- using spelling, punctuation and grammar with a high degree of accuracy or taking measures to check accuracy and make corrections

Text may need to be submitted

- in a specified format, e.g.
 - electronically
 - multiple copies

- numbered pages
- headers and footers, e.g. with student name and number
- according to organisational requirements, e.g. with a signed cover sheet
- according to set timelines, due dates
- with accompanying documentation such as medical certificates for late submissions

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

The demonstrated ability to:

- select text types
- plan complex texts
- produce a folio of texts over time which demonstrates the ability to structure, review and edit complex pieces

In addition to integrated demonstration of the elements and their related performance criteria, look for evidence that confirms:

- the knowledge requirements of this unit
- the skill requirements of this unit

Context of and specific resources for assessment

The unit may be assessed in a range of learning environments including formal classrooms, structured learning groups or individual mentoring arrangements

- assessment of performance requirements in this unit is best undertaken using resources drawn from the learner's environment
- creation of real / authentic texts in context
- access to real / authentic texts
- access to online facilities, communications technologies as appropriate
- access to computers for word processing as appropriate

Guidance information for assessment

A range of assessment strategies or options should be considered to suit the needs of the learner. The needs of the learner will be met by provision of:

- a learning environment appropriate to the assessment task
- appropriate support allowing for full participation
- computer hardware and software, if appropriate.

Appropriate assessment strategies include:

- portfolios, for example:
 - collections of samples compiled by the learner
 - product with supporting documentation
 - journal/log book
- direct observation, for example:
 - real time activities
 - activities in a simulated environment
- third party feedback, for example:
 - testimonials/reports from other teachers or support workers
 - peer feedback
- self evaluation

SECTION C7

VBAM082

Atomic structure and bonding

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

MODULE DETAILS

Module Name Atomic structure and bonding

Module Code VBAM082

MODULE PURPOSE The purpose of this module is to provide learners with basic knowledge of atomic structure, bonding and the periodic table.

Employability Skills The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).

Summary of Learning Outcomes

1. Apply the particle theory of matter.
2. Use the Bohr-Rutherford model of the atom to explain the structure of an atom.
3. Use knowledge of periodicity and bonding to explain the chemical and physical properties of common elements and compounds.
4. Derive systematic names and formulae for simple inorganic compounds.

Learning Outcome 1 Apply the particle theory of matter

Assessment Criteria

- 1.1 Use *appropriate terminology* to discuss classification and properties of matter
- 1.2 Account for the states of matter and their *common properties* in terms of the particle theory of matter
- 1.3 Distinguish between physical and chemical changes
- 1.4 Relate the properties of materials to their uses
- 1.5 Classify pure substances into *elements* and compounds on the basis of their properties and the particle theory of matter

Learning Outcome 2 Use the Bohr-Rutherford model of the atom to explain the structure of an atom

- Assessment Criteria**
- 2.1 Identify the *principal sub-atomic particles* together with mass, relative mass and charge
 - 2.2 Relate the shell/energy level structure of an atom to its electron configuration in the ground state
 - 2.3 *Explain the structure* of the modern periodic table
 - 2.5 Identify the relationship between the electronic configuration of an atom and its position in the periodic table
 - 2.6 Identify *atomic property trends* in the periodic table

Learning Outcome 3 Use knowledge of periodicity and bonding to explain the chemical and physical properties of common elements and compounds

- Assessment Criteria**
- 3.1 Identify stable electron configurations with reference to atoms of the noble gases and use this model to predict likely gain or loss of electrons for main group metallic and non-metallic atoms
 - 3.2 Explain ionic, covalent and metallic bonding using common examples and predict the likely nature of bonding in *elements* and binary compounds
 - 3.3 Use the concept of electronegativity to identify polar covalent bond
 - 3.4 Use electron dot diagrams to represent the transfer of electrons in ionic bonding
 - 3.5 Use electron dot and dash diagrams to represent the bonding in and structure of simple molecules
 - 3.6 Use the nature of bonding in an element or compound to predict or account for some of their *physical properties*

Learning Outcome 4 Derive systematic names and formulae for simple inorganic compounds

- Assessment Criteria**
- 4.1 Determine correct chemical formulae for binary compounds using basic valency concept
 - 4.2 Identify binary, ionic and molecular compounds

4.3 Determine correct *chemical formulae and names for acids, bases and salts*

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential knowledge and level, required for this module.

- appropriate terminology to discuss classification and properties of matter
- knowledge of the historical development of the structure of the atom
- the Bohr-Rutherford model of the atom
- knowledge of periodicity and bonding
- systematic names and formulae for simple inorganic compounds
- ability to work safely and efficiently with common chemicals and laboratory equipment.

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Appropriate terminology may include:

- matter, states of matter (solid, liquid, gas or vapour)
- changes of state (melting or liquefaction, vapourisation, condensation, solidification, sublimation)
- element, compound, mixture
- particle, atom, molecule.

Common properties may include:

- conservation of mass
- conservation of shape versus flow
- conservation of volume versus expansion
- compressibility.

Elements include:

- metals, non-metals and noble gases.

Principal sub-atomic particles are:

- electron, proton, neutron.

Explanation of the structure should:

- concentrate on the first 20 elements
- include drawing and interpreting diagrams which represent Bohr-Rutherford models of atoms and atomic ions.

Atomic property trends may include:

- atomic size
- electronegativity

Physical properties may include:

- electrical conductivity of solid or liquid

Chemical formulae and names for acids, bases and salts should be for:

- hardness, brittleness, malleability
- qualitative estimates of melting /boiling points).
- those compounds most commonly found in the laboratory and in the home.

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

The learner must be able to:

- use appropriate terminology to discuss classification and properties of matter
- use the Bohr-Rutherford model of the atom to explain the structure of an atom
- use knowledge of periodicity and bonding to explain the chemical and physical properties of common elements and compounds
- derive systematic names and formulae for simple inorganic compounds.

Context of and specific resources for assessment

- Periodic table
- Drawing materials
- Fully equipped chemistry laboratory.

Method of assessment

- Oral or written questioning
- Oral presentation
- Practical demonstration
- Research assignment
- Written or verbal report.

SECTION C8

VPAM083

Stoichiometry and solution chemistry

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

Version 1: December 2007



MODULE DETAILS

Module Name	Stoichiometry and solution chemistry
Module Code	VPAM083
MODULE PURPOSE	The purpose of this module is to provide learners with basic knowledge of stoichiometry and solution chemistry.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Pre-Requisite Unit	VPAM082 Atomic structure and bonding
Co-Requisite Unit	PMLOHS302A Participate in laboratory/field workplace safety
Summary of Learning Outcomes	<ul style="list-style-type: none"> • Use the mole definition and formulae to solve problems. • Derive balanced chemical equations for simple chemical reactions and apply stoichiometry to them. • Explain solution formation and solubility. • Solve concentration problems.
Learning Outcome 1	Use the mole definition and formulae to solve problems
Assessment Criteria	<p>1.1 Define the relative atomic mass of an element and calculate it using mass spectrometric data</p> <p>1.2 Calculate the relative molecular and formula mass of molecular and ionic compounds respectively</p> <p>1.3 Define the mole</p> <p>1.4 Use the mole definition to solve <i>problems</i></p> <p>1.5 Use experimental data to calculate the empirical formulae of compounds</p> <p>1.6 Use empirical formulae and relative molecular masses to determine molecular formulae.</p>
Learning Outcome 2	Derive balanced chemical equations for simple reactions and apply

stoichiometry to these equations

- Assessment Criteria**
- 2.1 Write balanced chemical equations to represent chemical reactions
 - 2.2 Distinguish between different types of *chemical reactions*
 - 2.3 Use stoichiometric equations to calculate mass-mass relationships between reactants and products.

Learning Outcome 3 Explain solution formation and solubility

- Assessment Criteria**
- 3.1 Identify various types of mixtures
 - 3.2 Use *terminology* relevant to solution formation
 - 3.3 Explain factors which affect solubility
 - 3.4 Explain factors which affect the rate at which a solute dissolves
 - 3.5 Explain the *types of solution*
 - 3.6 Construct and interpret solubility curves from experimental data.

Learning Outcome 4 Solve concentration problems

- Assessment Criteria**
- 4.1 Perform *dilution calculations*
 - 4.2 *Calculate the molarity* of solutions
 - 4.3 *Calculate concentration* in other units.

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential knowledge and level, required for this module.

Knowledge:

- the mole definition
- understanding of concentration and volume

Skills

- ability to use formulae to solve problems
- ability to write balanced chemical equations
- ability to construct solubility curves.

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Problems may include:

- mass of substance
- number of particles and relative atomic mass or molecular mass.

Chemical reactions may include:

- acid neutralization and combustion reactions
- association, dissociation and precipitation reactions
- combination and decomposition reactions.

Terminology may include:

- solubility, solute, solvent, solution and dissolution

Types of solution include:

- unsaturated, saturated and supersaturated

Dilutions are calculated:

- using $c \propto 1/v$

Calculate the molarity by:

- using the formula $c = \frac{n}{V}$

Calculating concentration includes:

- percentages, weight/volume, by volume (v/v) and parts per million (ppm).

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

The learner must be able to:

- use the mole definition and formulae to solve problems
- derive balanced chemical equations for simple chemical reactions and apply stoichiometry to them
- explain solution formation and solubility
- solve concentration problems.

Context of and specific resources for assessment

- Calculator
- Fully equipped chemistry laboratory.

Method of assessment

- oral or written questioning
- oral presentation
- practical demonstration
- research assignment
- written or verbal report
- problem solving.

SECTION C9

VPAM084

Organic chemistry and properties of materials

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

Version 1: December 2007



MODULE DETAILS

Module Name	Organic chemistry and properties of materials
Module Code	VPAM084
MODULE PURPOSE	The purpose of this module is to provide learners with basic knowledge of organic chemistry.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Pre-Requisites	VPAM082 Atomic structure and bonding
Summary of Learning Outcomes	<ol style="list-style-type: none"> 1. Use simple hydrocarbons to explain structure and isomerism of organic molecules. 2. Name and draw structures of simple organic molecules using IUPAC rules. 3. Explain the relationship between structure and properties of organic compounds. 4. Write balanced chemical equations to represent simple organic reactions.
Learning Outcome 1	Use simple hydrocarbons to explain structure and isomerism of organic molecules
Assessment Criteria	<ol style="list-style-type: none"> 1.1 Draw the structural formulae of <i>simple hydrocarbons</i> up to C₆ 1.2 <i>Explain the concept</i> of isomerism 1.3 Identify common functional groups in organic molecules
Learning Outcome 2	Name and draw structures of simple organic molecules using IUPAC rules
Assessment Criteria	<ol style="list-style-type: none"> 2.1 Use IUPAC conventions to name <i>simple organic compounds</i> on the basis of their molecular structures 2.2 Draw the structures of simple organic molecules based on their IUPAC names

Learning Outcome 3	Explain the relationship between structure and properties of organic compounds	
Assessment Criteria	3.1	Identify the <i>intermolecular bonding</i> present in <i>simple organic compounds</i>
	3.2	Relate the structures of organic compounds to their <i>physical properties</i>
Learning Outcome 4	Write balanced chemical equations to represent simple organic reactions	
Assessment Criteria	4.1	Write balanced equations for organic reactions where the reactants and products are specified
	4.2	Write balanced equations for the complete and/or partial combustion of hydrocarbons in the context of their use as fuels and their being a fire hazard
	4.3	Write balanced equations to demonstrate the acidic nature of carboxylic acids and the alkaline nature of organic amines.

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential skills and knowledge and level, required for this module.

Knowledge of:

- hydrocarbons
- isomerism
- functional groups
- IUPAC naming
- physical properties of organic compounds
- simple chemical reactions of organic compounds.

Ability to:

- write chemical equations in the correct format
- draw molecules using the appropriate techniques
- explain chemical knowledge using correct terminology
- produce written scientific reports using appropriate terminology.

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that

may affect performance.

Simple hydrocarbons include:

- alkanes, alkenes, alkynes, benzene

Explain the concept of isomerism:

- using alkanes up to C₆ as examples.

Simple organic compounds may include:

- alkanes, alkenes, alkynes
- aromatics as represented by benzene, alcohols, halogenated hydrocarbons, carboxylic acids and esters

Intermolecular bonds may include:

- dispersion bonds
- hydrogen bonds

Physical properties may include:

- melting and boiling points
- volatility
- solubility in water
- solubility in non-polar solvents

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

The learner must be able to:

- demonstrate knowledge of the structure and isomerism of organic molecules
- name and draw simple organic molecules using IUPAC rules
- explain the relationship between structure and properties of organic compounds
- write balanced chemical equations to represent simple organic reactions

Context of and specific resources for assessment

- drawing materials
- fully equipped chemistry laboratory

Method of assessment

- verbal or written questioning
- verbal presentation
- practical demonstration
- research assignment
- written or verbal report

SECTION C10

VPAM085

Waves and optics

21857VIC Certificate III in Science
21858VIC Certificate IV in Science

MODULE DETAILS

Module Name Waves and optics

Module Code VPAM085

MODULE PURPOSE To provide the learner with knowledge of wave theory and the laws of optics.

