

**22607VIC Certificate III in Science
22608VIC Certificate IV in Science**

This course has been accredited under Part 4.4 of the Education and Training Reform Act 2006.

Accredited for the period: 1 January 2023 to 31 December 2027

Version 1.0



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Section A: Applicant and course classification information

| | |
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| <p>1. Person in respect of whom the course is being accredited</p> | <p>Copyright of these courses is held by the Department of Education and Training, Victoria. © State of Victoria (Department of Education and Training) 2022</p> |
| <p>2. Address</p> | <p>Executive Director Higher Education and Workforce Division Higher Education and Skills Department of Education and Training (DET) GPO Box 4367 MELBOURNE Vic 3001</p> <p>Organisational Contact: Manager, Training and Learning Products Unit Portfolio Alignment Branch Higher Education and Workforce Division Higher Education and Skills Department of Education and Training (DET) Telephone: 131823 Email: course.enquiry@education.vic.gov.au</p> <p>Day-to-day contact: General Studies & Further Education Curriculum Maintenance Manager Victoria University Polytechnic PO Box 14428 Melbourne, VIC 8001 Ph: (03) 9919 5300 / 5302 Email: sicmm.generalstudies@vu.edu.au</p> |
| <p>3. Type of submission</p> | <p>This submission is for re accreditation of: 22441VIC Certificate III in Science 22442VIC Certificate IV in Science</p> |
| <p>4. Copyright acknowledgement</p> | <p>The following units of competency:</p> <ul style="list-style-type: none"> • BSBWHS211 Contribute to health and safety of self and others • BSBTEC203 Research using the internet |

are from the BSB Business Services Training Package (Release 8) administered by the Commonwealth of Australia

The following units of competency:

- ICTICT221 Identify and use specific industry standard technologies
- ICTICT226 Operate simple database applications
- ICTICT435 Create technical documentation

are from the ICT Information and Communications Technology Training Package (Release 8) administered by the Commonwealth of Australia

The following units of competency:

- MEM23004A Apply technical mathematics
- MEM23007A Apply calculus to engineering tasks
- MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment

are from the MEM05 -Metal and Engineering Training Package (Release 11.1) administered by the Commonwealth of Australia

The following units of competency:

- MSL933005 Maintain the laboratory/field workplace fit for purpose
- MSL943004 Participate in laboratory or field workplace safety
- MSL973013 Perform basic tests
- MSL973014 Prepare working solutions
- MSL973016 Perform aseptic techniques
- MSL973019 Perform microscopic examination

are from the MSL - Laboratory Operations (Release 3.2) administered by the Commonwealth of Australia

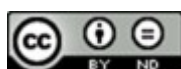
The following units of competency:

- VU22387 Engage with texts of limited complexity for learning purposes
- VU22392 Create texts of limited complexity for learning purposes

are from the 22472VIC Certificate I in General Education for Adults

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| <p>6. Course accrediting body</p> | <p>Victorian Registration and Qualifications Authority</p> |
| <p>7. AVETMISS information</p> | <p>ANZSCO code 234 Natural and physical science professionals Australian and New Zealand Standard Classification of Occupations ASCED Code: 1201 General Education Programmes Field of Education National course code 22607VIC Certificate III in Science 22608VIC Certificate IV in Science</p> |
| <p>8. Period of accreditation</p> | <p>1 January 2023 to 31 December 2027.</p> |

Section B: Course information

| 1. Nomenclature | |
|---|--|
| 1.1 Name of the qualification | Standard 4.1 AQTF 2021 Standards for Accredited Courses 22607VIC Certificate III in Science 22608VIC Certificate IV in Science |
| 1.2 Nominal duration of the course | Standard 5.8 AQTF 2021 Standards for Accredited Courses Certificate III in Science: 420 – 480 Certificate IV in Science: 710 – 830 |
| 2. Vocational or educational outcomes of the course | |
| 2.1 Outcome(s) of the course(s) | Standard 5.1 AQTF 2021 Standards for Accredited Courses The Certificates III and IV in Science are both preparatory programs which provide a study pathway to enable graduates to develop foundational skills and knowledge in Science, providing the opportunity for graduates to pursue further studies in Science, Technology, Engineering and/or Maths (STEM) areas. STEM education and training covers the specific knowledge and skills found in science, technology, engineering and mathematics disciplines. It also covers the interrelationship between these areas. The Certificate III in Science is primarily a preparatory qualification which introduces key science concepts and enables access to vocational courses in STEM related areas. The Certificate IV in Science consolidates and extends science concepts in a range of science disciplines including chemistry, biology, physics, ecology and genetics. It enables access to higher level VET courses or associate degrees or higher education degrees in STEM related areas. Further study in science and technology may include laboratory technology, nursing, biotechnology, information technology, food technology, environmental science, health, engineering, applied sciences and other related courses. |
| 2.2 Course description | Standard 5.1 AQTF 2021 Standards for Accredited Courses The Certificate III in Science supports learners, from diverse backgrounds and educational experience to pursue further study, and careers in a chosen area of Science. The course provides development of foundation or preparatory skills in science including study skills, basic scientific research and the option to focus on an area of science that will provide the opportunity to undertake |

| | |
|---|---|
| | <p>further study in VET Science, Technology, Engineering and/or Maths (STEM) related areas.</p> <p>The Certificate IV in Science provides learners with the opportunity to develop science-based knowledge, skills and terminology. The course includes research of different scientific fields of study, skills to undertake science-based laboratory or fieldwork, apply mathematical techniques in a scientific context and the option to specialise in a specific area of science to meet future study/career goals. The course provides pathway options for learners into higher level VET or undergraduate courses in Science, Technology, Engineering and/or Maths (STEM).</p> |
| <p>3. Development of the course</p> | |
| <p><i>3.1 Industry, education, legislative, enterprise or community needs</i></p> | <p>Standards 4.1, 5.1, 5.2, 5.3 and 5.4 AQTF 2021 Standards for Accredited Courses</p> <p>There is an increasing focus on Science, Technology, Engineering and Mathematics (STEM) by both National and State governments including a focus on increasing participation in STEM learning to support innovation in every sector of the economy. These courses provide an opportunity for learners to enter these fields of study through an alternative study path.</p> <p>The Certificate III and IV in Science support National and State policy initiatives to strengthen and provide STEM education with a focus on foundation skills, developing mathematical, scientific and digital literacy, and promoting problem solving, critical analysis and creative thinking skills.</p> <p>The National Skills Commission has identified Professional, Scientific and Technical Services as one of four industries which are projected to generate over three-fifths (or 64.4 per cent) of total employment growth over the five years to November 2025 (The National Skills Commission: Australian Jobs publication, 2020).</p> <p>A Victorian Government initiative, STEM in the Education State (2016), identifies the role of the training sector in boosting foundational STEM skills for adult learners and providing opportunities to re-engage (Department of Education and Training, 2016 p8).</p> <p>A 2021 National Industry Insights report by the AISC continues to support this original initiative and the importance of STEM stating:</p> <p>“Strong science, engineering, technology and mathematics (STEM) skills, are extremely important for the knowledge economy”(Australian Industry and Skills Committee 2021, p 80).</p> <p>While often associated with the university sector, the 2020 report, Australia’s STEM Workforce, released by the Office of the Chief Scientist on Australia’s STEM workforce, shows that learners from the vocational education and training (VET) sector provide more than two thirds of</p> |

Australia's STEM workforce (Australian Government: Australia's STEM Workforce 2020).

The Certificate III in Science has been developed for learners who have had none or minimal exposure to the basic concepts of science but who now want to pursue further studies in in VET Science, Technology, Engineering and/or Maths (STEM) related areas. This course includes foundation or preparatory skills in science, science specific vocabulary, an introduction to research, formulae development and the basic processes required to conduct science-based experiments.

The Certificate IV in Science is designed to provide a learner with the option to specialise in a specific area of science, to meet their future study/career goals. This course provides learners, who have already studied science at a foundational level, the opportunity to further extend and consolidate their application of science-based skills and knowledge to undertake further and advanced area of science-based study. Graduates from this course are eligible to apply for higher level VET courses, associate degrees or higher education degrees in Science, Technology, Engineering and/or Maths (STEM).

The Victorian enrolment data below indicates that numbers in both certificates have remained relatively consistent between 2019 and 2022 in spite of complications of delivering online for large components of learning and assessment due to the COVID pandemic. Although enrolments up to August 2022 have declined, it is anticipated that there may be a return to pre-pandemic enrolment numbers moving forward. All enrolments below are government subsidised.

Victorian Enrolments (* to August 2022)

| | 2019 | 2020 | 2021 | 2022 |
|-----------------|------|------|------|------|
| Certificate III | 51 | 48 | 42 | 30* |
| Certificate IV | 92 | 100 | 77 | 48* |

Source: Department of Education and Training

The target group for the Certificate III in Science includes:

- learners from diverse backgrounds who have had disrupted or negative experiences with schooling and are seeking to access studies in the science field
- mature age learners wanting to re-engage with study and those seeking a career change who want to pursue studies in the science field.

The target group for the Certificate IV in Science includes:

- learners who pathway into further study from the Certificate III in Science

- learners from diverse backgrounds who have had disrupted or negative experiences with schooling and are seeking to access studies in the science field
- school leavers who have not received the required ATAR to enter directly into a higher qualification level or did not complete their studies and need to further develop and consolidate skills and knowledge in the science field
- mature age learners and those seeking a career change who wish to access higher level studies in the science field

These courses:

- do not duplicate, by title or coverage, the outcomes of an endorsed training package qualification or skill set
- are not a subset of a single training package qualification that could be recognised through one or more statements of attainment or a skill set
- do not include units of competency additional to those in a training package qualification that could be recognised through statements of attainment in addition to the qualification
- do not comprise units that duplicate units of competency of a training package qualification.

A Skills and Knowledge Profile was developed to guide the outcomes of the qualification following consultation, feedback and validation from PSC members.

The course development was guided by a Project Steering Committee comprising:

| | |
|--------------------------|---|
| Tracey Salter (Chair) | Program Manager Applied Sciences, Social Care and Health, College of VE, RMIT University |
| Jude Moloney | Training Support and Quality Lead at RANZCOG. Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) University |
| Dr Thomas Hiscox | Lecturer and Coordinator First year Biology, Monash University |
| Dr Mariana Berak | Coordinator Science Programs, VE Department of Health, Science and Community, Swinburne University |
| Phillip McGlashan | Teacher Science Programs, VE Department of Health, Science and Community, Swinburne University |

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|--|---|
| <p><i>3.2 Review for re- accreditation</i></p> | <p>Standards 5.1, 5.2, 5.3 and 5.4 AQTF 2021 Standards for Accredited Courses</p> <p>The General Studies and Further Education Curriculum Maintenance Manager undertakes ongoing engagement with training providers who deliver each of the qualifications. A mid-cycle review was completed in 2020 to monitor the implementation of the qualifications and identify any required modifications. Enrolment data was reviewed and training providers surveyed via a questionnaire. Training providers considered that the course structures in both certificates provided the flexibility to enable a range of outcomes to meet student needs.</p> <p>Quantitative data and qualitative comments from providers and students confirmed students were transitioning from both Certificate III and IV in Science to higher VET and tertiary qualifications. The courses enabled students to engage with relevant science-based training supporting them to pathway to qualifications at higher levels and work towards meaningful employment outcomes. Providers stated courses are effective and continue to support learners to acquire the required skills and knowledge to access pathways in a range of science fields. Both courses enabled students to engage with relevant science-based training, supporting them to pathway to qualifications at higher levels and work towards meaningful.</p> <p>There were no amendments made to the Certificate III in Science as a result of the mid cycle review.</p> <p>Some feedback was provided on duplication in the maths and physics units in the Certificate IV in Science and this was reviewed as part of the reaccreditation process. There were no amendments made to the Certificate IV in Science as a result of the mid cycle review.</p> <p>The course 22607VIC Certificate III in Science supersedes and is equivalent to 22441VIC Certificate III in Science.</p> <p>The course 22608VIC Certificate IV in Science supersedes and is equivalent to 22442VIC Certificate IV in Science.</p> <p>The following table identifies the relationship between the current and previous units.</p> |
|--|---|

| Units from 22607VIC Certificate III in Science | | Units from 22441VIC Certificate III in Science | | Relationship |
|--|---|--|---|------------------------------------|
| VU23249 | Conduct and present simple scientific research | VU22065 | Conduct and present simple scientific research | Equivalent |
| VU23252 | Develop study skills for science | VU22066 | Develop study skills for science | Equivalent |
| VU23263 | Work with mathematical techniques | VU22067 | Work with mathematical techniques | Not Equivalent Element deleted. |
| VU23264 | Examine concepts in biology | VU22068 | Examine concepts in biology | Equivalent |
| VU23265 | Examine concepts in chemistry | VU22069 | Examine concepts in chemistry | Equivalent |
| VU23266 | Examine concepts in physics | VU22070 | Examine concepts in physics | Equivalent |
| VU23267 | Examine body systems | VU22071 | Examine body systems | Equivalent |
| BSBWHS211 | Contribute to health and safety of self and others | BSBWHS201 | Contribute to health and safety of self and others | Equivalent |
| VU22387 | Engage with texts of limited complexity for learning purposes | VU21326 | Engage with texts of limited complexity for learning purposes | Equivalent |
| VU22392 | Create texts of limited complexity for learning purposes | VU21330 | Create texts of limited complexity for learning purposes | Equivalent |
| MSL973014 | Prepare working solutions | MSL973002 | Prepare working solutions | Equivalent |
| MSL973019 | Perform microscopic examination | MSL973007 | Perform microscopic examination | Equivalent |
| MSL973013 | Perform basic tests | MSL973001 | Perform basic tests | Equivalent |
| BSBTEC203 | Research using the internet | | | Newly imported |
| MSL933005 | Maintain the laboratory/field workplace fit for | | | Newly imported |