Employability Skills The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).

Co-Requisite Unit PMLOHS302A Participate in laboratory/field workplace safety

Summary of Learning Outcomes

1. Distinguish between transverse and longitudinal wave types.
2. Explain the applications of the major bands of the electromagnetic spectrum.
3. Determine the path of a light ray.
4. Describe the formation of images by mirrors and lenses.

Learning Outcome 1 Distinguish between transverse and longitudinal wave types

Assessment Criteria

- 1.1 Use *appropriate terminology* used in wave theory
- 1.2 Explain the difference between a transverse wave and a longitudinal wave
- 1.3 Describe the motion of individual particles in a transverse and longitudinal wave
- 1.4 Explain how to identify when two particles in a wave are in phase

Learning Outcome 2 Explain the applications of the major bands of the electromagnetic spectrum

Assessment Criteria

- 2.1 Contrast the properties of the major components of the electromagnetic spectrum in relation to the aspects of source, frequency, wavelength, energy and detection
- 2.2 Provide an example of an application for each section of the electromagnetic spectrum

	2.3	Describe factors affecting the intensity of a source of electromagnetic radiation
	2.4	Calculate the wavelength or frequency of an electromagnetic wave
	2.5	Describe the features of laser radiation
Learning Outcome 3		Determine the path of a light ray
Assessment Criteria	3.1	<i>Describe the behaviour of light</i> when it undergoes reflection and refraction
	3.2	Determine quantitatively the path of a light ray
Learning Outcome 4		Describe the formation of images by mirrors and lenses
Assessment Criteria	4.1	Use ray tracing techniques to describe images formed by <i>mirrors</i> and lenses
	4.2	Identify the three principal rays for concave mirrors and concave lenses
	4.3	Explain the optics of <i>simple optical instruments</i>

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential skills and knowledge and level, required for this module.

Knowledge of the following:

- definition of a wave
- behaviour of light
- relationship between velocity, frequency and wavelength
- amplitude, period and phase
- light intensity
- electromagnetic spectrum
- lasers
- reflection and refraction
- Snell's law of refraction
- critical angle and total internal reflection
- optical fibres

Ability to

- use a scientific calculator
- use scientific equipment in a physics laboratory

- use magnifying glasses, telescopes, microscopes, cameras, slide projectors as appropriate
- produce written report using physics terminology appropriately
- make verbal presentations to a group.

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Appropriate terminology may include:

- frequency, wavelength, period, amplitude and velocity of a wave
- the wave equation (velocity = frequency x wavelength) to find any one quantity given the other two

Description of the behaviour of light may include:

- distinguishing between specular and diffuse reflection
- demonstrating experimentally Snell's law of refraction.
- calculating angles and refractive indices using Snell's law or refraction.
- explaining the dispersion of light into component colours

Mirrors may be:

- concave
- plane

Simple optical instruments may include:

- magnifying glasses, telescope, microscope, cameras, slide projectors

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

The learner must be able to:

- explain the differences between transverse and longitudinal wave types, including the motion of individual particles, and how to identify when two particles in a wave are in phase
- explain the applications of the major bands of the electromagnetic spectrum
- determine the path of a light ray
- describe the formation of images by mirrors and lenses.

Context of and specific resources for assessment

- scientific calculator
- physics laboratory equipped with a wave generator, slinky springs, ripple tanks, microwave generator, laser and accessories, Hodson's light box kits and optical bench, blackout facilities.

Method of assessment

- verbal or written questioning
- verbal presentation
- practical demonstration
- research assignment
- written or verbal report.

SECTION C11

VPAM086

Kinematics

21857VIC Certificate III in Science
21858VIC Certificate IV in Science

MODULE DETAILS

Module Name **Kinematics**

Module Code **VPAM086**

MODULE PURPOSE The purpose of this module is to provide the learner with the knowledge and skills to describe the motion of an object.

Employability Skills The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).

Summary of Learning Outcomes

1. Use kinematic terms to explain linear motion.
2. Explain the linear motion of an object.
3. Draw and interpret kinematic graphs.
4. Define vector and scalar quantities.
5. Calculate the displacement and velocity of an object in two dimensions.

Learning Outcome 1 Use kinematic terms to explain linear motion

Assessment Criteria

- 1.1 Distinguish between position, displacement and distance travelled for an object moving with linear motion
- 1.2 Calculate the velocity and speed of an object given the displacement, distance and time
- 1.3 Calculate the acceleration of an object given the initial velocity, final velocity and the time
- 1.4 *Present data*

Learning Outcome 2 Explain the linear motion of an object

Assessment Criteria

- 2.1 *Discuss* the motion of an object
- 2.2 Solve *problems* related to moving objects
- 2.3 *Present data*

Learning Outcome 3	Draw and interpret kinematic graphs
Assessment Criteria	<p>3.1 Draw position-time and velocity-time graphs from experimental data</p> <p>3.2 Calculate displacement and acceleration from a velocity-time graph</p> <p>3.3 Sketch position-time, velocity-time and acceleration-time graphs for objects moving with constant velocity and constant acceleration</p> <p>3.4 Describe the motion of an object using appropriate kinematic terms given the velocity-time graph</p> <p>3.5 <i>Present data</i></p>
Learning Outcome 4	Define vector and scalar quantities
Assessment Criteria	<p>4.1 Explain the difference between vector and scalar quantities</p> <p>4.2 Demonstrate vector quantities graphically</p> <p>4.3 Resolve a vector into two right-angled components</p> <p>4.4 <i>Present data</i></p>
Learning Outcome 5	Calculate the displacement and velocity of an object in two dimensions
Assessment Criteria	<p>5.1 Calculate the vector sum or subtraction of two displacement or velocity vectors that have directions parallel or perpendicular to each other</p> <p>5.2 Solve <i>vector addition problems</i></p> <p>5.3 <i>Present data</i></p>

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential knowledge and level, required for this module.

Knowledge of:

- position, displacement and distance
- velocity, speed and acceleration for linear motion
- constant velocity and constant acceleration situations
- position, velocity and acceleration versus time graphs

- vector and scalar quantities
- vector components
- addition and subtraction of vectors
- relative velocities

Ability to:

- produce and use data in graph form
- use kinematic terminology appropriately
- use a scientific calculator
- operate equipment in a physics laboratory
- operate a computer to produce scientific data
- produce written reports
- give verbal presentations to a group

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Present data by using:

- appropriate S.I. units and converting where necessary
- appropriate number of significant figures

Discussion should use terms such as:

- position, displacement, distance, velocity, speed, acceleration, time, constant, decreasing and increasing

Problems may include:

- those involving velocity, speed, displacement, distance and time for an object moving with constant velocity
- those involving displacement, velocity, acceleration and time for an object moving with constant acceleration

Vector addition problems may include:

- those for two or more displacement or velocity vectors using the scale diagram and component methods
- those involving relative velocities

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

The learner must be able to:

- use kinematic terms to explain linear motion
- explain the linear motion of an object
- draw and interpret kinematic graphs
- define vector and scalar quantities
- calculate the displacement and velocity of an object in two dimensions

Context of and specific resources for assessment

- drawing materials
- scientific calculator
- physics laboratory equipped with ticker timers, linear air tracks and computer interfacing equipment with light gates and/or sonic ranger

Method of assessment

- verbal or written questioning
- verbal presentation
- practical demonstration
- research assignment
- written or verbal report

SECTION C12

VPAU074

Conduct routine electrical tests

**21857VIC Certificate III in Science
21858VIC Certificate IV in Science**

Unit Code	VPAU074
Unit Title	Conduct routine electrical tests
Unit Descriptor	This unit covers the knowledge and skills to analyse and explain the operation of simple electrical circuits, motors, generators and domestic electricity supply.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Application of the Unit	<ul style="list-style-type: none"> • This unit addresses the application of concepts of electromagnetism to explain the operation of simple devices such as generators, motors, measuring instruments and transformers. • It includes knowledge of the main features of the domestic supply and of household circuits and safety components. • The skills covered can be applied in a range of environments.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

1	Apply the concepts of charge and electric current	1.1	<i>Calculate</i> the electrical force between point charges
		1.2	Solve problems involving charge, current and time
		1.3	Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures
2	Analyse and assemble an electric circuit comprising resistive elements	2.1	Discriminate between the conducting properties of metallic conductors, intrinsic semi-conductors and insulators
		2.2	Solve problems involving potential difference, work and charge
		2.3	Solve problems to find resistance, potential difference, current and power for circuits with resistors connected in series and parallel combinations

- | | | |
|---|---|--|
| | 2.4 | Assemble a simple electrical circuit given a circuit diagram |
| | 2.5 | Measure voltage and resistance for components of a circuit |
| | 2.6 | Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |
| 3 | Apply the concepts of electromagnetism | 3.1 Demonstrate a range of magnetic fields |
| | 3.2 | Demonstrate the ways that a changing magnetic field can produce an electric current |
| | 3.3 | Explain the operation of simple devices |
| | 3.4 | Solve problems involving voltage, current and power at both input and output of a transformer |
| | 3.5 | Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |
| 4 | Explain the main features of domestic supply and household circuits and safety components | 4.1 Discuss the main components and stages of the transmission of electric power to the household |
| | 4.2 | Discuss the main components of household electric circuits |
| | 4.3 | Select the correct wire colours and pin and socket positions for the use of appliances |
| | 4.4 | Explain the operation of fuses, circuit breakers and safety switches in a household circuit |
| | 4.5 | Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

- Knowledge of:
 - elementary unit of charge
 - Coulomb's law
 - electrical current
 - conventional current flow
 - S.I. units

- difference between potential difference and electromotive force
- Ohm's law
- definition of electrical power
- difference between AC and DC
- how and why electric power is transmitted at high voltages
- Ability to:
 - record and present results accurately and clearly
 - use a scientific calculator
 - use equipment in a physics laboratory
 - critically evaluate the quality of experimental data, both during the experiment and following simple error analysis
 - analyse experimental data, drawing valid conclusions and critically evaluating experimental technique
 - list and classify the possible sources of errors encountered when making a measurement
 - compute the magnitude of an error in a single measurement when using an instrument with a graduated scale or digital display
 - calculate the relative error in a measurement given the magnitude of a measurement and the error
 - write research reports
 - give verbal presentations to a group

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

Calculate:

- using Coulomb's law

Measure:

- using a multimeter current

Range of magnetic fields may be produced by:

- a magnet
- current carrying wire
- solenoid

Simple devices may include:

- generators
- motors
- measuring instruments
- transformers

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

The learner must be able to:

- calculate the electrical force between point charges
 - solve problems involving charge, current and time
 - use appropriate S.I. units and convert where necessary
 - present data with the appropriate number of significant figures
 - assemble a simple electrical circuit
 - demonstrate the ways that a changing magnetic field can produce an electric current
 - explain the main features of domestic supply and household circuits and safety components
-
- Scientific calculator
 - Physics laboratory equipped with electrical power supplies, multimeters, various electrical components for circuit connection and electromagnetic practical kits
-
- verbal or written questioning
 - verbal presentation
 - practical demonstration
 - research assignment
 - written or verbal report

Context of and specific resources for assessment

Method of assessment

SECTION C13

VPAU075

Conduct simple activities in a biological science laboratory

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

Version 1: December 2007



Unit Code	VPAU075
Unit Title	Conduct simple activities in a biological science laboratory
Unit Descriptor	This unit covers the skills required to conduct simple activities in a biological science laboratory. It involves performing basic microscopy tasks, including specimen preparation, staining and scientific sketching.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Co-requisite Unit	This unit may be assessed with PMLOHS302A Participate in laboratory/field workplace safety.
Application of the Unit	<ul style="list-style-type: none"> The skills covered in this unit are general laboratory skills and are designed to provide an introduction to working in a scientific laboratory.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

1	Operate monocular and stereo microscopes	1.1	Perform basic cleaning and general maintenance of monocular and stereo microscopes
		1.2	Obtain <i>focussed images</i> of <i>slide specimens</i>
2	Produce scientific diagrams of slide specimens	2.1	Obtain <i>focussed images</i> of professionally prepared slide specimen
		2.2	Accurately <i>sketch</i> biological material being viewed under the microscope
3	Prepare and stain plant and animal tissue specimens for microscopic examination	3.1	Prepare dry mount slides of biological material suitable for microscopic examination as demonstrated
		3.2	Prepare unstained and stained wet mount slides of biological material suitable for microscopic examination as demonstrated

- 3.3 Prepare unstained and stained squash preparations of biological material suitable for microscopic examination as demonstrated

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Knowledge:

- function of the major components of monocular and stereo microscopes

Ability to:

- produce scientific drawing
- produce slide specimens
- use microscopes
- write reports
- give verbal presentations to a group.

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

Focussed images may be obtained using:

- scanning, low or high power microscope settings

Sketch should be done:

- in a scientific manner

Slide specimens may include:

- low and high power light and electron microscope diagrams of typical plant and animal cells, incorporating organelles

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

- This unit requires evidence that the participant can consistently (that is on a number of occasions)
- safely and correctly operate monocular and stereo microscopes
- produce correctly labeled and accurate scientific diagrams of slide specimens.

- safely and correctly prepare and stain plant and animal tissue specimens for microscopic examination according to demonstrated techniques

Context of and specific resources for assessment

- fully equipped chemistry laboratory including monocular and stereo microscopes
- professionally prepared biological slide materials
- prepared slides depicting actual biological tissue undergoing mitosis
- drawing materials

Method of assessment

- verbal or written questioning
- verbal presentation
- practical demonstration
- research assignment
- review of documentary evidence e.g. laboratory reports
- written or verbal report

SECTION C14

VPAM087

Cell biology

21857VIC Certificate III in Science
21858VIC Certificate IV in Science

MODULE DETAILS

Module Name Cell biology

Module Code VPAM087

MODULE PURPOSE To provide participants with the knowledge and skills to identify cell organelles and structures, state their functions and outline various cellular life-supporting processes.

Employability skills The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).

Summary of Learning Outcomes

1. Outline cell theory.
2. Classify living things.
3. Describe cellular processes.
4. Outline the various stages of cellular reproduction – mitosis.

Learning Outcome 1 Outline cell theory

Assessment Criteria

- 1.1 Identify that *living things* are made of cells
- 1.2 Distinguish between living and non-living things
- 1.3 Describe the three tenets of Cell Theory

Learning Outcome 2 State function of typical eukaryotic cells

Assessment Criteria

- 2.1 Distinguish between prokaryotes and eukaryotes
- 2.2 Identify typical *cell components* in *eukaryote cells*
- 2.3 Describe the function of typical *cell components*
- 2.4 Identify the main features of cell components of plants and animals
- 2.5 Describe the structures and functions of cell membranes

Learning Outcome 3 Describe cellular processes

Assessment Criteria

- 3.1 Outline the main aspects of *cellular processes*
- 3.2 Describe diffusion, osmosis and active passage across cell

membranes

3.3 Describe the metabolic pathways of cellular respiration and photosynthesis

Learning Outcome 4 Outline the various stages of cellular reproduction - mitosis

Assessment Criteria 4.1 Outline aspects of the cell cycle and apoptosis

4.2 Describe the *stages* of mitosis and meiosis

4.3 Discuss the biological significance of mitosis and meiosis

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential knowledge and level, required for this module.

Knowledge of:

- name, structure and function of cellular characteristics common to both plants and animals
- a range of the biological terms used to describe Cell Theory, cellular processes and reproduction
- terms used to classify in biology

Ability to

- locate information and prepare reports using scientific terminology

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Living things may include:

- discussion of organisation, movement, feeding, respiration, excretion, reproduction, growth and sensitivity

Cell components may include

- cytoplasm
- nucleus
- cell membrane
- ribosomes
- vacuoles
- endoplasmic reticula
- lysosomes
- protein microtubules
- basic structure of the macromolecules of cell structures

Eukaryote cells may include

- plant and animal

Cellular processes may include:

- the metabolic pathways of respiration and photosynthesis
- difference between diffusion and osmosis
- active transport
- endocytosis
- exocytosis

Stages may include:

- sequence specific stages of mitosis including interphase, prophase, metaphase, anaphase and telophase - (IPMAT)

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

- evidence must demonstrate that the participant has knowledge of Cell Theory, is able to use appropriate scientific terminology to describe and explain eukaryotic cells, cellular processes and the various stages of cellular reproduction
- evidence requirements include the presentation of information verbally and in writing

Context of and specific resources for assessment

Participants should have access to scientific texts, audio visual resources and access to the internet.

Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications.

Method of assessment

Assessment should include methods such as:

- review and analysis of written reports
- oral or written questioning
- verbal presentations using diagrams and other visual aids

SECTION C15

VPAU076

Conduct simple dissections

**21857VIC Certificate III in Science
21858VIC Certificate IV in Science**

Unit Code	VPAU076
Unit Title	Conduct simple dissections
Unit Descriptor	This unit covers the knowledge and skills to conduct simple dissections using material from available mammalian body systems.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Application of the Unit	This unit of competency covers skills and knowledge applicable to laboratory and technical work roles and a number of job roles in the health sciences. PMLOHS302A Participate in laboratory / field workplace safety is a co-requisite unit.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

1	Prepare for dissection procedures	1.1	Select <i>material from available mammalian body system</i> for dissection
		1.2	Prepare <i>equipment</i>
2	Perform a simple dissection	2.1	Follow dissection procedures
		2.2	Describe procedure and make <i>observations</i> using appropriate terminology
		2.3	<i>Record</i> observations
		2.4	Complete required clean up procedures

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Knowledge of:

- major anatomical features of the selected human/mammalian body systems
- gross physiological functions of the major anatomical structures

- diseases of body systems and functions

Ability to:

- use dissection instruments
- produce written and verbal reports
- use scientific terminology accurately in carrying out tasks

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

Material from available mammalian body system may include:

- sheep, bullock or rat body parts
- brain, heart, lungs, trachea (pluck), stomach, kidney, tongue, male and female reproductive systems

Equipment may include:

- cleaning equipment including disinfectant
- dissection kit including Dumont, Vannas Scissors, Iris Forceps, Iris Scissors, Alm Retractor, Needle Holder, Blunt Probe

Observations may include:

- to establish links between anatomical structures and functions
- healthy tissue versus diseased tissue relevant to selected diseases
- related to particular body systems

Recording observations may include:

- written report
- verbal presentation
- group presentations
- observation of practical work and/or demonstrations
- logbook of practical work

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

- The learner is able to prepare for and perform a simple dissection safely, and record observations.

Context of and specific resources for assessment

- learning and assessment should be undertaken in a fully equipped biology laboratory.
- standard laboratory equipment and protective clothing

should be available and utilised appropriately

- access to anatomical charts, models and videos
- demonstrations of dissections
- professionally prepared slide specimens of healthy tissue, relevant to the selected body systems
- learners must have access to adequate dissecting, cleaning and safety materials.

Method of assessment

- observation of practical demonstration
- logbook of practical work
- verbal and written questioning.

SECTION C16

VPAM088

Anatomy and Physiology

21857VIC Certificate III in Science

21858VIC Certificate IV in Science

MODULE DETAILS

Module Name **Anatomy and Physiology**

Module Code **VPAM088**

MODULE PURPOSE To provide students with the knowledge and skills to be able to identify and describe the physiological functions of the major anatomical features of selected body systems and to investigate diseases and treatments.

Employability Skills The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).

Co-Requisites VPAU075 Conduct simple activities in a biological science laboratory.

Summary Of Learning Outcomes

1. Describe selected body systems
2. Describe symptoms and current treatments of common diseases affecting selected body systems

Learning Outcome 1 Describe selected body systems

Assessment Criteria

- 1.1 List anatomical features of major components for the *selected body systems*
- 1.2 Outline the physiological functions of the selected body systems

Learning Outcome 2 Describe symptoms and current treatments of common diseases affecting selected body systems

Assessment Criteria

- 2.1 List symptoms of *diseases* specific to selected body systems
- 2.1 Identify current treatments of a specific disease affecting one of the selected body systems
- 2.2 Identify the changes which have occurred in healthy tissue/organs which have resulted in selected diseases

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential knowledge and level, required for this module.

- Knowledge of and ability to use scientific terminology
- Knowledge of main features of good health
- Knowledge of selected body systems
- Knowledge of common diseases and conditions
- Ability to present information verbally and in writing
- Ability to source information on human anatomy and physiology

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Selected body systems may include:

- Nervous system
- Endocrine system
- Circulatory system
- Digestive system
- Excretory system
- Respiratory system
- Muscular system
- Skeletal system
- Reproductive system

Diseases may include:

- Common diseases and conditions associated with specific body systems, e.g.
 - multiple sclerosis
 - diabetes
 - coronary heart disease
 - infertility etc.

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

Learners can identify and describe the physiological functions of the major anatomical features of a minimum of three selected body systems

Learners can investigate diseases and treatments of common diseases.

Context of and specific resources for assessment

Participants should have access to scientific texts, audio visual resources and access to the internet. Access to anatomical charts, skeletons and other visual aids is recommended.

Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications.

Method of assessment

Learning outcomes may be assessed separately or in combination with others.

Assessment should include methods such as review and analysis of

- written reports
- oral or written questioning
- verbal presentations using visual aids such as charts

Guidance for assessment

Co-delivery and assessment with VPAM087 Cell Biology and VBPAU076 Conduct simple dissections is recommended.

SECTION C17

HLTAP301A

Recognise healthy body systems in a health care context

**21857VIC Certificate III in Science
21858VIC Certificate IV in Science**

HLTAP301A

Recognise healthy body systems in a health care context

Descriptor

This unit of competency describes the basic knowledge of anatomy and physiology required to recognise body systems and their components and to identify and refer alterations associated with the functioning of the human body in the context of health care work

Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills

The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements

Application

The application of knowledge and skills described in this competency unit may relate to functions such as client questioning and documentation of information, such as medical history, using a structured technique or pro forma for gathering and recording information

Functions at this level require a broad overview of healthy functioning of the human body and practical aspects of disease management

ELEMENT

Elements define the essential outcomes of a unit of competency.

1. Apply knowledge of the basic structure of the healthy human body

2. Apply basic knowledge of factors that support healthy functioning of the body

PERFORMANCE CRITERIA

The Performance Criteria specify the level of performance required to demonstrate achievement of the Element. Terms in italics are elaborated in the Range Statement.

1.1 Use accepted health terminology to describe the normal structure, function and location of the *major body systems*

1.2 Apply a basic understanding of the fundamental principles of maintaining a healthy body

1.3 Work with knowledge of the major components of each body system and their location in relation to other structures

2.1 Work with a basic understanding of how to maintain the whole body in an overall state of health

2.2 Work with a basic understanding of the relationships between body systems required to *support healthy functioning*

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level required for this unit.

Essential knowledge:

- Basic structure and functions of the body systems and associated components, including
 - cardiovascular system
 - respiratory system
 - musculo-skeletal system
 - endocrine system
 - nervous system
 - digestive system
 - urinary system
 - reproductive system
 - integumentary system
 - lymphatic system
 - the special senses – smell, taste, vision, equilibrium and hearing
 - cells, tissues and organs
- Basic maintenance for a healthy body

Essential skills:

Ability to:

- Use and articulate accurately common health terminology related to human anatomy and physiology.
- Apply essential knowledge as outlined to own work role

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Major body systems include:

- Cardiovascular system
- Respiratory system
- Musculo-skeletal system
- Endocrine system
- Nervous system
- Digestive system
- Urinary system
- Reproductive system
- Integumentary system
- Lymphatic system
- The special senses – smell, taste, vision, equilibrium and hearing

Processes, conditions and resources required by the body to support healthy functioning may include but are not limited to:

- Body regulation including
 - maintenance of body temperature
 - body fluids (including e.g. absorption of water from digestive system, loss of water through skin, distribution of water by cardiovascular system)
 - elimination of wastes from the body
 - maintenance of blood pressure
- Protection from infection
- Physical activity – active and passive

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

Critical aspects for assessment and evidence required to demonstrate this competency unit:

- Evidence must demonstrate the individual's ability to apply their knowledge within the requirements of an identified modality of health care or support services to a specific age group.
- Consistency of application of knowledge should be demonstrated over the required range of workplace applications relevant to an identified work role.