| Units from 22607VIC Certificate III in Science | | Units from 22441VIC Certificate III in Science | | Relationship |
|--|---------|--|--|--------------|
| | purpose | | | |
| | | ICTICT101 | Operate a personal computer | Deleted |
| | | ICTICT103 | Use, communicate and search securely on the internet | Deleted |

| 22608VIC Certificate IV in Science | | Units from 22442VIC Certificate IV in Science | | Relationship |
|------------------------------------|---|---|---|--------------|
| VU23268 | Apply essential further study skills for science | VU22072 | Apply essential further study skills for science | Equivalent |
| VU23269 | Research scientific fields of study | VU22073 | Research scientific fields of study | Equivalent |
| VU23270 | Use a range of techniques to solve mathematical problems | VU22074 | Use a range of techniques to solve mathematical problems | Equivalent |
| VU23271 | Apply mathematical techniques to scientific contexts | VU22075 | Apply mathematical techniques to scientific contexts | Equivalent |
| VU23272 | Investigate atomic structure and bonding | VU22076 | Investigate atomic structure and bonding | Equivalent |
| VU23273 | Investigate stoichiometry and solution chemistry | VU22077 | Investigate stoichiometry and solution chemistry | Equivalent |
| VU23274 | Investigate organic chemistry and properties of materials | VU22078 | Investigate organic chemistry and properties of materials | Equivalent |
| VU23275 | Investigate chemical reactions | VU22079 | Investigate chemical reactions | Equivalent |
| VU23276 | Investigate waves and optics | VU22080 | Investigate waves and optics | Equivalent |
| VU23277 | Apply principles of kinematics | VU22081 | Apply principles of kinematics | Equivalent |
| VU23278 | Apply principles of electricity | VU22082 | Apply principles of electricity | Equivalent |

| 22608VIC Certificate IV in Science | | Units from 22442VIC Certificate IV in Science | | Relationship |
|---|---|--|---|---------------------|
| VU23279 | Apply dynamics and conservation principles | VU22083 | Apply dynamics and conservation principles | Equivalent |
| VU23280 | Operate simple analogue and digital electronic circuits | VU22084 | Operate simple analogue and digital electronic circuits | Equivalent |
| VU23281 | Investigate cell biology | VU22085 | Investigate cell biology | Equivalent |
| VU23282 | Investigate anatomy and physiology | VU22086 | Investigate anatomy and physiology | Equivalent |
| VU23283 | Investigate introductory genetics | VU22087 | Investigate introductory genetics | Equivalent |
| VU23284 | Investigate ecology | VU22088 | Investigate ecology | Equivalent |
| VU23285 | Work mathematically with statistics and calculus | VU22089 | Work mathematically with statistics and calculus | Equivalent |
| MSL943004 | Participate in laboratory or field workplace safety | MSL943002 | Participate in laboratory or field workplace safety | Equivalent |
| MSL973016 | Perform aseptic techniques | MSL973004 | Perform aseptic techniques | Equivalent |
| MEM30012A | Apply mathematical techniques in a manufacturing engineering or related environment | MEM30012A | Apply mathematical techniques in a manufacturing engineering or related environment | No Change |
| MEM23007A | Apply calculus to engineering tasks | MEM23007A | Apply calculus to engineering tasks | No Change |
| ICTICT226 | Operate simple database applications | ICTICT210 | Operate database applications | Equivalent |
| MEM23004A | Apply technical mathematics | | | Newly imported |
| ICTICT435 | Create technical documentation | | | Newly imported |
| ICTICT221 | Identify and use specific industry standard technologies | | | Newly imported |

| 22608VIC Certificate IV in Science | | Units from 22442VIC Certificate IV in Science | | Relationship |
|------------------------------------|--|---|--------------------------------------|--------------|
| | | ICTICT102 | Operate word-processing applications | Deleted |
| | | ICTICT105 | Operate spreadsheet applications | Deleted |

4. Course outcomes

| | |
|---------------------------------------|--|
| <p><i>4.1 Qualification level</i></p> | <p>Standard 5.5 AQTF 2021 Standards for Accredited Courses</p> <p>The outcomes of the 22607VIC Certificate III in Science meet AQF level 3 criteria through the:</p> <ul style="list-style-type: none"> development of factual, technical, procedural and some theoretical knowledge of a specific area in the field of science for further learning including techniques and concepts to solve a range of mathematical problems related to the science field. development of a range of cognitive, technical and communication skills to select and apply a specialised range of methods, tools and materials to complete routine science activities and provide and transmit solutions to predictable and sometimes unpredictable problems application of knowledge and technical skills in semi autonomous contexts, to undertake routine and some non-routine tasks in a range of skilled operations such as solving a range of mathematical problems using appropriate techniques <p>The volume of learning for this qualification is typically between 1 and 2 years and incorporates structured training delivery and learning activities such as:</p> <ul style="list-style-type: none"> structured activities to undertake and present outcomes of simple investigations and develop problem solving techniques to solve a range of problems unstructured activities such as conducting simple scientific research and completing assignments and projects <p>The outcomes of the 22608VIC Certificate IV in Science meet AQF level 4 criteria through the:</p> <ul style="list-style-type: none"> development of broad factual, technical and theoretical knowledge in a specialised field of work and learning such as mathematics, chemistry, physics and biology. development of cognitive, technical and communication skills to, analyse, apply and communicate technical solutions of a non-routine or contingency nature to a defined range of predictable |
|---------------------------------------|--|

| | |
|---|---|
| | <p>and unpredictable problems such as undertaking calculations and presenting research findings. To compare and act on information from a range of sources such as assessing and evaluating the suitability of science research material.</p> <ul style="list-style-type: none"> • application of knowledge and specialist technical skills to complete routine and non-routine tasks and functions such as applying mathematical skills in a range of scientific contexts and for different purposes. • communication skills to guide activities and apply methods to participate in collaborative research and learning. • application of knowledge and technical skills to undertake specialised tasks or functions in known or changing contexts such as undertaking research in scientific fields of study and analysing and presenting data • application of knowledge and technical skills with responsibility for own functions and outputs, and may have limited responsibility for organisation of others such as applying computing skills to a range of tasks • application of knowledge and technical skills with limited responsibility for the quantity and quality of the output of others in a team within limited parameters such as using problem solving techniques to conduct scientific investigations. <p>The volume of learning for this qualification is typically between 0.5 and 2 years and incorporates structured training delivery and learning activities such as:</p> <ul style="list-style-type: none"> • structured activities to access, analyse and compare a range of scientific information and theories across scientific and mathematics areas • unstructured activities such as researching a science topic, using online library services to source scientific journals and completing scientific calculations. |
| <p><i>4.2 Foundation skills</i></p> | <p>Standard 5.6 AQTF 2021 Standards for Accredited Courses</p> <p>A summary of the foundation skills to be achieved in these courses can be found in Appendix A.</p> <p>Foundation skills applicable to the course are detailed in each unit of competency as appropriate.</p> |
| <p><i>4.3 Recognition given to the course</i></p> | <p>Standard 5.7 AQTF 2021 Standards for Accredited Courses</p> <p>Not Applicable</p> |
| <p><i>4.4 Licensing/regulatory requirements</i></p> | <p>Standard 5.7 AQTF 2021 Standards for Accredited Courses</p> <p>Not Applicable.</p> |
| <p>5. Course rules</p> | |

Standards 5.8 and 5.9 AQTF 2021 Standards for Accredited courses

5.1 Course structure

To be eligible for the award of 22607VIC Certificate III in Science, learners must successfully complete a total of 11 units comprising:

- 6 core units
- 5 elective units

At least one elective must be selected from the Science stream.

A maximum of two units may be selected from any other accredited course or endorsed training package:

Units imported from endorsed training packages or other accredited courses must:

- reflect the needs of the learner
- reflect the integrity of the AQF level of this qualification
- support the outcome of this qualification.

A Statement of Attainment will be issued for any unit of competency successfully completed if the full qualification is not completed.

| Unit of competency code | Field of Education code (six-digit) | Unit of competency title | Pre-requisite | Nominal hours |
|-------------------------|-------------------------------------|---|---------------|---------------|
| Core units | | | | |
| VU23449 | 120105 | Conduct and present simple scientific research | NIL | 20 |
| VU23252 | 120103 | Develop study skills for science | NIL | 30 |
| BSBWHS211 | 061301 | Contribute to health and safety of self and others | NIL | 20 |
| VU23263 | 010101 | Work with mathematical techniques | NIL | 100 |
| VU22387 | 120103 | Engage with texts of limited complexity for learning purposes | NIL | 25 |
| VU22392 | 120103 | Create texts of limited complexity for learning purposes | NIL | 25 |
| Science Stream | | | | |
| VU23264 | 019909 | Examine concepts in biology | NIL | 50 |
| VU23265 | 010501 | Examine concepts in chemistry | NIL | 50 |

| | | | | |
|----------------------------|--------|---|-----|------------------|
| VU23266 | 010301 | Examine concepts in physics | NIL | 50 |
| VU23267 | 019901 | Examine body systems | NIL | 50 |
| General Electives | | | | |
| MSL973014 | 019909 | Prepare working solutions | NIL | 50 |
| MSL973019 | 019909 | Perform microscopic examination | NIL | 40 |
| MSL973013 | 019909 | Perform basic tests | NIL | 60 |
| BSBTEC203 | 080905 | Research using the internet | NIL | 30 |
| MSL933005 | 019909 | Maintain the laboratory/field workplace fit for purpose | NIL | 30 |
| Total nominal hours | | | | 420 - 480 |

Standards 5.8 and 5.9 AQTF 2021 Standards for Accredited courses

5.1 Course structure

To be eligible for the award of 22608VIC Certificate IV in Science, learners must successfully complete a total of 15 units comprising:

- 5 core units
- 10 elective units.

A minimum of six electives must be selected from those listed below. A maximum of four electives may be selected from any other accredited course or endorsed training package. Units imported from endorsed training packages or other accredited courses must:

- reflect the needs of the learner
- reflect the integrity of the AQF level of this qualification
- support the outcome of this qualification.

A Statement of Attainment will be issued for any unit of competency successfully completed if the full qualification is not completed.

| Unit of competency code | Field of Education code (six-digit) | Unit of competency title | Pre-requisite | Nominal hours |
|-------------------------|-------------------------------------|---|---------------------|---------------|
| Core units | | | | |
| MSL943004 | 061301 | Participate in laboratory or field workplace safety | NIL | 40 |
| VU23268 | 120105 | Apply essential further study skills for science | NIL | 90 |
| VU23269 | 120105 | Research scientific fields of study | NIL | 40 |
| VU23270 | 010101 | Use a range of techniques to solve mathematical problems | NIL | 110 |
| VU23271 | 010199 | Apply mathematical techniques to scientific contexts | NIL | 70 |
| Chemistry | | | | |
| VU23272 | 010501 | Investigate atomic structure and bonding | NIL | 50 |
| VU23273 | 010501 | Investigate stoichiometry and solution chemistry | NIL | 45 |
| VU23274 | 010501 | Investigate organic chemistry and properties of materials | NIL | 20 |
| VU23275 | 010501 | Investigate chemical | VU23272 Investigate | 45 |

| | | | | |
|----------------|--------|---|---|----|
| | | reactions | atomic structure and bonding VU23273 Investigate stoichiometry and solution chemistry VU23274 Investigate organic chemistry and properties of materials | |
| Physics | | | | |
| VU23276 | 010301 | Investigate waves and optics | NIL | 40 |
| VU23277 | 010301 | Apply principles of kinematics | NIL | 40 |
| VU23278 | 031303 | Apply principles of electricity | NIL | 40 |
| VU23279 | 010301 | Apply dynamics and conservation principles | VU23277 Apply principles of kinematics | 40 |
| VU23280 | 031303 | Operate simple analogue and digital electronic circuits | VU23278 Apply principles of electricity | 50 |
| Biology | | | | |
| VU23281 | 010901 | Investigate cell biology | NIL | 40 |
| VU23282 | 010913 | Investigate anatomy and physiology | NIL | 40 |
| VU23283 | 010909 | Investigate introductory genetics | NIL | 40 |
| VU23284 | 010905 | Investigate ecology | NIL | 40 |
| MSL973016 | 019909 | Perform aseptic techniques | NIL | 40 |

| Mathematics | | | | |
|----------------------------|--------|---|--|------------------|
| MEM30012A | 010101 | Apply mathematical techniques in a manufacturing engineering or related environment | NIL | 40 |
| MEM23004A | 010101 | Apply technical mathematics | NIL | 80 |
| MEM23007A | 010101 | Apply calculus to engineering tasks | MEM23004 A - Apply technical mathematics | 80 |
| VU23285 | 010101 | Work mathematically with statistics and calculus | NIL | 50 |
| General Electives | | | | |
| ICTICT226 | 080905 | Operate simple database applications | NIL | 40 |
| ICTICT435 | 020399 | Create technical documentation | NIL | 20 |
| ICTICT221 | 080905 | Identify and use specific industry standard technologies | NIL | 40 |
| Total nominal hours | | | | 710 - 830 |

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| 5.2 Entry requirements | <p>Standard 5.11 AQTF 2021 Standards for Accredited Courses</p> <p>There are no entry requirements for either Certificate III in Science or the Certificate IV in Science.</p> <p>The following is a general guide to entry in relation to the language, literacy and numeracy skills of learners aligned to the Australian Core Skills Framework (ACSF). See the Department of Education, Skills and Employment for more details.</p> <p>Learners are best equipped to successfully undertake the Certificate III in Science if they have minimum language, literacy and numeracy skills that align to Level 2 of the ACSF.</p> <p>Learners are best equipped to successfully undertake the Certificate IV in Science if they have minimum language, literacy and numeracy skills that align to Level 3 of the ACSF.</p> <p>Learners with language, literacy and numeracy skills at lower levels than those suggested will require additional</p> |
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| | support to successfully undertake the qualifications. |
| 6. Assessment | |
| <i>6.1 Assessment strategy</i> | <p>Standard 5.12 AQTF 2021 Standards for Accredited Courses</p> <p>All assessment, including Recognition of Prior Learning (RPL), must be compliant with the requirements of:</p> <ul style="list-style-type: none"> • Standard 1 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 4.1 and 4.2 of the VRQA Guidelines for VET Providers, <p>or</p> <ul style="list-style-type: none"> • the Standards for Registered Training Organisations 2015 (SRTOs), <p>or</p> <ul style="list-style-type: none"> • the relevant standards and Guidelines for RTOs at the time of assessment <p>Assessment strategies for the course should:</p> <ul style="list-style-type: none"> • address the skills and knowledge which underpin performance • gather sufficient evidence to judge achievement of progress towards determining competence • utilise a variety of different processes/sources, such as written, oral and observation to assess knowledge and performance • recognise achievement of elements/competencies regardless of where the enabling learning took place • be flexible in regard to the range and type of evidence provided by the learner • provide opportunity for the learner to challenge assessment provisions and participate in reassessment • be equitable and fair to all learners • not unnecessarily restrict the progress of a learner through the course • comprise a clear statement of both the criteria and assessment process • use assessment tools to suit the needs of learners. <p>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 in terms of skills, knowledge and performance</p> |

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| | <p>Assessment methods and tools may include:</p> <ul style="list-style-type: none"> • observation of the learner’s performance • observation of practical tasks and experiments • review of written reports • oral or written questioning to assess knowledge which underpins performance • Assessment of units of competency from accredited courses and nationally endorsed training packages must comply with the assessment requirements detailed in the source training product. |
| <p><i>6.2 Assessor competencies</i></p> | <p>Standard 5.14 AQTF 2021 Standards for Accredited Courses</p> <p>Assessment must be undertaken by a person or persons in accordance with:</p> <ul style="list-style-type: none"> • Standard 1.4 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 3 of the VRQA Guidelines for VET Providers, <p>or</p> <ul style="list-style-type: none"> • the Standards for Registered Training Organisations 2015 (SRTOs), <p>or</p> <ul style="list-style-type: none"> • the relevant standards and Guidelines for RTOs at the time of assessment. <p>Units of competency imported from training packages or accredited courses must reflect the requirements for assessors specified in that training package or accredited course</p> |
| <p>7. Delivery</p> | |
| <p><i>7.1 Delivery modes</i></p> | <p>Standards 5.12 and 5.14 AQTF 2021 Standards for Accredited Courses</p> <p>Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications.</p> <p>Delivery of units that require students to undertake scientific experiments will require:</p> <ul style="list-style-type: none"> • access to an appropriately equipped laboratory (or where appropriate simulated) environment where skills can be developed and applied with appropriate guidance, support and supervision. • sufficient time to develop and apply the relevant skills and knowledge. <p>Delivery modes may also include:</p> |

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| | <ul style="list-style-type: none"> • online (asynchronous and/or synchronous) • independent self-paced learning (time spent by student involved in specified activities without direct teacher/trainer supervision while undertaking those activities) <p>Teaching and learning strategies must be selected to reflect the varying learning needs and educational backgrounds of the individual learner and the specific requirements of each unit. Some areas of content may be common to more than one unit and therefore integration may be appropriate.</p> <p>Delivery strategies should actively involve the learner and learning should be experiential, relevant and age appropriate.</p> <p>In keeping with effective practice all units should be appropriately contextualised.</p> <p>Learners may come from a wide variety of backgrounds with greatly varying life experiences. Where appropriate these experiences may be useful in group discussions and presentations.</p> |
| <p><i>7.2 Resources</i></p> | <p>Standard 5.14 AQTF 2021 Standards for Accredited Courses</p> <p>Training must be undertaken by a person or persons in accordance with:</p> <ul style="list-style-type: none"> • Standard 1.4 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guideline 3 of the VRQA Guidelines for VET Providers, <p>or</p> <ul style="list-style-type: none"> • the Standards for Registered Training Organisations 2015 (SRTOs), <p>or</p> <ul style="list-style-type: none"> • the relevant standards and Guidelines for RTOs at the time of assessment. <p>Units of competency imported from training packages or accredited courses must reflect the requirements for resources/trainers specified in that training package or accredited course.</p> <p>Physical resources for these courses include:</p> <ul style="list-style-type: none"> • equipment and resources to complete tasks • computer facilities with Internet access where this is appropriate • appropriate computer software • access to a range of science based knowledge sources. <p>Resources required for delivery of individual units are</p> |

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| | listed in the specific Unit of Competency. |
| 8. Pathways and articulation | |
| | <p>Standard 5.10 AQTF 2021 Standards for Accredited Courses</p> <p>There are no formal articulation arrangements in place, however the courses are designed to provide a pathway into VET qualifications and undergraduate higher education courses by developing the science and maths knowledge and skills required to participate effectively in learning within such qualifications.</p> <p>A range of potential pathways are possible when Training Package units or units of competency from accredited courses are utilised as electives. Successful completion of these units within these Certificates will provide credit into other endorsed or accredited qualifications containing these units. RTO's may design courses which contain a number of elective units from a particular Training Package or accredited course qualification to provide a specific pathway to that qualification on completion.</p> <p>Examples of qualifications that are potential destinations for graduates of the Certificate III in Science include:</p> <ul style="list-style-type: none"> • MSL40118 Certificate IV in Laboratory Techniques • 22582VIC Certificate IV in Tertiary Preparation (Science stream) • 22582VIC Certificate IV in Tertiary Preparation (Engineering stream) <p>Examples of qualifications that are potential destinations for graduates of the Certificate IV in Science:</p> <ul style="list-style-type: none"> • MEM50212 Diploma of Engineering – Technical • MSL50118 Diploma of Laboratory Technology • HLT54121 Diploma of Nursing • Bachelor of Science • Bachelor of Applied Science • Bachelor of Electrical Engineering • Bachelor of Health Sciences • Bachelor of Biomedical Sciences <p>Refer to link below for information on AQF pathways policy.</p> <p>AQF Second Edition 2013 Pathways Policy</p> |
| 9. Ongoing monitoring and evaluation | |
| | Standard 5.15 AQTF 2021 Standards for Accredited |

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| | <p>Courses</p> <p>The Service Industries Curriculum Maintenance Manager, General Studies and Further Education, has responsibility for the ongoing monitoring and maintenance of these qualifications.</p> <ul style="list-style-type: none">• A formal review will take place once during the period of accreditation and will be informed by feedback from users of the curriculum and will consider at a minimum:• any changes required to meet emerging or developing needs• changes to any units of competency from nationally endorsed training packages or accredited curricula. <p>The Victorian Registration and Qualifications Authority (VRQA) will be notified of any significant changes to the course/s resulting from course monitoring and evaluation processes.</p> |
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Appendix A: Foundation Skills Qualification Summary

22607VIC Certificate III in Science

The following table contains a summary of the foundation skills for this course. This table should be interpreted in conjunction with the detailed requirements of each unit of competency packaged in this course. The foundation skills facets described here are broad industry requirements that may vary depending on qualification packaging.

| Foundation Skill | Industry/education/legislative/enterprise/Community requirements for this qualification include the following facets: |
|------------------------------------|---|
| Reading skills to: | <ul style="list-style-type: none">• access read and interpret, information about key concepts in science• locate information necessary to solve a problem• read values in a table, chart or graph |
| Writing skills to: | <ul style="list-style-type: none">• take accurate notes to summarise key information• represent information in a graphical form convey information about key concepts in science• record results of scientific experiments |
| Oral communication skills to: | <ul style="list-style-type: none">• discuss and present research findings• collaborate with peers |
| Numeracy skills to: | <ul style="list-style-type: none">• interpret data in simple graphs or information in a table• check calculations and reasonableness of outcomes• use mathematical symbols, charts, diagrams and graphs as appropriate to convey mathematical thinking and processing• use specialised calculator functions relevant to mathematical needs |
| Learning skills to: | <ul style="list-style-type: none">• identify and use reliable sources of information to establish a hypothesis. |
| Problem-solving skills to: | <ul style="list-style-type: none">• manage time and prioritise tasks and information• identify relationships between elements• analyse scientific relationships and compare concepts• write balanced chemical equations |
| Teamwork skills to: | <ul style="list-style-type: none">• collaborate and work with peers to complete group tasks |
| Planning and organising skills to: | <ul style="list-style-type: none">• gather, select and organise information effectively• identify and apply effective study strategies• compare and classify information and concepts |
| Self management skills to: | <ul style="list-style-type: none">• complete group tasks collaboratively• work safely to perform science tasks |

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| Foundation Skill | Industry/education/legislative/enterprise/Community requirements for this qualification include the following facets: |
| Technology skills to: | <ul style="list-style-type: none"> • use a scientific calculator |
| Digital literacy skills to: | <ul style="list-style-type: none"> • access electronic library resources including internet and online searches |

22608VIC Certificate IV in Science

The following table contains a summary of the foundation skills for this course. This table should be interpreted in conjunction with the detailed requirements of each unit of competency packaged in this course. The foundation skills facets described here are broad industry requirements that may vary depending on qualification packaging.

| Foundation Skill | Industry/education/legislative/enterprise/Community requirements for this qualification include the following facets: |
|------------------------------------|---|
| Reading skills to: | <ul style="list-style-type: none">skim, scan and read for meaning to interpret scientific textsundertake research to source, examine and compare informationread and interpret values in a table, chart or graphlocate embedded information necessary to solve a problem or analyse quantitative information |
| Writing skills to: | <ul style="list-style-type: none">complete complex texts including correct use of citationstake notes including summarising and synthesising key informationsummarise and paraphrase academic textswrite chemical formulae |
| Oral communication skills to: | <ul style="list-style-type: none">negotiate, discuss and participate in collaborative learningcommunicate verbally for presentations |
| Numeracy skills to: | <ul style="list-style-type: none">perform a range of calculationsrepresent and interpret experimental datacalculate the relative error in a measurement given the magnitude of a measurement and the error |
| Learning skills to: | <ul style="list-style-type: none">continually research and source emerging information relating to science |
| Problem-solving skills to: | <ul style="list-style-type: none">assess appropriateness of information for specific purposeanalyse experimental data, and draw valid conclusionsevaluate the quality of experimental data, both during the experiment and following simple error analysisapply chemical concepts and processes to predict and explain chemical reactionsinterpret and calculate results from experimental data |
| Teamwork skills to: | <ul style="list-style-type: none">participate in collaborative learning including discussing and negotiating with peers |
| Planning and organising skills to: | <ul style="list-style-type: none">record sources of scientific informationcollect and organise mathematical and scientific data |

| Foundation Skill | Industry/education/legislative/enterprise/Community requirements for this qualification include the following facets: |
|-----------------------------|---|
| Self management skills to: | <ul style="list-style-type: none"> • identify and apply appropriate learning strategies to the study of science |
| Technology skills to: | <ul style="list-style-type: none"> • use scientific calculator functions including statistical functions • use computer software packages for simulations |
| Digital literacy skills to: | <ul style="list-style-type: none"> • access information using online technologies |

Section C—Units of competency

Units of competency imported from training packages

The following units of competency can be accessed from the National Register of VET (See the [National Register of VET](#) for more information

BSBWHS211 Contribute to health and safety of self and others

BSBTEC203 Research using the internet

ICTICT221 Identify and use specific industry standard technologies

ICTICT226 Operate simple database applications

ICTICT435 Create technical documentation

MEM23004A Apply technical mathematics

MEM23007A Apply calculus to engineering tasks

MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment

MSL933005 Maintain the laboratory/field workplace fit for purpose

MSL943004 Participate in laboratory or field workplace safety

MSL973013 Perform basic tests

MSL973014 Prepare working solutions

MSL973016 Perform aseptic techniques

MSL973019 Perform microscopic examination

The following imported units are from accredited courses. (See the [DET website](#) to access the full curriculum documents) and are from the 22472VIC Certificate I in General Education for Adults

VU22387 Engage with texts of limited complexity for learning purposes

VU22392 Create texts of limited complexity for learning purposes

The following units of competency developed for Certificate III in Science are contained in Section C:

VU23249 Conduct and present simple scientific research

VU23252 Develop study skills for science

VU23263 Work with mathematical techniques

VU23264 Examine concepts in biology

VU23265 Examine concepts in chemistry

VU23266 Examine concepts in physics

VU23267 Examine body systems

The following units of competency developed for Certificate IV in Science are contained in Section C:

- VU23268 Apply essential further study skills for science
- VU23269 Research scientific fields of study
- VU23270 Use a range of techniques to solve mathematical problems
- VU23271 Apply mathematical techniques to scientific contexts
- VU23272 Investigate atomic structure and bonding
- VU23273 Investigate stoichiometry and solution chemistry
- VU23274 Investigate organic chemistry and properties of materials
- VU23275 Investigate chemical reactions
- VU23276 Investigate waves and optics
- VU23277 Apply principles of kinematics
- VU23278 Apply principles of electricity
- VU23279 Apply dynamics and conservation principles
- VU23280 Operate simple analogue and digital electronic circuits
- VU23281 Investigate cell biology
- VU23282 Investigate anatomy and physiology
- VU23283 Investigate introductory genetics
- VU23284 Investigate ecology
- VU23285 Work mathematically with statistics and calculus