Access and equity considerations:

- All workers in the health industry should be aware of access and equity issues in relation to their own area of work
- All workers should develop their ability to work in a culturally diverse environment
- In recognition of particular health issues facing Aboriginal and Torres Strait Islander communities, workers should be aware of cultural, historical and current issues impacting on health of Aboriginal and Torres Strait Islander people
- Assessors and trainers must take into account relevant access and equity issues, in particular relating to factors impacting on health of Aboriginal and/or Torres Strait Islander clients and communities

Context of and specific resources for assessment:

- Assessment should replicate workplace conditions as far as possible.
- Where, for reasons of safety, assessment takes place away from the workplace, simulations should be used to represent workplace conditions as closely as possible
- Resources for assessment may include access to materials and space as required to demonstrate competence, such as:
 - anatomical models, charts and/or diagrams
 - relevant technology – internet and CD-ROM
 - workplace or simulated work environment

Method of assessment:

- Assessment must include questioning (verbal and written) to address Essential Knowledge as outlined in this unit

SECTION C18

VPAU077

Apply mathematical techniques to scientific contexts

21858VIC Certificate IV in Science

Unit Code	VPAU077
Unit Title	Apply mathematical techniques to scientific contexts
Unit Descriptor	The purpose of this unit is to provide learners with knowledge and skills related to basic statistics, functions and their graphs, trigonometric graphs, exponents and logarithms and introductory calculus.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Application of the Unit	The unit covers mathematical skills and knowledge which apply to a number of science further study pathways, and work roles.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

1	Use unit circle definitions of trigonometric quantities, graphs of the three basic trigonometric functions and radian measure to solve mathematics problems	1.1	Define $\sin \theta$, $\cos \theta$ and $\tan \theta$ in terms of the unit circle and convert the ratios of a negative angle to a ratio of a positive angle
		1.2	<i>Convert an angle</i> between degrees and radian measure
		1.3	Determine the value of the three basic trigonometric ratios of any angle given in degrees or radians
		1.4	Sketch the graphs of $y = \sin x$, $y = \cos x$ and $y = \tan x$, where x is measured in degrees or radians
		1.5	Sketch the graphs of $y = a \sin bx$ and $y = a \cos bx$, giving amplitude and wavelength
2	Use simple algebraic functions and their graphs to solve mathematics problems	2.1	Solve simple problems involving direct and inverse proportion
		2.2	Given a graph, describe its general shape, rates of change, intercepts, asymptotes and give its domain and range using set notation
		2.3	Sketch the <i>graph</i> of a quadratic function

- 2.4 Determine whether a relation is a function given its graph, the set of co-ordinates which make up the relation or its *equation*
- 2.5 Solve quadratic equations graphically
- 2.6 Determine equations from graphs with known quadratic rules
- 2.7 Solve *simultaneous equations* algebraically and graphically
- 3 Determine non-linear laws by transforming them into a linear form
- 3.1 Transform a set of non-linear data to a linear form, draw the line of best fit and then determine the corresponding non-linear formula
- 4 Solve problems involving exponential and logarithmic functions
- 4.1 Simplify exponential expressions using the laws of indices
- 4.2 Solve exponential equations without using logarithms
- 4.3 Convert between exponential and logarithmic form
- 4.4 *Evaluate* logarithms
- 4.5 Solve applied problems using logarithms and simple exponential equations
- 4.6 Draw graphs of exponential functions
- 5 Collect and process numerical data to illustrate its statistical properties
- 5.1 Present statistical data graphically and pictorially
- 5.2 Use frequency distribution curves to determine numbers and/or percentage values which have a particular characteristic
- 5.3 Determine measures of *central tendency* for a given set of data, giving limitations of their use in isolation
- 5.4 Determine measures of *spread*, giving limitations of their use in isolation
- 5.5 *Determine properties* of statistical data

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

- Angle Measurement and Basic Trigonometric Graphs - unit circle (3 basic trigonometric functions), negative angles, radian measure, sketch graphs of $y = \sin x$, $\cos x$ and $\tan x$, $y = a \sin bx$ and $y = a \cos bx$ (including amplitude and wavelength).
- Functions and Their Graphs - direct and inverse proportion, sketch graphs of quadratic functions and graphs of the form:
- $y = mx + c$, $y = \frac{1}{x}$, $y = \frac{1}{x^2}$, $y = ax^2$, quadratics and cubics, with relation to general shapes, asymptotes, intercepts, rates of change etc., concept and definition of a function, solution of quadratic equations graphically, equations from graphs with known quadratic rules, simultaneous equations (quadratic plus linear) solution algebraically and graphically, line of best fit for non-linear empirical data to determine formula (e.g. plot x^2 against y).
- Exponents and Basic Logarithms - index laws, solution of simple exponential equations, conversion between exponential and logarithmic form, evaluation of natural and base 10 logarithms, evaluation of logarithms with other bases, applications (e.g. decibels and pH), graphs of exponential functions.
- Descriptive Statistics - samples and populations, sampling and methods of data collection (random, systematic, stratified and quota), sources of bias, reliability, data presentation (e.g. pictogram, pie chart, bar graph, histogram, ogive), percentages on a frequency distribution; mean, median and mode; range, variance and standard deviation; statistics functions (including graphical representation) on a calculator/computer.
- ability to use appropriate keys on a scientific calculator.

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

Convert –

- using a calculator and/or giving a radian measurement in terms of π

Angle –

- angle measure is commonly based on the amount of turn between two rays with a common point. There are three common measures of angle: fraction of a full turn, degree and radian.
- a full turn = 360 degrees = 2π radian. A half turn = 180 degrees = π radian.

Graph –

- visual representation of data or functions. Cartesian graphs of functions and relations are plots of ordered pairs of values (x, y) that represent the function or relation relative to x and y coordinate axes and the fixed origin $(0, 0)$. Statistical graphs include dot plots, box and whisker plots, bar graphs and histograms.

- Equation should be:*
- of the general form $y = mx + c$, $y = a$, $x = b$ and $y = ax^2 + bx + c$
- Simultaneous equations are:*
- quadratic plus linear
- Evaluate may include*
- with and without a calculator
- Central tendency includes*
- mean, median and mode
- Spread*
- range, variance and standard deviation
- Determine properties may include*
- using a calculator
 - computer software

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

The learner must be able to:

- apply a range of strategies and techniques to solve mathematical problems including:
 - using unit circle definitions of trigonometric quantities, graphs of the three basic trigonometric functions and radian measure to solve mathematics problems
 - using simple algebraic functions and their graphs to solve mathematics problems
 - determining non-linear laws by transforming them into a linear form
 - solving problems involving exponential and logarithmic functions
 - collecting and processing numerical data to illustrate its statistical properties
 - demonstrate estimating skills to check calculations and reasonableness of outcomes
 - use mathematical symbolism, charts, diagrams and graphs as appropriate to convey mathematical thinking and processing
 - use a scientific calculator
- Context of and specific resources for assessment**
- scientific calculator
 - real/authentic or simulated tasks, materials and texts

Method of assessment

- Oral or written questioning, online responses
- Pictures, diagrams, models created by the learner
- Practical demonstration
- Products or samples compiled by the learner with supporting documentation
- Records of teacher observations of learner's activities, discussions and practical tasks
- Self-assessment sheets, reflections, journal entries
- Written or verbal reports of investigations or problem-solving activities

SECTION C19

FDFCORWCM2A

Present and apply workplace information

21858VIC Certificate IV in Science

FDFCORWCM2A Present and apply workplace information

Unit descriptor

This is a Core unit. It covers the skills and knowledge required to identify, collect and present information to convey meaning to others.

Element	Performance criteria
1. Present information to suit workplace and audience requirements	1.1 Information requirements are identified
	1.2 Information is collected and assessed
	1.3 Information is selected and structured in a logical way to convey meaning to others
	1.4 Appropriate methods are used to communicate effectively with others
2. Respond to information requests	2.1 Information requests are processed promptly and courteously
	2.2 The nature of requests is clarified
	2.3 Appropriate information is provided in response to requests
	2.4 Information is provided in a form appropriate to the enquirer
	2.5 Requests are referred to the appropriate personnel where they fall outside area of responsibility
3. Use and maintain workplace information	3.1 A range of information sources is accessed to support work requirements
	3.2 Information is recorded in appropriate formats according to workplace reporting requirements
	3.3 Information is analysed to meet work requirements

Range statement

The range statement indicates the context for demonstrating competence. This statement is a guide and, unless otherwise indicated, items may or may not apply as required by the work context.

- Workplace information may include Standard Operating Procedures (SOPs), specifications, production schedules and instructions, signs and symbols, Materials Safety Data Sheets (MSDSs), manufacturers' advice, standard forms and reports

- Information to be accessed/conveyed may be verbal, written and/or screen based and may include symbols, charts, signs, pictures and diagrams as relevant to own work
- Typical subjects for communication include work functions, shift handovers, company policies and codes of practice, rights and responsibilities, employment conditions and entitlements
- Interactive communication processes include active listening, turn taking, questioning and tolerating the views of others, seeking and providing constructive feedback
- Recording and/or accessing information electronically does not require an understanding of the programs used and the function involves limited interaction such as simple keyboard operations. Where a more detailed understanding of the computer system is required, also refer to the optional unit TDTK197B Use information technology devices and computer applications in the workplace

Evidence guide

The assessment process must address all of the following items of evidence.

Ability to:

1. Identify and access information to undertake work responsibilities
2. Seek information from people in the workplace to support work roles and responsibilities
3. Ascertain or clarify information requirements by asking questions
4. Prepare simple written or verbal presentations that structure and present information in a logical sequence
5. Present information appropriate to audience and information purpose. This may include use of graphs and/or diagrams as appropriate. The audience may include people from diverse cultural backgrounds and with people with limited ability to speak or understand English
6. Participate with others to achieve work outcomes. This requires demonstration of interactive communication processes
7. Participate in group discussions and processes as required. This includes demonstrating active listening skills and participating constructively in discussions
8. Respect and, where appropriate, represent the views of others
9. Record information in required format/s

Knowledge of:

10. Communication channels including consultative arrangements established in the workplace

11. Common colloquial and technical terms relating to work function
12. Sources of information and advice relating to work responsibilities
13. Methods and technologies used to access, record and store workplace information including print, and screen-based systems as relevant to the workplace
14. Presentation techniques to convey information on a range of typical workplace subjects appropriate to the audience
15. Recognition of different personal communication styles and appropriate communication options
16. Recognition of cultural diversity as appropriate in the workplace
17. Reporting roles and responsibilities
18. Interpersonal skills including active listening, questioning, seeking and responding to feedback
19. Basic meeting procedures to identify and achieve meeting/discussion outcomes

Relationship with other standards

Pre-requisite units

There are no pre-requisite units for this competency standard.

Co-assessment of related units

This unit should be assessed together with other units of competence relevant to the function or work role. In addition, the following optional or ancillary units may be relevant:

- FDFZPRW1A Participate effectively in a workplace environment
- FDFOPTSD2A Work in a socially diverse environment
- TDTK197B Use infotechnology devices and computer applications in the workplace

Resources required for assessment

Assessment must occur in a real or simulated workplace where the assessee has access to:

- Advice on work roles and responsibilities
- Opportunities to interact with others using typical workplace communication processes
- Typical group forums which can include work groups and committees
- Typical workplace information
- Information systems and procedures
- Standard forms and equipment (as required) for recording workplace information

Assessment requirements

For information on how to assess this competency standard and who can assess, refer to the Assessment Guidelines for this Training Package.