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|---|--|---|--|
| UNIT CODE | | VU23249 | |
| UNIT TITLE | | Conduct and present simple scientific research | |
| APPLICATION | | <p>This unit describes the skills and knowledge to undertake and report on simple scientific experiments and investigations.</p> <p>This unit applies to learners who are undertaking experiments/observations in different areas of Science (Chemistry, Physics or Biology) according to their intended destinations.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Conduct a simple scientific experiment | 1.1 | Formulate or develop a simple hypothesis for an experiment |
| | | 1.2 | Identify a scientific concept/model/theory for investigation |
| | | 1.3 | Identify a scientific method to investigate the scientific concept/model/theory |
| | | 1.4 | Use appropriate independent and dependent variables to undertake a simple experiment relating to the scientific concept/model/theory |
| | | 1.5 | Record and analyse the results of the experiment against the hypotheses |
| | | 1.6 | Present the findings of the experiment using appropriate scientific terminology |
| 2 | Conduct a simple investigation of a scientific issue | 2.1 | Identify an issue of scientific interest which has contributed to society |
| | | 2.2 | Identify the area of science which underpins the issue |
| | | 2.3 | Investigate the impact of the issue on society |
| | | 2.4 | Record the results of the investigation using appropriate scientific terminology |
| | | 2.5 | Present the findings of the investigation using appropriate scientific terminology |

RANGE OF CONDITIONS

Scientific concept/model/theory may include but is not limited to: internal combustion engine, electricity, solar system, classification of living things, astronomy, periodic classification of the elements or radioactivity

Scientific hypothesis to include independent and dependent variable

Simple experiments may include but are not limited to:

- reading scales such as linear scales for example burettes or thermometers, dials on meters such as multi-range milliammeter and/or digital displays such as pH meters
- colour matching for example, universal indicator, nitrate tester
- observing simple chemical reactions and or biological samples using a microscope
- classifying common substances using indicators or appropriate key and/or simple living things

Area of science may include but is not limited to:

- a branch of science such as: archaeology, astronomy, biochemistry, biology, biotechnology, chemistry, cosmology, meteorology, physics, microbiology
- combinations of areas of science in an application such as: biological and psychological understanding of human endurance applied to occupational health and safety in working environments
- principles of science such as: conservation, achievement of equilibrium/balance, transfer and transformation of energy, levers/inclined plane applied to simple machines/toys
- applications of science:
 - 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

FOUNDATION SKILLS

| Skill | Description |
|-------------------------------|--|
| Writing skills to: | <ul style="list-style-type: none"> • present information in a tabular and graphical form. |
| Oral communication skills to: | <ul style="list-style-type: none"> • discuss and present research findings |
| Numeracy skills to: | <ul style="list-style-type: none"> • interpret data in simple graphs or information in a table |
| Learning skills to: | <ul style="list-style-type: none"> • identify and use reliable sources of information to establish a hypothesis. |
| Problem-solving skills to: | <ul style="list-style-type: none"> • use scientific method to measure, record and explain results in simple experiments |

| Planning and organising skills to: | <ul style="list-style-type: none"> gather, select and organise information effectively | | | | | | |
|--|--|------------------------------------|------------------------------------|----------|--|--|------------|
| Digital literacy skills to: | <ul style="list-style-type: none"> access information using online technologies | | | | | | |
| UNIT MAPPING INFORMATION | <table border="1"> <thead> <tr> <th data-bbox="504 450 818 573">Code and Title Current Version</th> <th data-bbox="818 450 1123 573">Code and Title Previous Version</th> <th data-bbox="1123 450 1412 573">Comments</th> </tr> </thead> <tbody> <tr> <td data-bbox="504 573 818 707">VU23249 Conduct and present simple scientific research</td> <td data-bbox="818 573 1123 707">VU22065 Conduct and present simple scientific research</td> <td data-bbox="1123 573 1412 707">Equivalent</td> </tr> </tbody> </table> | Code and Title Current Version | Code and Title Previous Version | Comments | VU23249 Conduct and present simple scientific research | VU22065 Conduct and present simple scientific research | Equivalent |
| | Code and Title Current Version | Code and Title Previous Version | Comments | | | | |
| VU23249 Conduct and present simple scientific research | VU22065 Conduct and present simple scientific research | Equivalent | | | | | |

Assessment Requirements

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| TITLE | Assessment Requirements for VU23249 Conduct and present simple scientific research |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • determine a basic hypothesis, conduct an experiment and present the results. • undertake a simple investigation of the impact of a scientific issue on society, the environment or an individual and present the findings. |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • terminology to describe scientific issues and the impact of scientific issues • basic scientific research methods • impact of science on different areas of society • what is a scientific hypothesis and how it is used. |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • research facilities such as a library, computer and internet access • equipment and resources as needed to undertake a simple scientific research task. <p>Assessor requirements</p> <p>There are no specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23252 | |
| UNIT TITLE | | Develop study skills for science | |
| APPLICATION | | <p>This unit describes the skills and knowledge to establish a range of study strategies and develop specific study skills for science.</p> <p>This unit applies to learners who are seeking to re-engage with learning in the science field as a pathway to entering or re-entering formal study in science related disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Develop effective study strategies for science | 1.1 | Source information about effective study strategies |
| | | 1.2 | Apply study strategies and techniques to science tasks |
| | | 1.3 | Identify and use tools to aid study |
| | | 1.4 | Investigate available study support services |
| 2 | Develop note-taking skills | 2.1 | Use a range of techniques to highlight key information |
| | | 2.2 | Use a range of note-taking techniques and methods |
| | | 2.3 | Take accurate notes |
| 3 | Apply critical thinking skills to respond to study tasks | 3.1 | Determine the purpose and audience for the study task |
| | | 3.2 | Identify key science terms and concepts for the task |
| | | 3.3 | Determine types of input needed to complete the task |
| | | 3.4 | Examine science concepts using critical thinking skills |
| | | 3.5 | Seek advice from others in determining response to the task |
| 4 | Participate in group activity to complete | 4.1 | Apply collaborative techniques to analyse task |
| | | 4.2 | Allocate roles and responsibilities |

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| study tasks | 4.3 | Produce a timeline for stages of completion |
| | 4.4 | Establish group work protocols |
| | 4.5 | Complete collaborative tasks |

RANGE OF CONDITIONS

Effective study strategies may include but are not limited to time management, prioritising work, record keeping, organising information, listening and reading techniques

Study strategies and techniques may include but are not limited to writing up experiment results, brainstorming, mind maps, interpreting data/statistics, evaluating evidence, synthesizing information and identifying key questions

Tools to aid study include but are not limited to: study support services or sessions, print-based and digital library resources, websites, mentors

Critical thinking skills may include but are not limited to evaluation of statements and/or claims, investigating application of a theory to a context, analysing data, investigating validity of statements, problem solving and providing a solution.

Collaborative techniques may include but are not limited to brainstorming topic and task, participating in group or team-based learning with others to share ideas and/or problem solve.

FOUNDATION SKILLS

| Skill | Description |
|------------------------------------|---|
| Writing skills to: | <ul style="list-style-type: none"> take accurate notes |
| Oral communication skills to: | <ul style="list-style-type: none"> collaborate with other learners |
| Problem-solving skills to: | <ul style="list-style-type: none"> manage time and prioritise tasks and information |
| Teamwork skills to: | <ul style="list-style-type: none"> collaborate and work with peers to complete group tasks |
| Planning and organising skills to: | <ul style="list-style-type: none"> identify and apply effective study strategies |
| Self management skills to: | <ul style="list-style-type: none"> participate in collaborative group learning to complete tasks |

UNIT MAPPING INFORMATION

| Code and Title Current Version | Code and Title Previous Version | Comments |
|--|--|------------|
| VU23252 Develop study skills for science | VU22066 Develop study skills for science | Equivalent |



Assessment Requirements

| | |
|------------------------------|--|
| TITLE | Assessment Requirements for VU23252 Develop study skills for science |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • identify and apply study strategies and use tools and techniques to aid effective study for a range of study tasks in the science field • complete study tasks by applying collaborative techniques |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • sources of information on effective study strategies • study support services |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure:</p> <ul style="list-style-type: none"> • allowance of sufficient time for learners to develop and apply their study skills to a range of tasks • access to sources of information on study strategies <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23263 | |
| UNIT TITLE | | Work with mathematical techniques | |
| APPLICATION | | <p>This unit describes the skills and knowledge to work with key mathematical concepts and apply them in a scientific context.</p> <p>This unit applies to learners who wish to develop mathematical knowledge and skills which can be applied to a number of science streams.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Work with whole numbers, fractions, percentages and ratio | 1.1 | Perform basic functions using whole numbers and directed numbers |
| | | 1.2 | Determine and simplify ratios from information in a practical problem |
| | | 1.3 | Apply ratios to quantities |
| | | 1.4 | Convert between fractions, decimals and percentages |
| | | 1.5 | Perform simple calculations involving fractions, decimals, mixed numbers and percent. |
| 2 | Work with measurement to solve problems | 2.1 | Identify measurements using the metric system |
| | | 2.2 | Use the metric system of measurement to solve problems |
| | | 2.3 | Identify two-dimensional and three-dimensional shapes and their properties |
| | | 2.4 | Calculate perimeters and areas of basic shapes using appropriate and correct units |
| | | 2.5 | Calculate volumes of prisms using appropriate and correct units |
| | | 2.6 | Use Pythagoras' Theorem to determine unknown sides of right angled triangles |
| | | 2.7 | Use common properties of triangles and quadrilaterals |

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| | | | to determine unknown angles |
| 3 | Work with basic indices | 3.1 | Evaluate simple index form expressions |
| | | 3.2 | Apply the first two index laws to simplify simple exponential expressions |
| | | 3.3 | Apply Scientific Notation to large and small decimal numbers |
| | | 3.4 | Perform simple calculations with numbers expressed in Scientific Notation |
| 4 | Work with simple equations and formulae | 4.1 | Substitute given values into simple equations and formulae |
| | | 4.2 | Write equations to solve simple problems |
| | | 4.3 | Transpose simple formulae |
| | | 4.4 | Solve simple linear equations |
| | | 4.5 | Solve simultaneous linear equations |
| 5 | Work with simple line graphs | 5.1 | Identify parts of a graph |
| | | 5.2 | Plot points determined from the general formula $y=mx+c$ on the Cartesian plane |
| | | 5.3 | Determine the gradient of a straight line |
| | | 5.4 | Determine the equation of a straight line with the general formula $y = mx + c$, $y = a$ and $x = b$ |
| | | 5.5 | Interpret graphical information |
| | | 5.6 | Draw and make predictions based on a line of best fit |
| 6 | Work with formulae and their graphical representations | 6.1 | Sketch linear and simple non-linear graphs |
| | | 6.2 | Determine equations for given linear graphs, including lines of best fit |
| 7 | Work with statistical information | 7.1 | Collect, organise and produce representations of statistical data |
| | | 7.2 | Interpret representations of statistical data |
| | | 7.3 | Calculate measures of central tendency |

RANGE OF CONDITIONS

Calculations should be performed using a combination of pen and paper and calculator as appropriate to the calculation

Basic functions may include but not limited to addition, subtraction, multiplication and division

The simple calculations may include but not limited to all the basic functions listed and a percentage (%) of.

Measurements must include length, mass and volume

Basic shapes include rectangles, triangles, circles and simple combined shapes.

Prisms should include cross sections of rectangular, triangular, circular and combining simple shapes

Formulae include simple formulae with powers.

Simple linear equations refers to one and two step operations.

Statistical data may include but is not limited to grouped or individual data

Measures of central tendency may include but are not limited to: mean, median, mode.

FOUNDATION SKILLS

| Skill | Description |
|-------------------------------|---|
| Reading skills to: | <ul style="list-style-type: none"> • read off values in a table, chart or graph • locate information necessary to solve a problem |
| Writing skills to: | <ul style="list-style-type: none"> • represent information in a graphical form |
| Oral communication skills to: | <ul style="list-style-type: none"> • describe the general shape of a given or plotted scatter diagram |
| Numeracy skills to: | <ul style="list-style-type: none"> • estimate to check calculations and reasonableness of outcomes • use mathematical symbols, charts, diagrams and graphs as appropriate to convey mathematical thinking and processing • use specialised calculator functions relevant to mathematical needs |
| Problem-solving skills to: | <ul style="list-style-type: none"> • perform calculations involving fractions and mixed numbers • perform calculations involving whole numbers, decimals and directed number • round a decimal to a given number of decimal places • use simple geometry to determine angles in triangles |



| | | | |
|---------------------------------|---|---|----------------|
| | <ul style="list-style-type: none"> convert quantities between different metric units | | |
| UNIT MAPPING INFORMATION | Code and Title Current Version | Code and Title Previous Version | Comments |
| | VU23263 Work with mathematical techniques | VU22067 Work with mathematical techniques | Not Equivalent |

Assessment Requirements

| | |
|------------------------------|---|
| TITLE | Assessment Requirements for VU23263 Work with mathematical techniques |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • work with a number of mathematical concepts to perform simple calculations and solve simple problems • sketch graphs from a given formula to: <ul style="list-style-type: none"> – represent statistical information – identify connections between formulae and graphical representations • use simple algebraic techniques to solve problems • use Pythagoras' theorem to solve problems • use estimating skills to check calculations and reasonableness of outcomes • use mathematical symbolism, charts, diagrams and graphs as appropriate to convey mathematical thinking and processing |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • fractions and mixed numbers • whole numbers, decimals and directed number • terminology for metric units • features of general shapes • main characteristics of linear and simple non-linear graphs • Pythagoras' theorem |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • materials and texts to support completion of tasks • computer and internet to access relevant mathematical information/data to complete tasks • a scientific calculator. <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

| | | | |
|---|---|---|--|
| UNIT CODE | | VU23264 | |
| UNIT TITLE | | Examine concepts in biology | |
| APPLICATION | | <p>This unit describes the skills and knowledge to examine the major concepts in biology such as cell biology and ecology and their basic application.</p> <p>This unit applies to learners who wish to develop basic knowledge and skills in the area of biology.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Examine the basic building blocks for life | 1.1 | Compare the characteristics of living and non-living things. |
| | | 1.2 | Identify the cellular features within different types of cells and describe their function |
| | | 1.3 | Explain the differences between plant and animal cells |
| | | 1.4 | Describe the process of cellular replication |
| | | 1.5 | Describe the sources of energy and the processes cells use to obtain and use energy |
| 2 | Explain the classification of living things | 2.1 | Identify key features of different kingdoms to classify organisms |
| | | 2.2 | Explain the lower levels of classification |
| | | 2.3 | Use dichotomous keys to classify living things |
| 3 | Describe the interaction of living things | 3.1 | Identify ecosystems and their features |
| | | 3.2 | Describe the flow of energy through ecosystems |
| | | 3.3 | Investigate the relationships between members of ecosystems |
| | | 3.4 | Describe the adaptations of living things to their surroundings |

| <p>RANGE OF CONDITIONS</p> <p>Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications.</p> <p>Cell Types include eukaryotes and prokaryotes</p> <p>Cellular replication includes: cell cycle mitosis (including cytokinesis), meiosis and binary fission</p> <p>Sources of energy may include but not limited to food and light</p> <p>Processes include photosynthesis and cellular respiration (aerobic and anaerobic)</p> <p>Kingdoms include: eubacteria, archaeaprotists, fungi, plants, animals</p> <p>Lower levels of classification include: phylum, class, order, family, genus, species</p> <p>Ecosystems may include: aquatic, marine, terrestrial</p> <p>Interrelationships may include: symbiosis, commensalism, prey/predator</p> | | | | | | | | | | | | | |
|---|---|-------------------------------------|------------|-------|-------------|--------------------|---|--------------------|--|----------------------------|---|------------------------------------|---|
| <p>FOUNDATION SKILLS</p> <table border="1"> <thead> <tr> <th>Skill</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Reading skills to:</td> <td> <ul style="list-style-type: none"> interpret information about key concepts in biology </td> </tr> <tr> <td>Writing skills to:</td> <td> <ul style="list-style-type: none"> convey information about key concepts in biology </td> </tr> <tr> <td>Problem-solving skills to:</td> <td> <ul style="list-style-type: none"> analyse scientific relationships and compare concepts </td> </tr> <tr> <td>Planning and organising skills to:</td> <td> <ul style="list-style-type: none"> compare and classify information and concepts </td> </tr> </tbody> </table> | | | | Skill | Description | Reading skills to: | <ul style="list-style-type: none"> interpret information about key concepts in biology | Writing skills to: | <ul style="list-style-type: none"> convey information about key concepts in biology | Problem-solving skills to: | <ul style="list-style-type: none"> analyse scientific relationships and compare concepts | Planning and organising skills to: | <ul style="list-style-type: none"> compare and classify information and concepts |
| Skill | Description | | | | | | | | | | | | |
| Reading skills to: | <ul style="list-style-type: none"> interpret information about key concepts in biology | | | | | | | | | | | | |
| Writing skills to: | <ul style="list-style-type: none"> convey information about key concepts in biology | | | | | | | | | | | | |
| Problem-solving skills to: | <ul style="list-style-type: none"> analyse scientific relationships and compare concepts | | | | | | | | | | | | |
| Planning and organising skills to: | <ul style="list-style-type: none"> compare and classify information and concepts | | | | | | | | | | | | |
| <p>UNIT MAPPING INFORMATION</p> | Code and Title Current Version | Code and Title Previous Version | Comments | | | | | | | | | | |
| | VU23264 Examine concepts in biology | VU22068 Examine concepts in biology | Equivalent | | | | | | | | | | |



Assessment Requirements

| | |
|------------------------------|---|
| TITLE | Assessment Requirements for VU23264 Examine concepts in biology |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • Apply the basic concepts of biology to explain: <ul style="list-style-type: none"> - the structure and function of cells - sources and use of energy - the classification of living things - functions and relationships of ecosystems |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • structure and function of cells • sources and use of energy in cellular processes • classification of living things • functions of ecosystems • scientific terminology related to the area of biology |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • research facilities such as library, computer and internet • scientific texts <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

| | | | |
|---|-----------------------------|--|--|
| UNIT CODE | | VU23265 | |
| UNIT TITLE | | Examine concepts in chemistry | |
| APPLICATION | | <p>This unit describes the skills and knowledge to examine the major concepts in chemistry such as atomic structure, chemical reactions and solution chemistry and their basic application.</p> <p>This unit applies to learners who wish to develop basic knowledge and skills in the area of chemistry.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Examine atomic structure | 1.1 | Describe the particle theory view of matter |
| | | 1.2 | Explain states of matter and their properties with reference to particles |
| | | 1.3 | Describe the arrangement of subatomic particles in an atom and their electrical charge |
| | | 1.4 | Explain the mass and volume of atoms in terms of their structure |
| | | 1.5 | Explain the structure of isotopes and ions of atoms |
| 2 | Examine how atoms combine | 2.1 | Describe the combination of atoms to make more stable formations |
| | | 2.2 | Describe different types of chemical bonding |
| | | 2.3 | Describe the concept of mole in chemistry |
| | | 2.4 | Calculate the mass in grams of one mole of selected compounds |
| 3 | Describe the periodic table | 3.1 | Discuss the purpose of the periodic table |
| | | 3.2 | Discuss the structure of the periodic table |
| | | 3.3 | Describe the relationship between elements in a group |
| | | 3.4 | Identify the information contained in the table for each element |

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|---|---|-----|--|
| | | 3.5 | Describe the general features of metals, metalloids and non-metals |
| 4 | Describe chemical reactions | 4.1 | Describe the difference between chemical and physical changes |
| | | 4.2 | Describe the main classes of chemical reactions |
| | | 4.3 | Write balanced chemical equation for common reactions |
| 5 | Investigate the reactions between acids and bases | 5.1 | Define the meaning of the terms acid and base according to the Brønsted-Lowry theory |
| | | 5.2 | Explain the properties of acids and bases |
| | | 5.3 | Describe the process of neutralisation |
| | | 5.4 | Determine the pH of substances. |
| 6 | Define solutions and solubility | 6.1 | Explain the characteristics of solutions, suspensions and other mixtures |
| | | 6.2 | Interpret solubility curves |
| | | 6.3 | Construct solubility curves using experimental data |
| | | 6.4 | Calculate the molarity of solutions |

RANGE OF CONDITIONS

Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications. The theoretical concepts and practical applications for this unit should be at a foundational or introductory level of learning.

States of matter include but not limited to gases, liquids and solids and can include intramolecular (e.g. covalent bonds, ionic bonds & metallic bonds) and intermolecular Interactions (including but not limited to hydrogen bonding and dispersion forces).
Subatomic particles include protons, neutrons and electrons

Formations include molecules, ions and lattices

Bonding includes Intramolecular interactions (including covalent, ionic and metallic) as well as chemical bonding for example intermolecular bonding (hydrogen bonding or dispersion forces)

Identity Information in periodic table including name, symbol, atomic number, mass number

Main Classes of chemical reactions include combination or synthesis, decomposition, simple displacement, double displacement, acid-base and combustion

FOUNDATION SKILLS

| Skill | Description | | |
|---------------------------------|--|---------------------------------------|------------|
| Reading skills to: | <ul style="list-style-type: none"> • read and interpret key information • read and follow instructions | | |
| Writing skills to: | <ul style="list-style-type: none"> • summarise key information • record results | | |
| Numeracy skills to: | <ul style="list-style-type: none"> • calculate mass of various compounds • calculate molarity | | |
| Problem-solving skills to: | <ul style="list-style-type: none"> • write balanced chemical equations • identify relationships between elements | | |
| UNIT MAPPING INFORMATION | | | |
| | Code and Title Current Version | Code and Title Previous Version | Comments |
| | VU23265 Examine concepts in Chemistry | VU22069 Examine concepts in Chemistry | Equivalent |

Assessment Requirements

| | |
|------------------------------|--|
| TITLE | Assessment Requirements for VU23265 Examine concepts in Chemistry |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply the basic concepts in chemistry to explain or describe: <ul style="list-style-type: none"> – the classification and properties of matter – atomic structure – the features and characteristics of the periodic table – solutions and solubility – chemical reactions including those involving acids |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • classification and properties of matter • using scientific terminology • atomic structure • periodic table • chemical equations • chemical reactions • solutions and solubility • acids and bases • Brønsted-Lowry theory • relationship between mole and mass • basic chemical calculations |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • research facilities such as a library, computer and internet access • relevant scientific texts <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

| | | | |
|---|---|---|---|
| UNIT CODE | | VU23266 | |
| UNIT TITLE | | Examine concepts in physics | |
| APPLICATION | | <p>This unit describes the skills and knowledge required to examine the major concepts in physics such as motion, magnetism and sound and their basic application.</p> <p>This unit applies to learners who wish to develop basic knowledge and skills in the areas of physics</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Determine basic quantities in the measurement of straight line motion | 1.1 | Explain key terminology relevant to the description of straight line motion |
| | | 1.2 | Make measurements of displacement and time from observations of straight line motion |
| | | 1.3 | Make determinations of velocity and acceleration from straight line motion data |
| | | 1.4 | Plot displacement and velocity graphs from straight line motion data |
| | | 1.5 | Make descriptions of motion from displacement and velocity graphs |
| 2 | Explain the basic concepts in Newton's laws of motion | 2.1 | Explain key terminology relevant to the laws of motion |
| | | 2.2 | Describe the effect on the movement of a body in the absence of a net force |
| | | 2.3 | Explain the relationships between the net force, acceleration and mass |
| | | 2.4 | Explain the relationship between gravity, mass and weight |
| | | 2.5 | Explain observable phenomena that illustrate the motion of an object consistent with Newton's first and second laws |
| | | 2.6 | Explain observable phenomena that illustrate reactive forces consistent with Newton's third law |

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| 3 | Explain the basic concepts in magnetism | 3.1 | Describe magnetic forces in relation to the north and south poles of a compass |
| | | 3.2 | Explain the difference between a magnetised and non-magnetised piece of iron |
| | | 3.3 | Explain the production of magnetic fields by an electric current |
| | | 3.4 | Describe the construction of an electromagnet |
| | | 3.5 | Describe factors that affect the strength of a magnetic force |
| | | 3.6 | Identify the use of magnets in day to day life |
| 4 | Explain the properties and behaviour of sound | 4.1 | Explain the movement of sound through various mediums. |
| | | 4.2 | Explain the representation of sound by the use of a wave |
| | | 4.3 | Explain the meaning of intensity, its representation and measurement |
| | | 4.4 | Explain the meaning of frequency, its representation and measurement |
| | | 4.5 | Explain the meaning of velocity, its representation and measurement |

RANGE OF CONDITIONS

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

Factors that affect magnetic force may include but not limited to temperature, knocks or vibrations, metal alloy used in construction of magnet and from magnet and/or pole

The use of magnets may include but not limited to tools, utensils, toys, games, compasses, electricity, headphones and speakers

Mediums for sound to pass through may include gases, liquids and/or solids

FOUNDATION SKILLS

| Skill | Description |
|--------------------|--|
| Reading skills to: | <ul style="list-style-type: none"> read and interpret and about key concepts in physics |
| Writing skills to: | <ul style="list-style-type: none"> convey information about key concepts in physics |



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| <p>Numeracy skills to:</p> | <ul style="list-style-type: none"> • measure displacement and time • determine velocity and acceleration • plot graphs from data | | |
| <p>Problem-solving skills to:</p> | <ul style="list-style-type: none"> • use data to determine and plot information • identify relationships between concepts of motion | | |
| <p>UNIT MAPPING INFORMATION</p> | | | |
| | <p>Code and Title Current Version</p> | <p>Code and Title Previous Version</p> | <p>Comments</p> |
| <p>VU23266 Examine concepts in physics</p> | <p>VU22070 Examine concepts in physics</p> | <p>Equivalent</p> | |

Assessment Requirements

| | |
|------------------------------|--|
| TITLE | Assessment Requirements for VU23266 Examine concepts in physics |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • Apply basic concepts in physics to explain: <ul style="list-style-type: none"> – straight line motion – the relationship between acceleration, force and mass – the attractive force between objects – magnetism and magnetic force – properties of sound. |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • the actions of an object • the relationship between acceleration, force and mass • the attractive force between objects • magnetism and magnetic force • sound energy and its behaviour • scientific terminology related to physics |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • research facilities such as library, computer, internet resources • relevant scientific texts <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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|---|-----------------------------|---|--|
| UNIT CODE | | VU23267 | |
| UNIT TITLE | | Examine body systems | |
| APPLICATION | | <p>This unit describes the skills and knowledge to examine the major body systems, the organs which belong to them and their functions.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of anatomy and physiology and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Identify major body systems | 1.1 | Identify the major body systems and their major organs |
| | | 1.2 | Explain the functions of major body systems |
| 2 | Examine a body system | 2.1 | Select a body system for examination |
| | | 2.2 | Determine the parts of the body system being examined |
| | | 2.3 | Examine the structure and function of the organs within the system |
| | | 2.4 | Identify disorders or diseases affecting the body system |
| | | 2.5 | Compare disorders with the normal function of the body system |