SECTION C20

VPAM089

Chemical reactions

21858VIC Certificate IV in Science

MODULE DETAILS

Module Name	Chemical reactions
Module Code	VPAM089
MODULE PURPOSE	The purpose of this module is to provide learners with basic knowledge of chemical reactions so that they can explain acid-base and redox theory.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Pre-Requisites	VPAM082 Atomic structure and bonding VPAM083 Stoichiometry and solution chemistry VPAM084 Organic chemistry and properties of materials
Co-Requisites	PMLOHS302A Participate in laboratory/field workplace safety
Summary of Learning Outcomes	<ol style="list-style-type: none"> 1. Use ionic equations to represent reactions involving ions in solution. 2. Use current theories to explain acid-base behaviour. 3. Explain the pH scale. 4. Use titration results to complete concentration problems. 5. Write ionic equations to represent redox reactions. 6. Explain the operation and uses of galvanic and electrolytic cells. 7. Explain the corrosion of steel and its prevention in terms of redox theory.
Learning Outcome 1	Use ionic equations to represent reactions involving ions in solution
Assessment Criteria	<ol style="list-style-type: none"> 1.1 Define the term '<i>electrolyte</i>' 1.2 Distinguish between ionic liquids and aqueous solutions containing ions 1.3 Distinguish between ionisation and dissociation reactions 1.4 Classify electrolytes into strong or weak depending on the degree of their ionisation or dissociation

	1.5	Write <i>ionic equations</i>
Learning Outcome 2		Use current theories to explain acid-base behaviour
Assessment Criteria	2.1	List the general properties of acids and bases
	2.2	Classify common substances as acids or bases using the <i>Arrhenius</i> and <i>Lowry-Bronstead</i> theories
	2.3	Use <i>terms relevant to explaining acid-base behaviour</i>
	2.4	Explain the differences between strong and weak acids and bases
	2.5	Write stoichiometric and ionic equations for neutralisation reactions
	2.6	Write ionic equations for the ionisation reactions of common polyprotic acids
Learning Outcome 3		Explain the pH scale
Assessment Criteria	3.1	Use the ionic product of water and the pH formula to solve simple pH calculations
	3.2	Use the pH scale to classify aqueous solutions as acidic, alkaline or neutral
	3.3	Explain why aqueous solutions of some neutralisation salts are not pH neutral
Learning Outcome 4		Use titration results to complete concentration problems
Assessment Criteria	4.1	Discuss the <i>terms and equipment used in the titration technique</i>
	4.2	Calculate the concentration of an acid or base from titration results
	4.3	Draw and interpret a pH titration curve (of a strong acid and base) from experimental data
Learning Outcome 5		Write ionic equations to represent redox reactions
Assessment Criteria	5.1	Use <i>terms relevant to redox reactions</i>
	5.2	Use the activity series of metals to predict reactions between metals and water
	5.3	Write ionic equations (half and total) for <i>simple redox reactions</i>
Learning Outcome 6		Explain the operation and uses of galvanic and electrolytic cells

Assessment Criteria	6.1	Identify the parts of an electrochemical (galvanic) cell
	6.2	Make <i>predictions</i> as to the behaviour of electrochemical cells
	6.3	Identify the parts of an electrolytic cell and explain the differences between an electrochemical and electrolytic cell
	6.4	Write ionic equations (half and total) for simple electrolytic processes.
Learning Outcome 7	Explain the corrosion of steel and its prevention in terms of redox theory	
Assessment Criteria	7.1	List the conditions needed for corrosion
	7.2	Use redox theory and ionic equations to explain the corrosion of steel and its prevention

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential knowledge and level, required for this module.

Knowledge of

- ionic equations
- acid-base theories
- strengths of acids and bases
- titration calculations
- pH scale
- redox reactions

Ability to

- produce a written or verbal report using scientific information
- discuss chemical concepts and processes using scientific terminology
- use equipment and resources safely in a chemical laboratory

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Electrolyte may be:

- liquid e.g. ionic liquids, aqueous solutions containing ions
- solid e.g. ceramic fuel cell

Ionic equations may be for:

- ionisation and dissociation

- precipitation (association) reactions
 - production of H_3O^+ (aq) or OH^- (aq) in water
 - proton transfer
 - hydrolysis
 - amphoteric (amphiprotic) substance
 - conjugate acid and base
 - pipette, burette, volumetric flasks, aliquot, titre, end point, indicator, standard solution
 - oxidation, reduction, redox, reductant (reducer) and oxidant (oxidiser)
 - metal displacement reactions
 - oxidation, reduction, redox, reductant (reducer) and oxidant (oxidiser)
 - determining the anode and cathode
 - direction of electron and ionic flows
 - reactions occurring at each electrode
 - total cell reaction
 - polarity of the electrodes
 - maximum voltage (emf) the cell may produce
- Arrhenius* theory:
- Lowry-Bronstead* theory:
- Terms relevant to explaining acid-base behaviour* may include:
- Terms and equipment used in the titration technique* may include:
- Terms relevant to redox reactions* may include:
- Simple redox reactions* may include:
- Predictions* may include:

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

The learner must be able to:

- use ionic equations to represent reactions involving ions in solution
- use current theories to explain acid-base behaviour
- explain the pH scale
- use titration results to complete concentration problems
- write ionic equations to represent redox reactions
- explain the operation and uses of galvanic and electrolytic cells

**Context of and specific resources
for assessment**

Method of assessment

- explain the corrosion of steel and its prevention in terms of redox theory
- drawing materials
- fully equipped chemical laboratory
- verbal or written questioning
- verbal presentation
- practical demonstration
- research assignment
- written or verbal report

SECTION C21

VPAU078

Apply dynamics and conservation principles

21858VIC Certificate IV in Science

Unit Code	VPAU078
Unit Title	Apply dynamics and conservation principles
Unit Descriptor	This unit covers the knowledge and skills to apply dynamics and conservation principles to an object and/or system.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Pre-requisite Units	VPAM086 Kinematics
Application of the Unit	This unit addresses the application of dynamics and conservation principles including Newton's laws of motion, the work-energy principle, the conservation of energy principle, the impulse-momentum equation, conservation of momentum principle and the principle of moments.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

- | | | | |
|---|---------------------------------|-----|--|
| 1 | Apply Newton's laws of motion | 1.1 | Demonstrate one proportionality from Newton's second law of motion |
| | | 1.2 | Calculate using vectors the net force on an object when forces such as weight, friction and applied forces are acting |
| | | 1.3 | Apply Newton's second law to determine the mass, force or acceleration of an object |
| | | 1.4 | Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |
| 2 | Apply the work-energy principle | 2.1 | Calculate the kinetic energy of an object given the mass and the velocity |
| | | 2.2 | Apply the work-energy equation to determine the work or change in kinetic energy of an object |
| | | 2.3 | Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |

- | | | |
|---|---|---|
| 3 | Apply the <i>conservation of energy principles</i> | 3.1 Calculate gravitational potential energy given mass and height |
| | | 3.2 Demonstrate that the gain (or loss) in potential energy equals the loss (or gain) in kinetic energy when friction is negligible |
| | | 3.3 Calculate the transfer of energy to heat when friction cannot be neglected |
| | | 3.4 Apply the law of conservation of energy to determine relevant quantities |
| | | 3.5 Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |
| 4 | Apply the <i>impulse-momentum equation</i> | 4.1 Calculate the impulse on an object when a force is applied for a certain time |
| | | 4.2 Calculate the momentum of an object given the mass and the velocity |
| | | 4.3 Apply the impulse-momentum equation to determine relevant quantities in one-dimensional situations |
| | | 4.4 Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |
| 5 | Apply the conservation of momentum principle | 5.1 Apply the law of conservation of momentum to determine the mass or velocity of an object in a one-dimensional collision |
| | | 5.2 Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |
| 6 | Apply the principle of moments | 6.1 Use <i>levers</i> to demonstrate the principle of moments |
| | | 6.2 Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |
| 7 | Investigate energy resources | 7.1 List various forms of energy resources and discuss how efficient these are for commercial electricity supply |
| | | 7.2 Identify and discuss various methods of energy conservation |
| | | 7.3 Use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures |

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Knowledge of:

- Newton's three laws of motion
- ability to distinguish between the weight and mass of an object
- definition of work and energy
- definition of potential energy
- definition of impulse and momentum
- law of conservation of momentum
- definition of the moment of force
- definition of the principles of moments

Skills:

- ability to analyse experimental data, drawing valid conclusions and critically evaluating experimental technique
- ability to list and classify the possible sources of errors encountered when making a measurement
- ability to compute the magnitude of an error in a single measurement when using an instrument with a graduated scale or digital display.
- ability to calculate the relative error in a measurement given the magnitude of a measurement and the error
- ability to use a scientific calculator

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

Energy conservation principles
may include

- everyday physical observations
- human body movements
- vehicle observations

Applications of the impulse-momentum
may include

- everyday physical observations
- human body movements
- vehicle observations
- sporting movements and actions

Levers
may include

- human body movements
- engineering equipment
- construction equipment

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

The learner must be able to:

- demonstrate one proportionality from Newton's second law of motion
- calculate using vectors the net force on an object when forces such as weight, friction and applied forces are acting
- apply Newton's second law to determine the mass, force or acceleration of an object
- calculate the kinetic energy of an object given the mass and the velocity
- apply the work-energy equation to determine the work or change in kinetic energy of an object
- calculate gravitational potential energy given mass and height
- demonstrate that the gain (or loss) in potential energy equals the loss (or gain) in kinetic energy when friction is negligible
- calculate the transfer of energy to heat when friction cannot be neglected
- apply the law of conservation of energy to determine relevant quantities
- calculate the impulse on an object when a force is applied for a certain time
- calculate the momentum of an object given the mass and the velocity
- apply the impulse-momentum equation to determine relevant quantities in one-dimensional situations
- apply the law of conservation of momentum to determine the mass or velocity of an object in a one-dimensional collision
- use levers to demonstrate the principle of moments
- use appropriate S.I. units and convert where necessary, presenting data with the appropriate number of significant figures
- identify and discuss various methods of energy conservation

Context of and specific resources for assessment

- Scientific calculator
- Physics laboratory equipped with ticker timers, linear air tracks and computer interfacing equipment with light gates and /or sonic ranger

Method of assessment

- Review of data records prepared by the candidate, such as counts, observations, results
- verbal or written questioning
- verbal presentation
- Practical demonstration
- Research assignment
- Written or verbal report

SECTION C22

VPAU079

Operate simple analogue and digital electronic circuits

21858VIC Certificate IV in Science

Unit Code	VPAU079
Unit Title	Operate simple analogue and digital electronic circuits
Unit Descriptor	This module provides students with knowledge and skills to assemble, analyse and explain the operation of simple analogue and digital electronic circuits.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Pre-requisite Units	VPAU074 Conduct routine electrical tests
Application of the Unit	This unit addresses the application of operating analogue and digital electronic circuits using an appropriate variety of instruments and electronic components

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

1	Analyse an electrical signal	1.1	Use a cathode ray oscilloscope to measure peak to peak voltage, peak voltage and period of a signal
		1.2	Calculate the frequency of a signal
		1.3	Calculate the RMS voltage for a sinusoidal signal
2	Analyse the operation of a DC CR series circuit	2.1	Calculate the capacitance of a capacitor
		2.2	Calculate the potential difference and charge stored on a capacitor
		2.3	Calculate the time constant for a CR circuit and predict the extent of charging of the capacitor
		2.4	Distinguish between the operation of a CR circuit with AC and DC
3	Analyse the operation of diodes and transistors in electronic circuits	3.1	Distinguish between a diode in forward bias and reverse bias
		3.2	Determine the current and potential difference across components in a circuit containing a diode or LED

- | | | |
|---|---|---|
| | 3.3 | Calculate current and voltage in parts of a common emitter circuit |
| | 3.4 | Calculate the current gain for a common emitter circuit |
| | 3.5 | Distinguish between amplifying and switching modes of a transistor circuit |
| 4 | Analyse the operation of a DC power supply | 4.1 Describe the operation of diodes in the half wave rectifier and the full wave bridge rectifier |
| | 4.2 | Illustrate graphically the voltage signal at each stage of a DC power supply |
| | 4.3 | Discuss the effect of different size capacitors on the ripple component of a voltage |
| 5 | Analyse the logic levels in circuits made up of logic gates | 5.1 Express the <i>logic output of the logic gates</i> |
| | 5.2 | Identify the correct circuit symbols for logic gates |
| | 5.3 | Determine the logic levels at points in circuits made up of logic gates |
| | 5.4 | Determine graphically the output of a simple logic gate circuit given timing diagrams for the inputs |
| | 5.5 | Assemble logic gate circuits using <i>integrated circuit packages</i> and demonstrate the output |
| 6 | Analyse the operation of an adder | 6.1 Identify the inputs and outputs of a half adder and a full adder |
| | 6.2 | Determine logic outputs of a half and a full adder |
| | 6.3 | Determine the logic levels at various points on a logic gate representation of a full adder |
| | 6.4 | Determine the logic levels at various points on a four-bit adder |
| 7 | Analyse the operation of the SC, JK and D flip flops as components of latches, counters and shift registers | 7.1 Determine the outputs of the SC (set-clear) flip flop for a given sequence of inputs |
| | 7.2 | Differentiate between positive edge triggered and negative edge triggered flip flops |
| | 7.3 | Determine the outputs of a JK flip flop for a given sequence of inputs |
| | 7.4 | Determine the outputs of a D flip flop for a given sequence of inputs |

	7.5	Determine the counting sequence of a counter made up of a particular configuration of JK or D flip flops
	7.6	Determine the logic outputs of a shift register made up of D flip flops for a given sequence of inputs and clock pulses
8	Assemble and analyse the operation of a simple electronic circuit	8.1 Assemble a <i>simple electronic circuit</i> and demonstrate the operation of the circuit
		8.2 Measure current, voltage, power and signal characteristics at various points of the circuit
		8.3 Report the results of the analysis of the circuit

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Knowledge of:

- main components of the cathode ray oscilloscope
- operation of the main components of the cathode ray oscilloscope
- components of a bipolar junction transistor
- components of a DC power supply
- definition of the terms: rectification, filtering, voltage regulation
- how the SC flip flop can be used as a latch

Ability to

- assemble electrical components correctly in electrical circuits
- use a scientific calculator
- use equipment safely in a physics laboratory
- use computer software packages for simulations

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

Logic output of the logic gates may be:

- AND, NAND, OR, NOR, NOT and XOR for all possible inputs

Integrated circuit packages may be:

- a package such as the TTL 7400 series

Simple electronic circuit may:

- comprise a number of discrete electronic components and/or integrated circuits

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

The learner must be able to demonstrate the appropriate use of a cathode ray oscilloscope to analyse an electrical signal

The learner must be able to assemble, use and analyse the operation of:

- a DC CR series circuit
- diodes and transistors in electronic circuits
- a DC power supply
- an adder
- the SC, JK and D flip flops as components of latches, counters and shift registers
- a simple electronic circuit

- The learner must be able to assemble, use and analyse the logic levels in circuits made up of logic gates.

Context of and specific resources for assessment

- Scientific calculator
- Formula sheets
- Physics laboratory equipped with electrical power supplies, cathode ray oscilloscopes, signal generators, multimeters, soldering irons, PCB stands, solder suckers, and various electronic components for circuit connection
- Computers with software package which enables electronic circuit simulations e.g. Crocodile Clips

Method of assessment

- Verbal or written questioning
- Verbal presentation
- Practical demonstration
- Research assignment
- Written or verbal report

SECTION C23

VPAM090

Introductory genetics

21858VIC Certificate IV in Science

MODULE DETAILS

Module Name **Introductory genetics**

Module Code **VPAM090**

MODULE PURPOSE The purpose of this module is to provide learners with knowledge of the key elements of genetically-related phenomena including DNA structure, function and replication; chromosomes; and genes.

Employability skills The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).

Summary of Learning Outcomes

1. Explain the relationship between genes, chromosomes, DNA and RNA.
2. Explain sex determination.
3. Explain types and causes of genetic mutation and chromosomal disorders.
4. Analyse and explain Mendel's laws of inheritance.
5. Define the process and significance of the process of meiosis.
6. Discuss procedures and issues in current genetic engineering techniques.

Learning Outcome 1 Explain the relationship between genes, chromosomes, DNA and RNA

Assessment Criteria

- 1.1 Define the terms 'DNA', 'chromosome' and 'gene'
- 1.2 Describe the *functions and structure* of genes, chromosomes, DNA and RNA

Learning Outcome 2 Explain sex determination

Assessment Criteria

- 2.1 Outline and *demonstrate* the steps involved in determining the sex of human beings
- 2.2 Outline the steps involved in determining the sex of birds
- 2.3 Outline the steps involved in determining the sex of bees

Learning Outcome 3	Explain types and causes of genetic mutation and chromosomal disorders
Assessment Criteria	<p>3.1 Define the terms genetic mutation and chromosomal disorder</p> <p>3.2 Classify <i>mutation types</i></p> <p>3.3 List <i>causes</i> of increased mutation rates</p>
Learning Outcome 4	Analyse and explain Mendel's laws of inheritance
Assessment Criteria	<p>4.1 Define important relevant <i>genetic terms</i></p> <p>4.2 Outline Mendelian laws</p> <p>4.3 Illustrate laws of inheritance using appropriate terminology</p>
Learning Outcome 5	Define the process and significance of the process of meiosis
Assessment Criteria	<p>5.1 Outline <i>key stages</i> in the process of meiosis</p> <p>5.2 Use diagrams to support definition</p> <p>5.3 Use examples to illustrate biological significance of the process of meiosis</p>
Learning Outcome 6	Discuss procedures and issues in current genetic engineering techniques
Assessment Criteria	<p>6.1 Define <i>key terms</i> related to genetic engineering</p> <p>6.2 Explain <i>procedures</i> used in genetic engineering</p> <p>6.3 Give examples of <i>issues</i> surrounding emerging genetic technologies</p>

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential knowledge and level, required for this module.

Knowledge of:

- relevant scientific terminology related to genetics
- genetic processes
- laws of inheritance
- mutations
- genetic engineering

Ability to

- construct and interpret scientific charts and diagrams related to genetics
- analyse and discuss issues related to genetic disorders and genetic engineering
- use literacy skills to conduct research into key topics in genetics
- use literacy skills to present written reports
- use communication skills to present scientific information
- use computing skills related to research and presentation
- produce charts and visuals related to genetics

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Functions and structure may include:

- the structure of DNA
- four nucleotide bases pairs ---> A-T, C-G
- biological function of DNA, chromosomes and genes
- main differences/similarities between DNA, chromosomes and genes
- steps involved in the replication of DNA
- structure and function of RNA
- major steps and ultimate outcome of the protein synthesis process

Demonstration may include:

- constructing a model human (male and female) karyotype of chromosomes

Mutation types may include:

- base substitution, frame shift, deletion
- several human conditions resulting from chromosomal disorders: Turner Syndrome, Down Syndrome, Klinefelter Syndrome etc.
- mutation effects in the process of protein synthesis

Causes may include:

- mutagens

Genetic terms may include:

- allele
- phenotypes, genotypes
- dominant, recessive, gene pairs
- linked, autosome or sex chromosome
- homozygous, heterozygous, mono and dihybrid crosses etc.

Outline of Mendelian laws may include explanation and examples of:

- Mendelian-based genetic problems
- Mendelian traits e.g. sickle-cell anemia, Tay-Sachs disease, cystic fibrosis and xeroderma pigmentosa. mendelian traits
- the laws of segregation and independent assortment

Illustration may include:

- various animal and human pedigree charts to illustrate mode of inheritance and possible genotypes of specific individuals in a pedigree
- construction of a simple pedigree chart for learners own family
- labelled diagrams

Key stages include:

- interphase I, prophase I, metaphase I, anaphase I and telophase I - IPMAT I + (MAT II)

Key terms may include:

- restriction enzymes
- PCR
- gene probes
- genetic engineering, genetically modified organisms
- clones, gene therapy
- DNA fingerprinting

Procedures may include:

- current uses of bacterial restriction enzymes
- separation of DNA fragments
- genetic cloning

Issues may include:

- ethical
- social
- legal

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

- evidence must demonstrate that the participant has knowledge of key aspects of genetics, is able to use appropriate scientific terminology to describe and present information on genetic processes, laws of inheritance, mutations and is able to present and discuss issues related to genetic engineering
- evidence requirements include the presentation of information in diagrammatic form as well as verbally and in writing

Context of and specific resources for assessment

Participants should have access to scientific texts, audio visual resources, charts and sample/models and to the internet.

Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications

Method of assessment

Learning outcomes may be assessed separately or in combination with others.

A range of suitable assessment methods can include:

- direct observation of practical work and/or demonstrations
- review of logbook of practical work/investigation/research activities
- analysis of laboratory reports
- review and analysis of written reports
- verbal or written questioning
- direct observation of verbal presentations/PowerPoint presentations

SECTION C24

VPAM091

Ecology

21858VIC Certificate IV in Science

MODULE DETAILS

Module Name Ecology

Module Code VPAM091

MODULE PURPOSE To provide students with the knowledge and skills to be able to recall and apply key principles underpinning issues of concern about any specific type of environment.

Employability skills The required outcomes described in this unit of competency contain applicable facets of Employability skills. The qualification's employability Skills Summary in which this unit is included, will assist in identifying employability skill requirements.

Summary Of Learning Outcomes

1. Identify and explain the levels of classification used in plant and animal taxonomy.
2. Outline the general characteristics of ecosystems
3. Interpret food chains and webs, illustrating energy flow and nutrient recycling through living systems.
4. Discuss key issues involved in major current ecological problems caused by humans

Learning Outcome 1 Identify and explain the levels of classification used in plant and animal taxonomy

Assessment Criteria

- 1.1 Name the *major levels of classification* used in plant and animal classification
- 1.2 Summarise the scientific requirements needed for two organisms to be placed into the same species.
- 1.3 Demonstrate the correct use of classification keys - both plant and animal.

Learning Outcome 2 Outline the general characteristics of ecosystems

Assessment Criteria

- 2.1 State the *major components and terminologies* associated with of any type of ecosystem
- 2.2 Identify the biotic and abiotic features and other major components in specific ecosystem contexts.

Learning Outcome 3	Interpret food chains and webs, illustrating energy flow and nutrient recycling through living systems
Assessment Criteria	<p>3.1 Categorise specific features and major components of food chains and webs.</p> <p>3.2 Define energy flow through an ecosystem.</p> <p>3.3 List the different types of special symbiotic relationships that can occur within any ecosystems.</p> <p>3.4 Illustrate energy flow through an ecosystem.</p>
Learning Outcome 4	Discuss key issues involved in major current ecological problems caused by humans
	<p>4.1 Identify the key issues surrounding an ecological problem caused by human activity.</p> <p>4.2 Provide a detailed description of a major ecological problem and its environmental impact using appropriate scientific terminology.</p>

REQUIRED SKILLS AND KNOWLEDGE

This provides a summary of the essential knowledge and level, required for this module.

Knowledge of

- levels of classification used in plant and animal taxonomy
- general characteristics of eco systems
- features and components of food chains and webs
- terminology related to ecology

Ability to

- discuss current ecological issues
- use scientific terminology accurately
- present information in verbal, diagrammatic and written formats

RANGE STATEMENT

The Range Statement relates to the module as a whole. It allows for different work environments and situations that may affect performance.

Major levels of classification may include

- kingdom, phylum (division), class, order, family, genus and species.

Major components and terminologies may include

- niche, community, population, biotic and abiotic factors, competition, symbiosis etc.

Food chains and webs may include

- aquatic, marine and terrestrial

Illustration may be through

- constructing aquatic, marine or terrestrial food chains and web

Major current ecological problems may include

- global warming
- land degradation
- air, water or land pollution
- biomagnification of poisons
- salinity

Environmental impact may include

- horticultural / food production
- water supply
- disease
- erosion
- salination

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Learning Outcomes, Assessment Criteria, Required Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate the achievement of the learning outcomes of this module

- evidence must demonstrate that the participant has knowledge of the classifications used in plant and animal taxonomy, can outline the general characteristics of ecosystems including food chains and webs, and is able to discuss issues involved in current ecological problems
- evidence requirements include the presentation of information in diagrammatic form as well as verbally and in writing

Context of and specific resources for assessment

Participants should have access to scientific texts, audio visual resources, charts and sample/models and to the internet.

Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications

Method of assessment

Learning outcomes may be assessed separately or in combination with others.

A range of suitable assessment methods can include:

- direct observation of practical work and/or demonstrations
- review of logbook of practical work/investigation/research activities
- analysis of laboratory reports
- review and analysis of written reports
- oral or written questioning
- direct observation of verbal presentations/PowerPoint presentations

SECTION C25

VPAU080

Conduct routine water quality tests

21858VIC Certificate IV in Science

Unit Code	VPAU080
Unit Title	Conduct routine water quality tests
Unit Descriptor	This unit covers the skills and knowledge to conduct routine water quality tests.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Application of the Unit	<ul style="list-style-type: none"> Apply practical skills and knowledge to perform chemical and other testing procedures to measure water quality.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

1	Measure water quality under laboratory conditions	1.1	Perform a <i>range of chemical tests</i> to measure water quality, under laboratory conditions
		1.2	Record and analyse test results
		1.3	<i>Report</i> findings
2	Measure water quality in a local setting	2.1	Collect water samples from a <i>local waterway</i>
		2.2	Conduct a <i>range of chemical tests</i> on the water samples
		2.3	Record and analyse chemical data obtained from the samples, to determine the quality of the water
		2.4	<i>Report</i> on procedures and findings of the water quality tests

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Knowledge of:

- scientific terminology and formulas
- definition of water quality

- general characteristics of ecosystems
- ecological implications of environmental effects e.g. water or land pollution, biomagnification of poisons, salinity

Ability to

- identify ecosystems characteristics in specific contexts.
- use a water testing kit
- use equipment in a biological laboratory
- produce verbal and written reports and presentations
- produce and present data in appropriate form

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

Range of chemical tests may include:

- dissolved O₂
- dissolved CO₂
- dissolved nitrates
- dissolved phosphates
- pH
- turbidity
- temperature

Report may include:

- written log sheet/lab report
- verbal presentation using visual aids
- discussion of findings using scientific terminology
- discussion of implications of water quality for a range of contexts

Local waterway may include:

- creek, stream, river or beach

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

The learner must be able to:

- perform a range of chemical tests to measure water quality, under laboratory conditions and analyse the results
- conduct a range of chemical tests on collected water samples and analyse the results

Context of and specific resources for assessment

- Fully equipped biology laboratory
- Water testing kits

Method of assessment

- review of data records prepared by the candidate, such as counts, observations, results
- verbal or written questioning
- verbal presentation
- research assignment
- written or verbal report.