RANGE OF CONDITIONS

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

Major body systems may include circulatory, respiratory, skeletal, muscular, digestive and/or nervous

Major organs may include: heart, lungs, stomach, liver and/or brain

Disorders include illnesses, diseases and/or conditions that affect the system's ability to function normally



| FOUNDATION SKILLS | | | |
|---------------------------------|-----------------------------------|---|------------|
| Skill | | Description | |
| Reading skills to: | | <ul style="list-style-type: none"> access, read and interpret information about the major body systems and their parts | |
| Problem-solving skills to: | | <ul style="list-style-type: none"> locate organs within the appropriate body system | |
| UNIT MAPPING INFORMATION | | | |
| | Code and Title Current Version | Code and Title Previous Version | Comments |
| | VU23267 Examine body systems | VU22071 Examine body systems | Equivalent |

Assessment Requirements

| | |
|------------------------------|--|
| TITLE | Assessment Requirements for VU23267 Examine body systems |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • access and interpret information about major body systems and the major organs which belong to them • select at least 2 body systems and examine their components and normal function within the whole system |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • terminology related to the anatomy and physiology of major body systems and major organs • location of major body systems • functions of major organs • disorders which can affect different body systems • differences between healthy and diseased body systems and organs |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • information about body systems and their parts • models and charts of body systems <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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|---|--|--|---|
| UNIT CODE | | VU23268 | |
| UNIT TITLE | | Apply essential further study skills for science | |
| APPLICATION | | <p>This unit describes the knowledge and skills required to study and participate effectively in a tertiary learning environment within a science or science related discipline.</p> <p>This unit applies to learners who wish to engage with studies in the science field and who need to develop study skills essential to the study of science or science related disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Use a range of learning strategies related to the study of science | 1.1 | Identify a range of learning strategies that can be applied to the study of science |
| | | 1.2 | Investigate the main learning contexts that may be experienced in the study of science in a tertiary learning environment |
| | | 1.3 | Use learning strategies appropriate for a range of learning contexts in the science field |
| | | 1.4 | Assess individual strengths, weaknesses and preferences in the use of different learning strategies to support the study of science |
| 2 | Use a range of library and online sources to access information related to the science field | 2.1 | Describe the main services of a library |
| | | 2.2 | Identify the range of sources for obtaining information about science in a library |
| | | 2.3 | Access and assess appropriateness of scientific information. |
| | | 2.4 | Record and store information appropriately |
| 3 | Use effective reading strategies to interpret complex scientific texts | 3.1 | Describe and apply a range of academic reading strategies |
| | | 3.2 | Identify and discuss the significance of context for the meaning of a text |
| | | 3.3 | Apply techniques for note-taking, summarising and |



| | | | |
|---|---|-----|---|
| | | | synthesising information |
| | | 3.4 | Use the parts of the text to assist with interpretation of meaning |
| | | 3.5 | Use dictionaries and other reference materials to assist with interpretation of scientific texts |
| 4 | Use academic writing skills to produce complex scientific texts | 4.1 | Identify the main features of different academic texts in the science field |
| | | 4.2 | Identify the main phases of the academic writing process |
| | | 4.3 | Identify the significance of audience and context in the conventions of academic writing |
| | | 4.4 | Use appropriate citation for references and quoted work |
| | | 4.5 | Apply academic standards on plagiarism and collusion |
| | | 4.6 | Produce a scientific text |
| 5 | Participate effectively in collaborative learning | 5.1 | Identify the key features of collaborative learning |
| | | 5.2 | Describe the characteristics of effective collaborative learning |
| | | 5.3 | Apply verbal, interpersonal and participatory skills necessary for effective learning collaboration |
| | | 5.4 | Negotiate appropriate planning processes with fellow students to achieve agreed outcomes |

RANGE OF CONDITIONS

Learning strategies for science may include but are not limited to : note-taking, revision, partnerships with other students, tracking, grouping/classifying information or data, representing information visually, using inferences and prior knowledge, hypothesising, estimating, inquiry, analysing and/or comparing data

Learning contexts may include but are not limited to laboratory work, practical activities, lectures, on-line learning, tutorials, seminars, field work, group work, independent projects and/or examinations

Academic reading strategies may include but are not limited to: skimming and scanning information, selecting main points, critical reading, assessing data

Parts of the text may include but are not limited to: structure such as chapter headings, paragraph and sub headings, diagrams and illustrations, tables and charts, bibliographies and references, specialised or technical vocabulary, wording and syntax

Academic texts in the science field may include but are not limited to: government reports written for the broader public that include easy and accessible common terminology and language for example, government reports on areas such as waterways, agriculture,



| <p>health, food standards, climate change, and other organisations such as the CSIRO , Bureau of Meteorology peer review science articles</p> <p>Collaborative learning may include study groups, learning partnerships, group presentations, tutorials, workshops and/or on-line discussion groups, fieldwork</p> | | | | | | | |
|--|--|-----------------------------------|------------------------------------|----------|--|--|------------|
| <p>FOUNDATION SKILLS</p> | | | | | | | |
| <p>Skill</p> | <p>Description</p> | | | | | | |
| <p>Reading skills to:</p> | <ul style="list-style-type: none"> skim, scan and read for meaning to interpret scientific texts | | | | | | |
| <p>Writing skills to:</p> | <ul style="list-style-type: none"> complete complex texts including correct use of citations take notes including summarising and synthesising key information | | | | | | |
| <p>Oral communication skills to:</p> | <ul style="list-style-type: none"> negotiate, discuss and participate in collaborative learning | | | | | | |
| <p>Learning skills to:</p> | <ul style="list-style-type: none"> continually research and source emerging information relating to science. | | | | | | |
| <p>Problem-solving skills to:</p> | <ul style="list-style-type: none"> assess appropriateness of information for specific purpose | | | | | | |
| <p>Teamwork skills to:</p> | <ul style="list-style-type: none"> participate in collaborative learning including discussing and negotiating with peers | | | | | | |
| <p>Planning and organising skills to:</p> | <ul style="list-style-type: none"> record sources of scientific information | | | | | | |
| <p>Self management skills to:</p> | <ul style="list-style-type: none"> identify and apply appropriate learning strategies to the study of science | | | | | | |
| <p>Digital literacy skills to:</p> | <ul style="list-style-type: none"> access electronic library resources including internet and online searches | | | | | | |
| <p>UNIT MAPPING INFORMATION</p> | <table border="1"> <thead> <tr> <th>Code and Title Current Version</th> <th>Code and Title Previous Version</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>VU23268 Apply essential further study skills for science</td> <td>VU22072 Apply essential further study skills for science</td> <td>Equivalent</td> </tr> </tbody> </table> | Code and Title Current Version | Code and Title Previous Version | Comments | VU23268 Apply essential further study skills for science | VU22072 Apply essential further study skills for science | Equivalent |
| Code and Title Current Version | Code and Title Previous Version | Comments | | | | | |
| VU23268 Apply essential further study skills for science | VU22072 Apply essential further study skills for science | Equivalent | | | | | |



Assessment Requirements

| | |
|------------------------------|---|
| TITLE | Assessment Requirements for VU23268 Apply essential further study skills for science |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • source scientific information from a range of reliable sources • apply reading strategies and the writing process to interpret 2 different simple scientific texts and produce 2 associated pieces of academic writing • work effectively in a collaborative learning environment |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • range of learning strategies related to science • library and online services to access information • reading strategies to interpret scientific texts • key stages in the writing process • text structures and features in scientific texts • conventions of academic referencing • what constitutes plagiarism and the consequences of submitting plagiarised work |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • library resources • appropriate scientific texts • internet access and printing facilities • computers and word processing software <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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|---|---|---|---|
| UNIT CODE | | VU23269 | |
| UNIT TITLE | | Research scientific fields of study | |
| APPLICATION | | <p>This unit describes the knowledge and skills to research a scientific field of study in a tertiary learning environment</p> <p>This unit applies to learners who are preparing for study in the science or science related disciplines at a tertiary level.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Research a scientific field of study | 1.1 | Identify scientific fields of study available in tertiary environments |
| | | 1.2 | Select a field of study for investigation |
| | | 1.3 | Describe the field of study and areas of specialisation |
| | | 1.4 | Examine the core subject matter and areas of specialisation |
| | | 1.5 | Describe forms of enquiry and research methods used in the field of study |
| 2 | Use on-line technologies for researching a field of study | 2.1 | Source information using academic databases and search engines |
| | | 2.2 | Cross check information using alternative sources and accepted authorities |
| | | 2.3 | Examine online texts for reliability and quality of evidence and argument |
| | | 2.4 | Examine online resources for consistency with academic discourse and conventions. |
| 3 | Use online technology to examine a journal article | 3.1 | Access journal article abstracts using academic databases |
| | | 3.2 | Select and access a peer reviewed journal article |
| | | 3.3 | Describe the peer review process |

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| | | 3.4 | Examine the research methods and the subject matter presented in the journal article |
| 4 | Deliver a presentation on field of study examined | 4.1 | Identify audience and purpose of the presentation |
| | | 4.2 | Structure and organise presentation to fit time available |
| | | 4.3 | Source images appropriate to purpose and sequence logically |
| | | 4.4 | Source supporting material as required |
| | | 4.5 | Use delivery register appropriate to audience and communicate clearly and succinctly |
| | | 4.6 | Respond to questions and discussion |

RANGE OF CONDITIONS

Scientific fields of study may include but are not limited to the following sciences: biological, physical chemical or earth

Specialisations may include aeronautics, anatomy, astronomy, biochemistry, biology, biotechnology, botany, chemistry, ecology, engineering, environmental science, food technology, forestry, genetics, geology, geography, health, microbiology, nursing, nutrition, pathology, physics, physiology, renewable, energy and/or zoology

Forms of enquiry may include but are not limited to: research such as text based, laboratory, action based, quantitative and/or qualitative, workplace/community or archaeological investigations, case-studies, longitudinal studies and/or sampling

FOUNDATION SKILLS

| Skill | Description |
|-------------------------------|---|
| Reading skills to: | <ul style="list-style-type: none"> undertake research to source, examine and compare information |
| Writing skills to: | <ul style="list-style-type: none"> summarise and paraphrase academic texts |
| Oral communication skills to: | <ul style="list-style-type: none"> communicate verbally for presentations |
| Problem-solving skills to: | <ul style="list-style-type: none"> critically assess reliability and quality of online information |
| Digital literacy skills to: | <ul style="list-style-type: none"> access information using online technologies |

UNIT MAPPING INFORMATION

| Code and Title Current Version | Code and Title Previous Version | Comments |
|-----------------------------------|------------------------------------|----------|
| | | |



| | | | | |
|--|---|---|------------|--|
| | VU23269 Research scientific fields of study | VU22073 Research scientific fields of study | Equivalent | |
|--|---|---|------------|--|

Assessment Requirements

| | |
|------------------------------|---|
| TITLE | Assessment Requirements for VU23269 Research scientific fields of study |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • obtain information about scientific fields of study from a variety of sources • use online technologies, specifically search engines and online authoring tools to research and make a presentation on a scientific field of study. |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • fields of science related study available at Australian universities • online technologies, science data bases and their applications • the purpose of peer review of journals • research methods specific to fields of study • presentation techniques and protocols |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • library resources to access information about fields of study • course directories • field of study guides • internet access and printing facilities • computers and word processing software <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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|---|---|---|---|
| UNIT CODE | | VU23270 | |
| UNIT TITLE | | Use a range of techniques to solve mathematical problems | |
| APPLICATION | | <p>This unit describes the skills and knowledge to use a range of specialist techniques and concepts to solve mathematical problems.</p> <p>This unit applies to learners who wish to develop mathematical knowledge and skills which can be applied to a number of science streams.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. 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 triangles |
| 3 | Use indices to solve problems | 3.1 | Evaluate index form expressions |
| | | 3.2 | Simplify 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 |
| 4 | Use measurements to | 4.1 | Determine lengths and perimeters of rectangles, triangles, circles and simple combined shapes using |



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| | solve mensuration problems in two and three dimensions | | 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 equations and formulae | 5.1 | Substitute given values into equations and formulae |
| | | 5.2 | Write equations to solve problems |
| | | 5.3 | Transpose formulae |
| | | 5.4 | Solve linear equations |
| 6 | Solve problems by plotting points | 6.1 | Plot given points and points determined from the general formula $y = mx+c$ on the Cartesian plane |
| | | 6.2 | Determine the gradient of a straight line |
| | | 6.3 | Determine the equation of a straight line, where the equation has the general form: $y = mx+c$, $y = a$ 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 statistical data |
| | | 7.2 | Interpret and analyse statistical information |
| 8 | Identify connections between formulae and graphical representations | 8.1 | Use graphical techniques to draw linear and non-linear graphs |
| | | 8.2 | Develop equations for given linear graphs, including lines of best fit |
| 9 | Use algebraic techniques to analyse and solve problems | 9.1 | Develop formulae to describe relationships between variables and substitute into formulae to find particular values |
| | | 9.2 | Use a range of techniques to solve a range of algebraic problems and perform algebraic manipulations |
| RANGE OF CONDITIONS | | | |

Formulae may include simple formulae with powers

Straight line includes line of best fit for empirical data

Statistical data may be presented but not limited to grouped data or by using standard graphing conventions

Statistical information may include but not limited to using central tendencies such as mean, median, mode, percentiles and/or measures of spread

Non-linear graphs may include: exponential, inverse and quadratic relationships

For experimental data, lines of best fit can be drawn by eye. Experimental data may also include non-linear relationships where software may be used