SECTION C26

PMLTEST305B

Perform aseptic techniques

21858VIC Certificate IV in Science

Unit Code	PMLTEST305B
Unit Title	Perform aseptic techniques
Unit Descriptor	<p>This unit of competency covers the ability to perform aseptic techniques to maintain the integrity of both the sample source and the sample. It applies to sampling techniques in tissue culture and to generic microbiological procedures.</p> <p>This unit of competency has no prerequisites.</p> <p>This unit of competency is applicable to laboratory assistants and technicians working in the field or laboratory in the biomedical, biology, food and beverage and environmental sectors of the industry.</p> <p>Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These are found at the end of this unit of competency under the section 'This competency in practice'.</p>
Unit Sector	No sector assigned.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

- | | | |
|---|--|--|
| 1 | Prepare for aseptic sampling or transfer | <p>1.1 Ensure that any sampling procedure conforms with the requirements of the sampling plan</p> <p>1.2 Use specified personal protective clothing and equipment</p> <p>1.3 Prepare the work area for safe and effective sample transfer</p> <p>1.4 Select equipment and materials specified by the procedure</p> <p>1.5 Organise equipment to minimise contamination during manipulations</p> <p>1.6 Label containers for clear identification</p> <p>1.7 Record details in relevant log or database</p> |
| 2 | Transfer materials aseptically | <p>2.1 Protect the integrity of the sample source by sterilising the sampling site and flaming the mouth of transport or culture vessel</p> |

- 2.2 Sterilise inoculating loops and/or pipette where used to prevent contamination
- 2.3 Perform transfer while utilizing opportunities for contamination and cross-infection
- 2.4 After transfer, and before sealing the transport or culture vessel flame the vessel mouth to maintain sterility
- 2.5 Re-sterilise inoculating loops, utilizing the generation of aerosols
- 2.6 Streak plate inoculations to utilize potential for single colony growth and to avoid contamination
- 2.7 Label transport or culture vessels for clear identification
- 3 Maintain work area and equipment to prevent cross-infection and contamination
 - 3.1 Place disposable and reusable items into relevant receptacles
 - 3.2 Clean and disinfect work area and equipment after use
 - 3.3 Transport disposable and reusable contaminated materials to relevant areas for disinfection, utilization and cleaning or disposal.

KEY COMPETENCIES

The seven key competencies represent generic skills considered for effective work participation. The bracketed numbering against each of the key competencies indicates the performance level required in this unit. These are stand-alone levels and do not correspond to levels in the Australian Qualifications Framework (AQF).

Level (1) represents the competence to undertake tasks effectively

Level (2) represents the competence to manage tasks

Level (3) represents the competence to use concepts for evaluating and reshaping tasks.

Key Competency	Performance Level
Communicating ideas and information	1
Collecting, utilizing and utilizing information	1
Planning and utilizing activities	2
Working with others and in teams	1
Using mathematical ideas and techniques	1
Solving problems	1
Using technology	1

RANGE STATEMENT

The range of variables relates to the unit of competency as a whole. It allows for different work environments and situations that will affect performance.

Where reference is made to industry Codes of Practice, and/or Australian/international standards, it is expected the latest version will be used.

Personnel work in accordance with work instructions and standard operating procedures which incorporate all relevant aspects of OHS legislation and the codes, guidelines, regulations and Australian standards applying to environmental hazards and dangerous goods.

Regulations, codes and standards may include

- AS/NZ 2243.3 Safety in laboratories, Part 3 – Microbiology
- AS 2500 Storage of goods
- AS 2503 Safety storage and handling information cards
- AS 2982 Hand washing facilities
- SAA HB9 Occupational personal protection, and other relevant standards for protective, clothing (for example, AS 2161, AS 2210, AS 1337 and AS 1338)
- AS 4187 Code of Practice for cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities
- Food Standards Code Australia and New Zealand.

Facilities, equipment and processes would conform to the recommendations of AS/NZ 2243.3 Safety in laboratories, Part 3- Microbiology, and National Health and Medical Research Council guidelines on infection control.

Personal protective equipment may include

- gloves, safety glasses, goggles, face guards, coveralls, gowns, body suits, respirators
- biohazard containers and laminar flow cabinets.

Aseptic sampling and transfers will typically involve accessing a sample source, using specified equipment to remove a sample and transferring it to a specified vessel without

- contamination of the sample source
- contamination of the sample
- cross contamination
- contamination of the workplace.

Sampling transfers may include sample pot and transfer media and the subculturing and/or passaging of culture to

- sterile broth
- media for isolation of colony
- tissue culture media
- media for continuous culture systems.

Samples could include

- body fluids and liquids
- water and soil
- sterile pharmaceuticals
- yeasts and moulds
- milk and yoghurt
- swabs and smears
- propagation tissue
- plant material
- fermented foods and beverages.

Equipment may include

- transfer equipment, such as inoculating loops, pipettes (quantitative and qualitative), flasks, tubes and spatulas
- steril burners and bench incinerators
- anaerobic jars
- incubators, waterbaths, refrigerators, freezers and possibly dry ice and liquid nitrogen cylinders
- laminar flow units and biohazard cabinets
- autoclave or pressure cooker
- swabs
- continuous culture systems.

The range of material may involve

- solid and/or liquid media
- supplied media, such as media manufactured in the enterprise or raw material supplies for media
- disinfecting and sterilizing agents and materials, such as methylated spirits, ethanol and ether
- disposable equipment and clothing
- tissue culture media
- growth media in broths, plates, deeps or slopes
- receptacles for safe disposal of wastes and for processing of reusable materials
- bar coding material and labels.

Sterilisation techniques could include autoclaving, steam and membrane filtration, boiling, microwaving, radiation, high temperature, high pressure steam, gas and chemical treatments.

Hazards may include

- accessing the sample from difficult or dangerous areas
- dry ice and liquid nitrogen vapour
- UV light sources
- heat from bunsen burners
- molten agar
- sharps
- hazardous substances and/or infectious agents.

Workplace information may include

- standard operating procedures (SOPs)
- specifications for safe waste disposal of biohazardous materials
- production schedules and instructions
- work notes
- material safety data sheets (MSDSs)
- manufacturer's instructions
- verbal instructions from laboratory manager, supervisor or senior technician
- guidelines for small scale genetic manipulation work.

It is expected that all procedures, including recording of samples, operation of equipment and cleaning/decontamination will be carried out according to established laboratory procedures and these may vary across sectors. All sterilising equipment must meet state OHS legislation for pressure equipment. All samples and wastes must be handled in accordance with OHS and environmental guidelines and Australian Standard AS 2243.3.

Health, safety and environment

All operations to which this unit applies are subject to stringent health, safety and environmental (HSE) requirements, which may be imposed through State or Federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between performance criteria and HSE requirements, the HSE requirements take precedence.

All operations assume the potentially hazardous nature of samples and require standard precautions to be applied. Users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council and State and Territory Departments of Health. All operations are performed in accordance with standard operating procedures.

EVIDENCE GUIDE

The Evidence Guide describes the underpinning knowledge and skills that must be demonstrated to prove competence.

Critical aspects of competency

Competency must be demonstrated in the ability to perform consistently at the required standard. In particular, assessors should look to see that the candidate:

- prevents cross contamination of sample source and sample
- manipulates equipment to prevent contamination of culture medium during transfer
- sterilises equipment as required to prevent cross contamination of work area, personnel and environment.

Underpinning knowledge

Competency includes the ability to apply and explain:

- principles of infection control related to occupational health and safety, sampling and transfer of materials in microbiological investigations
- disinfection and sterilisation procedures used in the collection, processing and safe disposal of samples and materials
- importance of pure culture techniques and aseptic transfer to the successful microbiological investigation and correct interpretation of laboratory results
- growth requirements of micro-organisms (bacteria, fungi, protozoans, viruses and multicellular parasites) in terms of their laboratory culture
- effects of physical and chemical agents on microbial growth and death.

The candidate must be able to follow defined OHS policies and procedures. In some instances the candidate may also need to apply:

- environmental requirements
- infection control procedures
- food safety principles
- relevant health, safety and environment requirements.

Specific industry

Additional knowledge requirements may apply for different industry sectors. For example, for the food processing industries:

- food spoilage symptoms
- beneficial/detrimental organisms relevant to specific food industry sector.

Assessment context and methods

This unit of competency is to be assessed in the workplace or simulated workplace environment.

The following assessment methods are suggested:

- review of quality assurance results and examination of samples transferred by the candidate
- observation of the candidate successfully transferring a range of samples
- written and/or oral questioning to assess underpinning knowledge (questioning will be appropriate to the language and literacy levels of the candidate).

In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly.

Questioning techniques should suit the language and literacy levels of the candidate.

Interdependent assessment of unit

This unit of competency may be assessed with:

- PMLOHS302A Participate in laboratory/field workplace safety.

Resource implications

Resources may include:

- standard laboratory with appropriate equipment and materials
- enterprise procedures and standard methods
- material safety data sheets (MSDSs).

This competency in practice

Food processing

As part of the quality assurance program at an ice-cream manufacturer, six ice-creams were removed from the production line, placed in sterile bags and then stored in a freezer in the microbiology laboratory. Later in the morning, the laboratory assistant removed the samples from the freezer, registered the samples with the date received and test code and signed the register book. She/he then placed the samples in a water bath set at 42 DegreesC. While the samples were melting, the laboratory assistant labelled the respective agar plates with the registered codes. Using aseptic techniques she/he carefully transferred 1ml of ice-cream mix into the total plate count agar. The plates were then placed in the incubator. The final results were noted and recorded.

Biomedical

In preparation for antibiotic sensitivity testing and biochemical identification of presumed pathogenic bacteria, a technical assistant was asked to prepare a sterile peptone suspension of a lactose fermenting colony. The colony had been previously identified by the supervisor on a MacConkey's agar plate. The assistant labelled a 5mL tube of peptone broth with the sample number and a code for the identified colony and then donned a pair of disposable gloves. Bringing the labelled tube and the MacConkey's plate near to the Bunsen, she/he took an inoculating loop and sterilised it in the incandescent flame. She/he carefully cooled the loop in a sterile area of the agar and gently scraped off half the colony. With the other hand, and in the vicinity of the heated air of the Bunsen, she/he removed the cover of the peptone tube in her/his crooked finger. In a continuous and coordinated way she/he flamed the lip of the tube and emulsified the colony in the broth. She/he then flamed the lip of the tube and replaced its cover. Finally, the technical assistant resterilised the inoculating loop by introducing and holding it in the bunsen flame to minimise the generation of bacterial aerosols.

SECTION C27

MEM30012A

Apply mathematical techniques in a manufacturing, engineering or related environment

21858VIC Certificate IV in Science

MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment

Unit descriptor	This unit covers applies the <i>concepts of mathematics</i> to appropriate and simple engineering situations within the individual's area of engineering expertise.
Prerequisites	None
Competency field	Engineering technician
Application of the competency	This unit applies to technician level work that requires basic algebraic, trigonometric and statistical knowledge and skill.
Related units	None
Band	None
Unit weight	4
Notes	There are no notes for this unit.

Elements Elements are the essential outcomes of the unit of competency.	Performance criteria Together, performance criteria specify the requirements for competent performance. Text in italics is explained in the range statement following.
1 Use concepts of arithmetic in the solution of engineering problems	1.1 Units of physical quantities are converted to facilitate engineering calculations. 1.2 Calculations are performed to solve problems involving rational and irrational numbers. 1.3 Scientific notation is used to represent numbers. 1.4 Calculations are checked for reasonableness using estimating and approximating techniques.
2 Solve engineering problems involving algebraic expressions with one independent variable	2.1 Algebraic expressions are manipulated using mathematical operations in their <i>correct order</i> .
3 Use two-dimensional geometry to solve practical problems	3.1 Angles expressed in degrees are correctly converted to radians and vice versa. 3.2 The perimeter, area, length and angles of a range of two-dimensional figures are correctly calculated. 3.3 The volume and surface area of <i>complex figures</i> are correctly calculated. 3.4 Points identified in terms of cartesian coordinates can be converted to polar coordinates and vice versa.
4 Use trigonometry to solve practical problems	4.1 Basic trigonometry functions are used to calculate the lengths of the sides of right-angled triangles.

	<p>4.2 Inverse trigonometry functions are used to determine angles in a right-angled triangle given the lengths of two sides.</p> <p>4.3 The sine rule is used to determine the lengths of the sides of acute and obtuse angled triangles given one side and two angles.</p> <p>4.4 The cosine rule is used to determine the lengths of the sides of acute and obtuse angled triangles given two sides and one angle.</p>
5 Graph linear functions	<p>5.1 Linear functions are solved graphically and equations of straight lines are determined from the slope and one point, or two points.</p> <p>5.2 Two linear functions are solved simultaneously both algebraically and geometrically.</p> <p>5.3 The length and mid point of a line segment are determined.</p>
6 Solve quadratic equations	<p>6.1 Quadratic equations are solved.</p> <p>6.2 Simultaneous linear and quadratic equations are solved.</p>
7 Perform basic statistical calculations	<p>7.1 Mean, median and mode are calculated from given data.</p> <p>7.2 Standard deviation is calculated and interpreted employing graphical representation.</p>

Range statement

The range statement provides information about the context in which the unit of competency is carried out. The variables and scope cater for different work requirements, work practices and knowledge between States, Territories and the Commonwealth, and between organisations and workplaces. The range statement relates to the unit as a whole and provides a focus for assessment. Text in italics in the performance criteria is explained here.

The following variables may be present and may include, but are not limited to, the examples listed under the scope. All work is undertaken to relevant legislative requirements, where applicable.

Variable	Scope
<i>Concepts of mathematics</i>	Include arithmetic, algebraic expressions with one independent variable, two-dimensional geometry, trigonometry, linear functions, basic quadratic functions, basic statistical methods
<i>Correct order</i>	Refers to the correct procedure when expanding brackets, factorising algebraic expressions, factorising quadratic expressions, simplifying algebraic fractions, transposing formulae, solving simple one variable equations, finding the quotient and remainder given a linear division
<i>Complex figures</i>	May include cones, pyramids, spheres, frustums and intersections of figures singularly or in combination

Evidence guide

The evidence guide specifies the evidence required to demonstrate achievement in the unit of competency as a whole. It must be read in conjunction with the unit descriptor, performance criteria, range statement and the assessment guidelines for the Metal and Engineering Training Package.

Overview of assessment requirements	A person who demonstrates competency in this unit must be able to apply mathematical skills and knowledge to simple engineering applications. Evidence from tasks and projects should/may be used to complement and demonstrate integration of competency.
Context of assessment	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.
Interdependent assessment	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying mathematical concepts to engineering applications, or other units requiring the exercise of the skills and knowledge covered by this unit.
Method of assessment	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
Consistency of performance	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
Required skills	Look for evidence that confirms skills in: <ul style="list-style-type: none"> • using and applying mathematical formulas: <ul style="list-style-type: none"> logical thinking problem solving

	calculating applying statistics using computer numerical methods drawing graphs
Required knowledge	Look for evidence that confirms knowledge of: <ul style="list-style-type: none">• transposing and evaluating formulae• polynomials• straight line coordinate geometry• introduction to indices• introduction to trigonometry• circular functions• trigonometry of oblique triangles• trigonometric identities• introduction to functions and their graphs

SECTION C28

MEM23002A

Apply calculus in engineering situations

21858VIC Certificate IV in Science

Unit Code	MEM23002A
Unit Title	Apply calculus in engineering situations
Unit Descriptor	This unit covers applying concepts of calculus to engineering situations.
Prerequisites	
Path 1	MEM30012A Apply mathematical techniques in manufacturing, engineering or related situations
Competency Field	Engineering science
Application of the Competency	This unit applies to selecting and applying calculus techniques to resolve engineering problems. It includes finding derivatives from first principles, using rules of derivatives to find first and second derivatives of functions; applying integral calculus to functions; applying differential and integral calculus to engineering problems.
Related Units	None
Band	None
Unit Weight	None
Notes	This unit only has application in qualifications that are not points based.
ELEMENTS	PERFORMANCE CRITERIA
Elements are the essential outcomes of the unit of competency	Together, performance criteria specify the requirements for competent performance. Text in <i>italics</i> is explained in the range statement following.
1 Apply differentiation techniques to engineering applications	1.1 Solve engineering problems using the <i>rules of differentiation</i> .
2 Apply integration techniques to engineering applications	2.1 Use <i>integration techniques</i> to obtain integrals of algebraic, trigonometric and exponential functions and evaluate definite integrals.
	2.2 Solve engineering problems using the rules of integration.

RANGE STATEMENT

The range statement provides information about the context in which the unit of competency is carried out. The variables and scope cater for different work requirements, work practices and knowledge between States, Territories and the Commonwealth, and between organisations and workplaces. The range statement relates to the unit as a whole and provides a focus for assessment. Text in *italics* in the performance criteria is explained here.

The following variables may be present and may include, but are not limited to, the examples listed under the scope. All work is undertaken to relevant legislative requirements, where applicable.

Variable

Calculation aids/devices

Scope

Computer and microprocessor driven devices may be used to assist with the performance of calculations.

EVIDENCE GUIDE

The evidence guide specifies the evidence required to demonstrate achievement in the unit of competency as a whole. It must be read in conjunction with the unit descriptor, performance criteria, range statement and the assessment guidelines for the Metal and Engineering Training Package.

Overview of assessment requirements

A person who demonstrates competency in this unit must be able to apply calculus in engineering situations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

Context of assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of team. The assessment environment should not disadvantage the candidate.

Interdependent assessment

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying calculus in engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.

Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted

to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Consistency of performance

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

Required skills

Look for evidence that confirms skills in:

- solving engineering problems using the principles of differentiation
- obtaining first and second derivatives of algebraic, trigonometric, exponential and logarithmic functions
- obtaining integrals of algebraic, trigonometric and exponential functions
- evaluating definite integrals
- solving engineering problems using the principles of integration

Required knowledge

Look for evidence that confirms knowledge of:

- the rules of differentiation
- the concept of implicit and explicit functions
- the Newton's method for solving equations
- the procedures for determining the following:
 - equations of tangents and normals
 - stationary points and curve sketching
 - rates of change
 - rectilinear motion
 - maxima and minima
- the concept of integration being the inverse of differentiation
- the procedures for obtaining the integral of a function
- the rules of integration
- applications of Simpson's rule
- areas between curves
- distance travelled
- rectilinear motion

SECTION C29

VPAU081

Work mathematically with statistics and calculus

21858VIC Certificate IV in Science

Unit Code	VPAU081
Unit Title	Work mathematically with statistics and calculus
Unit Descriptor	The purpose of this unit is to provide learners with knowledge and skills related to statistical relationships between bivariate data, the normal distribution, sets applied to problems, probability and differential calculus.
Employability Skills	The required outcomes described in this module contain applicable facets of Employability Skills. The qualification's Employability Skills Summary, in which this module is included, will assist in identifying employability skill requirements. The summary is included in Part B Course Requirements (see Appendix B).
Application of the Unit	The unit covers mathematical skills and knowledge which apply to a number of science further study pathways, and work roles.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria indicate the standard of performance required to demonstrate achievement of the element. Where bold italicised text is used, further detail is provided in the range statement.

Assessment of performance is to be consistent with the evidence guide.

- | | | | |
|---|--|-----|--|
| 1 | Determine the correlation coefficient and the equation of the regression line for bivariate data | 1.1 | Plot <i>bivariate data</i> on a scatter diagram and estimate trends and the degree of correlation by inspection |
| | | 1.2 | <i>Calculate</i> the correlation coefficient |
| | | 1.3 | Evaluate the correlation coefficient as a measure of the degree to which the association between the variables approaches a linear functional relationship |
| | | 1.4 | <i>Calculate the equations of regression lines</i> from <i>bivariate data</i> |
| | | 1.5 | Use the equations of regression lines to make predictions in <i>practical situations</i> |
| | | 1.6 | Investigate <i>practical problems</i> using correlation and regression |
| | | 1.7 | Describe the limitations of the use of regression lines for making predictions |

- | | | | |
|---|---|-----|--|
| 2 | Solve mathematics problems involving sets | 2.1 | Use the properties of set operations or Venn Diagrams to simplify set expressions, and to prove equivalence between set expressions |
| | | 2.2 | Solve applied problems using the concepts and techniques of set algebra |
| 3 | Use probability theory to solve mathematics problems | 3.1 | Calculate <i>theoretical probabilities</i> for simple and complementary events and compare them with experimental results |
| | | 3.2 | Infer probabilities from experiments for events which cannot be predicted theoretically |
| | | 3.3 | Identify, describe and give examples of mutually exclusive and independent events |
| | | 3.4 | Determine the probability of compound events using the addition and multiplication principles |
| | | 3.5 | Define, explain and distinguish between permutations and combinations and <i>evaluate</i> them |
| | | 3.6 | Determine the probability of events using permutations and combinations |
| 4 | Solve analytical and applied probability distribution problems | 4.1 | Define and explain the probability density function for a continuous random variable in terms of the distribution function |
| | | 4.2 | Describe the importance, occurrence, properties and use of the normal distribution model |
| | | 4.3 | Use tables and/or calculator to determine probabilities and solve problems where the variable is normally distributed |
| | | 4.4 | Interpret particular normal distributions |
| 5 | Interpret the concept of derivative graphically and as a rate of change | 5.1 | Determine the derivative of a polynomial, giving the instantaneous rate of change of a quantity at a time t , using first principles or approximating graphically |
| | | 5.2 | Determine the derivative of a polynomial, giving the instantaneous rate of change of a quantity at a time t , using 'the rule' |
| | | 5.3 | Apply the process of differentiation of a function to solve problems in applied areas where the derivative has a meaning, including cases where there is a zero rate of change |

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Knowledge of:

- Statistics - Relationships between Variables - bivariate data, scatter diagrams, linear relationship trend, calculation of r , with and without a calculator, properties of r ; estimate from scatter diagram, lines of “best fit”, regression line equations and predictions, practical problems using correlation and regression
- Properties of Sets - set notation and terminology, Venn diagrams, properties of set operations: commutative, associative, distributive, de Morgans laws, equivalence, applications
- Elementary Probability - definition of probability of an event, theoretical and relative frequency, Venn diagrams of events, sample spaces, complementary and compound events, addition and multiplication principles, conditional probability, independent and mutually exclusive events, permutations and combinations
- Statistics - Normal Distributions - probability distributions as tables and graphs, normal distribution, its properties, occurrence and use; Standard normal distribution - z scores
- Differential Calculus - gradient as a rate of change for a linear function, general rates of change on graphs, average and instantaneous rate of change, (including approximation of instantaneous rate of change), derivative as gradient/rate of change function, derivative by first principles and by rule, simple applications of differential calculus e.g. maxima and minima.

Ability to

- generate data using surveys, experiments and sampling procedures.
- calculate summary statistics for centrality (mode, median and mean), spread (box plot, inter-quartile range, outliers) and association (by-eye estimation of the line of best fit from a scatter plot).
- distinguish informally between association and causal relationship in bi-variate data, and make predictions based on an estimated line of best fit for scatter-plot data with strong association between two variables
- use tables and/or calculator to determine probabilities, applications
- use appropriate keys on a scientific calculator
- produce scientific information in charts, diagrams and graphs.

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different situations that may affect performance e.g. access to resources; regional contexts.

- | | |
|--|---|
| <i>Bivariate data includes</i> | <ul style="list-style-type: none"> • data relating to the simultaneous measurement of two variables; for example, age and income. |
| <i>Calculate may include</i> | <ul style="list-style-type: none"> • a calculator • software package |
| <i>Calculate the equations of regression lines may include</i> | <ul style="list-style-type: none"> • using a calculator/software package • plotting the regression line on a scatter diagram |
| <i>Practical situations and problems may include</i> | <ul style="list-style-type: none"> • looking at patterns over time with different groups of people, e.g. disease in different age groups over time |
| <i>Theoretical probabilities include:</i> | <ul style="list-style-type: none"> • conditional probability |
| <i>Evaluate may include</i> | <ul style="list-style-type: none"> • using the definition and a calculator |

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.

Critical Aspects for assessment and evidence required to demonstrate competency in this unit

The learner must be able to:

- apply a range of strategies and techniques to solve mathematical problems including:
 - determining the correlation coefficient and the equation of the regression line for bivariate data and making predictions from these
 - solving mathematics problems involving sets, using the properties of sets and equivalence
 - using probability theory to solve mathematics problems
 - solving analytical and applied probability distribution problems where the random variable is continuous and normally distributed
 - interpreting the concept of derivative graphically and as a rate of change (for polynomials only) and solving applied problems

- demonstrate estimating skills to check calculations and reasonableness of outcomes
- use mathematical symbolism, charts, diagrams and graphs as appropriate to convey mathematical thinking and processing
- use a scientific calculator

Context of and specific resources for assessment

- Scientific calculator
- Real/authentic or simulated tasks, materials and texts

Method of assessment

- verbal or written questioning, online responses
- pictures, diagrams, models created by the learner
- practical demonstration
- products or samples compiled by the learner with supporting documentation
- records of teacher observations of learner's activities, discussions and practical tasks
- self-assessment sheets, reflections, journal entries
- written or verbal reports of investigations or problem-solving activities