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 and the simplification of expressions in index form including negative indices

Range of algebraic problems may include but are not limited to: linear (involving multiple operations), simultaneous linear and/or Quadratic

Calculations should be performed using a combination of pen and paper and calculator as appropriate to the calculation

FOUNDATION SKILLS

| Skill | Description |
|----------------------------|--|
| Reading skills to: | <ul style="list-style-type: none"> • read and interpret values in a table, chart or graph • locate embedded information necessary to solve a problem or analyse quantitative information |
| Numeracy skills to: | <ul style="list-style-type: none"> • perform a range of calculations including: <ul style="list-style-type: none"> – fractions and mixed numbers – decimals and directed numbers |
| Problem-solving skills to: | <ul style="list-style-type: none"> • round a decimal to a given number of decimal places • use geometry to determine angles in triangles (including non-right angled) • convert unit quantities to units with a different prefix • write a number correct to a given number of significant figures • calculate systematic, random and percentage errors • describe the general shape of a given or plotted scatter diagram |



| | <ul style="list-style-type: none"> • identify and determine dimensions of general shapes • estimate to check calculations and reasonableness of outcomes • use a range of mathematical symbolism, charts, diagrams and graphs to represent mathematical thinking and processing | | | | | | |
|--|--|------------------------------------|------------------------------------|----------|--|--|------------|
| Planning and organising skills to: | <ul style="list-style-type: none"> • collect and organise mathematical data | | | | | | |
| Technology skills to: | <ul style="list-style-type: none"> • use scientific calculator functions including statistical functions | | | | | | |
| UNIT MAPPING INFORMATION | <table border="1"> <thead> <tr> <th>Code and Title Current Version</th> <th>Code and Title Previous Version</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>VU23270 Use a range of techniques to solve mathematical problems</td> <td>VU22074 Use a range of techniques to solve mathematical problems</td> <td>Equivalent</td> </tr> </tbody> </table> | Code and Title Current Version | Code and Title Previous Version | Comments | VU23270 Use a range of techniques to solve mathematical problems | VU22074 Use a range of techniques to solve mathematical problems | Equivalent |
| | Code and Title Current Version | Code and Title Previous Version | Comments | | | | |
| VU23270 Use a range of techniques to solve mathematical problems | VU22074 Use a range of techniques to solve mathematical problems | Equivalent | | | | | |



Assessment Requirements

| | |
|------------------------------|--|
| TITLE | Assessment Requirements for VU23270 Use a range of techniques to solve mathematical problems |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply a wide range of mathematical concepts and techniques to solve mathematical problems including: <ul style="list-style-type: none"> – 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 – presenting and evaluating statistical information – identifying connections between formulae and graphical representations – using algebraic techniques to analyse and solve problems • apply estimation to check calculations and reasonableness of problem solving outcomes • use mathematical symbolism, charts, diagrams and graphs to convey mathematical thinking and processing. |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • use of Pythagoras Theorem in trigonometry • principles of algebra • techniques to solve algebraic problems • major characteristics of linear and simple non-linear graphs • graphical techniques to draw graphs |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • calculators to perform calculations • computers and internet to access relevant mathematical data such as spreadsheets and data bases • materials and texts to support completion of tasks <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23271 | |
| UNIT TITLE | | Apply mathematical techniques to scientific contexts | |
| APPLICATION | | <p>This unit describes the skills and knowledge related to basic statistics, functions and their graphs, circular functions, exponents and logarithms for study in science related disciplines.</p> <p>This unit applies to learners who are seeking to re-engage with learning in the science field</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Use trigonometry and circular function to solve mathematical problems | 1.1 | Define $\sin \theta$, $\cos \theta$ and $\tan \theta$ in terms of the unit circle and use symmetry properties to convert the function of a negative angle or an angle greater than 90° to the function of an acute angle |
| | | 1.2 | Convert angles 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 |
| | | 1.6 | Solve problems involving simple applications of circular functions |
| 2 | Use simple algebraic functions and their graphs to solve mathematical problems | 2.1 | Solve simple problems involving direct and inverse proportion |
| | | 2.2 | Describe general shape, rates of change, intercepts and asymptotes of a graph and give domain and range using set notation |
| | | 2.3 | Sketch the graph of a quadratic function |
| | | 2.4 | Determine whether a relation of a given graph is a function from a graph, a set of co-ordinates or an equation |



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| | | 2.5 | Solve quadratic equations algebraically and 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 and draw the line of best fit |
| | | 3.2 | 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 expressions between exponential and logarithmic forms |
| | | 4.4 | Evaluate logarithms to determine scientific parameters |
| | | 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 using tables and graphs |
| | | 5.2 | Use frequency distribution curves to determine numbers and/or percentage values which have a particular characteristic |
| | | 5.3 | Use cumulative frequency curves to determine percentiles for data |
| | | 5.4 | Determine measures of central tendency for a given set of data and identify limitation of their use in isolation |
| | | 5.5 | Determine measures of spread and identify limitation of their use in isolation |
| | | 5.6 | Determine properties of statistical data |

RANGE OF CONDITIONS

In the context of creating a graph, sketch means using main features not by plotting points.

Simultaneous equations are quadratic plus linear

Graphs should include histograms, cumulative frequency ogives and box and whiskers plots

| Measures of central tendency include mean, median and mode | | | | | | | |
|---|--|------------------------------------|------------------------------------|----------|--|--|------------|
| Measures of spread include range, variance and standard deviation | | | | | | | |
| FOUNDATION SKILLS | | | | | | | |
| Skill | Description | | | | | | |
| Reading skills to: | <ul style="list-style-type: none"> • read, interpret and use statistical data | | | | | | |
| Writing skills to: | <ul style="list-style-type: none"> • record statistical data | | | | | | |
| Oral communication skills to: | <ul style="list-style-type: none"> • present statistical data | | | | | | |
| Problem-solving skills to: | <ul style="list-style-type: none"> • apply a range of mathematical functions including: <ul style="list-style-type: none"> – trigonometric functions and radian measure – algebraic functions – exponential and logarithmic functions | | | | | | |
| Technology skills to: | <ul style="list-style-type: none"> • use appropriate keys on a scientific calculator | | | | | | |
| UNIT MAPPING INFORMATION | <table border="1"> <thead> <tr> <th>Code and Title Current Version</th> <th>Code and Title Previous Version</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>VU23271 Apply mathematical techniques to scientific contexts</td> <td>VU22075 Apply mathematical techniques to scientific contexts</td> <td>Equivalent</td> </tr> </tbody> </table> | Code and Title Current Version | Code and Title Previous Version | Comments | VU23271 Apply mathematical techniques to scientific contexts | VU22075 Apply mathematical techniques to scientific contexts | Equivalent |
| | Code and Title Current Version | Code and Title Previous Version | Comments | | | | |
| VU23271 Apply mathematical techniques to scientific contexts | VU22075 Apply mathematical techniques to scientific contexts | Equivalent | | | | | |



Assessment Requirements

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| TITLE | Assessment Requirements for VU23271 Apply mathematical techniques to scientific contexts |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply a range of strategies and techniques to solve mathematical 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 |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • 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: $y = mx + c$, $y = a$, $x = b$ and $y = ax^2 + bx + c$, 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. |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • scientific calculator • materials and texts to support completion of tasks <p>Assessor requirements</p> |

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| | No specialist vocational competency requirements for assessors apply to this unit. |
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| UNIT CODE | | VU23272 | |
| UNIT TITLE | | Investigate atomic structure and bonding | |
| APPLICATION | | <p>This unit describes the skills and knowledge to investigate the application of atomic structure, bonding and the periodic table.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of chemistry and related science disciplines</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Apply the particle theory of matter | 1.1 | Use appropriate terminology to discuss classification and properties of matter |
| | | 1.2 | Use the particle theory of matter to explain the states of matter and their common properties |
| | | 1.3 | Identify distinctions between physical and chemical changes |
| | | 1.4 | Describe the relationship between properties of materials and their uses |
| | | 1.5 | Classify pure substances into elements and compounds on the basis of their properties and the particle theory of matter |
| 2 | Use the Bohr-Rutherford model to explain the structure of an atom and how this relates to the periodic table | 2.1 | Identify the principal sub-atomic particles together with their mass, relative mass and charge |
| | | 2.2 | Explain the way shell/energy level structure of an atom relates to its electron configuration in the ground state |
| | | 2.3 | Explain the structure of the modern periodic table |
| | | 2.4 | Explain the relationship between the electronic configuration of an atom and its position in the periodic table |
| | | 2.5 | Explain atomic property trends in the periodic table |

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| 3 | Use knowledge of the Periodic table to explain the properties and bonding of elements and compounds | 3.1 | Identify stable electron configurations with reference to atoms of the noble gases and use 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 | Describe the role polarity plays in intermolecular forces |
| | | 3.5 | Use electron dot diagrams to represent the transfer of electrons in ionic bonding |
| | | 3.6 | Use electron dot and dash diagrams to represent the bonding in and structure of simple molecules |
| | | 3.7 | Use the nature of bonding in an element or compound to predict some of their physical properties |
| 4 | Derive systematic names and formulae for simple inorganic compounds | 4.1 | Determine the correct chemical formulae for binary compounds using basic valency concept |
| | | 4.2 | Identify binary, ionic and molecular compounds |
| | | 4.3 | Determine the correct chemical formulae and names for acids, bases and salts |

RANGE OF CONDITIONS

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

Common properties of matter may include conservation of mass, conservation of shape versus flow, conservation of volume versus expansion and/or compressibility

Elements include metals, non-metals and noble gases

Principal sub-atomic particles include electrons, protons and neutrons

Explanation of the structure of the periodic table should include but is not limited to:

- at least the first 20 elements
- some transition elements
- drawing and interpreting diagrams which represent Bohr-Rutherford models of atoms and atomic ions

Atomic property trends may include but are not limited to atomic size and/or electronegativity

Physical properties in an element or compound may include but are not limited to electrical

conductivity of solid or liquid, hardness, brittleness, malleability and/or qualitative estimates of melting /boiling points.

Chemical formulae and names for acids, bases and salts may include but are not limited to compounds found in the laboratory and/or in the home.

FOUNDATION SKILLS

| Skill | Description |
|----------------------------|---|
| Reading skills to: | <ul style="list-style-type: none"> read and interpret the periodic table |
| Writing skills to: | <ul style="list-style-type: none"> write chemical formulae |
| Problem-solving skills to: | <ul style="list-style-type: none"> apply particle theory and identify chemical relationships classify elements and compounds draw and interpret electronic dot/dash diagrams predict electron configurations of atoms |
| Self management skills to: | <ul style="list-style-type: none"> apply safety procedures to work with common chemicals |

UNIT MAPPING INFORMATION

| Code and Title Current Version | Code and Title Previous Version | Comments |
|--|--|------------|
| VU23272 Investigate atomic structure and bonding | VU22076 Investigate atomic structure and bonding | Equivalent |

Assessment Requirements

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|------------------------------|--|
| TITLE | Assessment Requirements for VU23272 Investigate atomic structure and bonding |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply theories in atomic structure and bonding and the periodic table to: <ul style="list-style-type: none"> – classify properties of matter – explain the structure of an atom – explain the chemical and physical properties of common elements and compounds – determine names and formulae for simple inorganic compounds – represent information related to structure and bonding |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • 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 • structure of the periodic table and its relationship to atomic structure • periodicity and bonding • systematic names and formulae for simple inorganic compounds • safety procedures to work safely with common chemicals |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • periodic table • drawing materials • equipment and resources to complete tasks <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23273 | |
| UNIT TITLE | | Investigate stoichiometry and solution chemistry | |
| APPLICATION | | <p>This unit describes the skills and knowledge to apply stoichiometry and solution chemistry to solve problems.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of stoichiometry and solution chemistry and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| PREREQUISITE UNIT(S) | | VU23272 Investigate atomic structure and bonding | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Use the mole definition and formulae to solve problems | 1.1 | Define and calculate the relative atomic mass of an element using mass spectrometric data |
| | | 1.2 | Calculate the relative molecular and formula mass of molecular and ionic compounds |
| | | 1.3 | Use the mole to solve problems |
| | | 1.4 | Use experimental data to calculate the empirical formulae of compounds |
| | | 1.5 | Use empirical formulae and relative molecular masses to determine molecular formulae. |
| 2 | Derive balanced chemical equations for simple reactions and apply stoichiometry to these equations | 2.1 | Write balanced chemical equations to represent chemical reactions |
| | | 2.2 | Distinguish the differences between types of chemical reactions |
| | | 2.3 | Use stoichiometric equations to calculate mass-mass relationships between reactants and products. |
| 3 | Explain solution formation and solubility | 3.1 | Explain the characteristics of solutions, suspensions and other mixtures |
| | | 3.2 | Use terminology relevant to solution formation |
| | | 3.3 | Explain factors which affect solubility |

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| | | 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. |
| 4 | Solve concentration problems | 4.1 | Perform dilution calculations |
| | | 4.2 | Calculate the molarity of solutions |
| | | 4.3 | Calculate concentration in other units. |

RANGE OF CONDITIONS

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

Problems may include but are not limited to: mass of substance, number of particles and relative atomic mass or molecular mass.

Types of chemical reactions may include but are not limited to the following reactions: acid neutralization and combustion, association, dissociation and precipitation, combination and decomposition.

Concentration in other units include percentages, weight/volume, volume(v/v) and parts per million(ppm).

FOUNDATION SKILLS

| Skill | Description |
|-------------------------------|--|
| Numeracy skills to: | <ul style="list-style-type: none"> perform calculations related to solution formation and solubility |
| Problem-solving skills to: | <ul style="list-style-type: none"> use formulae to solve problems write balanced chemical equations construct solubility curves use experimental data to make calculations |
| Oral communication skills to: | <ul style="list-style-type: none"> convey information about solutions and solubility |

UNIT MAPPING INFORMATION

| Code and Title Current Version | Code and Title Previous Version | Comments |
|--|--|------------|
| VU23273 Investigate stoichiometry and solution chemistry | VU22077 Investigate stoichiometry and solution chemistry | Equivalent |

Assessment Requirements

| | |
|------------------------------|--|
| TITLE | Assessment Requirements for VU23273 Investigate stoichiometry and solution chemistry |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply concepts in stoichiometry and solution chemistry to solve problems and perform a range of calculations including: <ul style="list-style-type: none"> – representing chemical reactions for simple chemical reactions with chemical equations – calculating solution formation and solubility rates • calculating the concentration of solutions • interpret experimental data |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • definition of mole to solve problems • solution formation and solubility • different types of chemical reactions • terminology related to solution formation and solubility • types of solution <ul style="list-style-type: none"> – unsaturated – saturated – supersaturated |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • calculator • resources and equipment to complete tasks <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

| | | | |
|---|--|--|--|
| UNIT CODE | | VU23274 | |
| UNIT TITLE | | Investigate organic chemistry and properties of materials | |
| APPLICATION | | <p>This unit describes the skills and knowledge to investigate and apply the concepts of organic chemistry and properties of materials to solve problems.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of organic chemistry and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Use simple hydrocarbons to explain structure and isomerism of organic molecules | 1.1 | Draw the structural formulae of simple hydrocarbons up to C6 |
| | | 1.2 | Explain the concept of isomerism |
| | | 1.3 | Identify common functional groups in organic molecules |
| 2 | Identify the structure of simple organic molecules | 2.1 | Use International Union of Pure and Applied Chemistry(IUPAC) conventions to name simple organic compounds on the basis of their molecular structures |
| | | 2.2 | Draw the structures of simple organic molecules based on their IUPAC names |
| 3 | Investigate the relationship between structure and properties of organic compounds | 3.1 | Identify the intermolecular bonding present in simple organic compounds |
| | | 3.2 | Determine the relationship between the structures of organic compounds and their physical properties |
| | | 3.3 | Describe the formation of polymers from simple monomers |
| 4 | Write balanced chemical equations to represent simple | 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 |

| | organic reactions | | their use as fuels | | | | | | | | | | |
|--|---|------------|--|-----------------------------------|------------------------------------|--------------------|--|---|--|----------------------------|---|---------------------|--|
| | | 4.3 | Write balanced equations to demonstrate the acidic nature of carboxylic acids and the alkaline nature of organic amines. | | | | | | | | | | |
| <p>RANGE OF CONDITIONS</p> <p>Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications</p> <p>Simple hydrocarbons include alkanes, alkenes, alkynes and benzene</p> <p>Simple organic compounds may include but are not limited to: alkanes, alkenes, alkynes, aromatics as represented by benzene, alcohols, halogenated hydrocarbons, carboxylic acids and/or esters</p> <p>Intermolecular bonds may include dispersion bonds and/or hydrogen bonds</p> <p>Physical properties of organic compounds may include but are not limited to: volatility, solubility in water or in non-polar solvents, melting and boiling points.</p> | | | | | | | | | | | | | |
| <p>FOUNDATION SKILLS</p> <table border="1"> <thead> <tr> <th>Skill</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Reading skills to:</td> <td> <ul style="list-style-type: none"> investigate relationships between structures and properties interpret and apply conventions related to naming and representing molecular structures </td> </tr> <tr> <td>Writing skills to:</td> <td> <ul style="list-style-type: none"> write chemical equations in the correct format </td> </tr> <tr> <td>Problem-solving skills to:</td> <td> <ul style="list-style-type: none"> represent simple chemical reactions of organic compounds identify relationships between chemical properties draw molecules using the appropriate techniques </td> </tr> <tr> <td>Numeracy skills to:</td> <td> <ul style="list-style-type: none"> use ratios for balancing equations </td> </tr> </tbody> </table> | | | | Skill | Description | Reading skills to: | <ul style="list-style-type: none"> investigate relationships between structures and properties interpret and apply conventions related to naming and representing molecular structures | Writing skills to: | <ul style="list-style-type: none"> write chemical equations in the correct format | Problem-solving skills to: | <ul style="list-style-type: none"> represent simple chemical reactions of organic compounds identify relationships between chemical properties draw molecules using the appropriate techniques | Numeracy skills to: | <ul style="list-style-type: none"> use ratios for balancing equations |
| Skill | Description | | | | | | | | | | | | |
| Reading skills to: | <ul style="list-style-type: none"> investigate relationships between structures and properties interpret and apply conventions related to naming and representing molecular structures | | | | | | | | | | | | |
| Writing skills to: | <ul style="list-style-type: none"> write chemical equations in the correct format | | | | | | | | | | | | |
| Problem-solving skills to: | <ul style="list-style-type: none"> represent simple chemical reactions of organic compounds identify relationships between chemical properties draw molecules using the appropriate techniques | | | | | | | | | | | | |
| Numeracy skills to: | <ul style="list-style-type: none"> use ratios for balancing equations | | | | | | | | | | | | |
| <p>UNIT MAPPING INFORMATION</p> <table border="1"> <thead> <tr> <th>Code and Title Current Version</th> <th>Code and Title Previous Version</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>VU23274 Investigate organic chemistry and properties of materials</td> <td>VU22078 Investigate organic chemistry and properties of materials</td> <td>Equivalent</td> </tr> </tbody> </table> | | | | Code and Title Current Version | Code and Title Previous Version | Comments | VU23274 Investigate organic chemistry and properties of materials | VU22078 Investigate organic chemistry and properties of materials | Equivalent | | | | |
| Code and Title Current Version | Code and Title Previous Version | Comments | | | | | | | | | | | |
| VU23274 Investigate organic chemistry and properties of materials | VU22078 Investigate organic chemistry and properties of materials | Equivalent | | | | | | | | | | | |

Assessment Requirements

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|------------------------------|---|
| TITLE | Assessment Requirements for VU23274 Investigate organic chemistry and properties of materials |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply concepts in organic chemistry and properties of material to solve problems and represent information including: <ul style="list-style-type: none"> – demonstrating knowledge of the structure and isomerism of organic molecules – representing simple organic molecules using IUPAC rules – using knowledge of the relationships between structure and properties of organic compounds – representing simple organic reactions through balanced equations |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • structural formulae of simple hydrocarbons • the concept of isomerism • functional groups in organic molecules • IUPAC naming and conventions • at least 2 physical properties of organic compounds • names of simple organic compounds • correct terminology to describe concepts of organic chemistry and the properties of materials |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • drawing materials • resources and equipment to complete tasks • IUPAC conventions <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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|---|---|--|---|
| UNIT CODE | | VU23275 | |
| UNIT TITLE | | Investigate chemical reactions | |
| APPLICATION | | <p>This unit describes the skills and knowledge to apply basic concepts related to chemical reactions including acid-base and redox theory.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of chemistry and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| PREREQUISITE UNIT(S) | | <p>VU23272 Investigate atomic structure and bonding</p> <p>VU23273 Investigate stoichiometry and solution chemistry</p> <p>VU23274 Investigate organic chemistry and properties of materials</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Use ionic equations to represent reactions involving ions in solution | 1.1 | Distinguish ionic liquids from aqueous solutions containing ions |
| | | 1.2 | Distinguish ionisation reactions from dissociation reactions |
| | | 1.3 | Classify electrolytes into strong or weak depending on the degree of their ionisation or dissociation |
| | | 1.4 | Write ionic equations |
| 2 | Use current theories to explain acid-base behaviour | 2.1 | Identify the general properties of acids and bases |
| | | 2.2 | Classify common substances as acids or bases using the Arrhenius and Bronstead- Lowry theories |
| | | 2.3 | Use terminology relevant to explaining acid-base behaviour |
| | | 2.4 | Explain the differences between strong and weak acids and bases |
| | | 2.5 | Write stoichiometric and ionic equations for neutralisation reactions |

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| | | 2.6 | Write ionic equations for the ionisation reactions of common polyprotic acids |
| 3 | Use the pH scale | 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 |
| 4 | Use titration results to complete concentration problems | 4.1 | Prepare equipment to perform titrations |
| | | 4.2 | Perform titrations |
| | | 4.3 | Calculate the concentration of an acid or base from titration results |
| | | 4.4 | Draw and interpret a pH titration curve (of a strong acid and base) from experimental data |
| 5 | Write ionic equations to represent redox reactions | 5.1 | Use terminology relevant to redox reactions |
| | | 5.2 | Use the activity series of metals to predict reactions between metals and water |
| | | 5.3 | Write ionic equations (half and total) for simple redox reactions |
| | | 5.4 | Determine and use oxidation numbers to identify redox reactions. |
| 6 | Investigate the operation and uses of galvanic and electrolytic cells | 6.1 | Identify the parts of an electrochemical (galvanic) cell |
| | | 6.2 | Make predictions 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. |
| 7 | Investigate the corrosion of steel and its prevention | 7.1 | Identify the conditions needed for corrosion |
| | | 7.2 | Use redox theory and ionic equations to explain the corrosion of steel and its prevention |

RANGE OF CONDITIONS

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

Electrolytes may include liquid such as ionic liquids, aqueous solutions containing ions and/or solid such as ceramic fuel cell.

Ionic equations may be for but not limited to: ionisation and dissociation and/or precipitation (association) reactions.

Simple redox reactions may include but are not limited to: metal displacement reactions, oxidation, reduction, redox, reductant (reducer) and/or oxidant (oxidiser).

Predictions may include but are not limited to: determining the anode and cathode, direction of electron and ionic flows, reactions occurring at each electrode, total cell reaction, polarity of the electrodes and/or maximum voltage (emf) the cell may produce.

FOUNDATION SKILLS

| Skill | Description |
|----------------------------|--|
| Problem-solving skills to: | <ul style="list-style-type: none"> • apply chemical concepts and processes to predict and explain chemical reactions • write and solve equations • calculate pH and acid/base concentration • classify aqueous solutions • interpret and calculate results from experimental data |
| Numeracy skills to: | <ul style="list-style-type: none"> • write equations to represent different chemical reactions • undertake calculations related to different types of chemical reactions |
| Reading skills to: | <ul style="list-style-type: none"> • classify information related to different aspects of chemical reactions |

UNIT MAPPING INFORMATION

| Code and Title Current Version | Code and Title Previous Version | Comments |
|--|--|------------|
| VU23275 Investigate chemical reactions | VU22079 Investigate chemical reactions | Equivalent |

Assessment Requirements

| | |
|------------------------------|--|
| TITLE | Assessment Requirements for VU23275 Investigate chemical reactions |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply theories related to chemical reactions to solve problems, perform calculations and interpret and represent data including: <ul style="list-style-type: none"> – writing ionic equations representing different reactions including those involving ions in solution, redox reactions and simple electrolytic processes – explaining chemical behaviour – using the pH scale to solve problems and perform calculations – performing titrations and interpreting results |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • definition of electrolyte • acid-base theories including Arrhenius and Bronstead-Lowry theories • strengths of acids and bases • titration techniques and calculations • structure of the pH scale • redox theory • terminology related to: <ul style="list-style-type: none"> – titration techniques – acid-base behaviour – redox reactions – classification of: <ul style="list-style-type: none"> – electrolytes – acids and bases – aqueous solutions • procedures for the safe use of chemical equipment and resources |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • drawing materials • equipment and materials to complete tasks such as: <ul style="list-style-type: none"> – chemical solutions & indicators <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23276 | |
| UNIT TITLE | | Investigate waves and optics | |
| APPLICATION | | <p>This unit describes the skills and knowledge to apply wave theory and the laws of optics.</p> <p>The unit applies to learners who wish to develop their knowledge and skills in the area of physics and related science disciplines</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Distinguish between wave types | 1.1 | Use wave theory terminology appropriately |
| | | 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 determine when two particles in a wave are in phase |
| 2 | Investigate the nature of sound waves | 2.1 | Explain the properties of sound waves |
| | | 2.2 | Identify the purpose and features of the decibel scale |
| | | 2.3 | Describe the behaviour of sound waves |
| | | 2.4 | Describe the properties of resonance and standing waves |
| 3 | Research the applications of the major bands of the electromagnetic spectrum | 3.1 | Contrast the properties of the major components of the electromagnetic spectrum |
| | | 3.2 | Provide an example of an application for each section of the electromagnetic spectrum |
| | | 3.3 | Describe factors affecting the intensity of a source of electromagnetic radiation |
| | | 3.4 | Calculate the wavelength or frequency of an electromagnetic wave |



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| | | 3.5 | Describe the features of laser radiation |
| 4 | Determine the path of a light ray | 4.1 | Describe the behaviour of light when it undergoes reflection and refraction |
| | | 4.2 | Determine the path of a light ray quantitatively |
| 5 | Investigate the formation of images by mirrors and lenses | 5.1 | Use ray tracing techniques to describe images formed by mirrors and lenses |
| | | 5.2 | Identify the three principal rays for concave mirrors and concave lenses |
| | | 5.3 | Explain the optics of simple optical instruments |

RANGE OF CONDITIONS

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

Properties of sound waves may include but are not limited to: velocity, pitch and frequency, interference, diffraction, intensity and/or loudness

Behaviour of sound waves may include but are not limited to: shock waves, boundary behaviour, reflection, refraction, interference and/or beats

Properties of the electromagnetic spectrum include but are not limited to: source, frequency, wavelength, energy and/or detection

Simple optical instruments may include but are not limited to: magnifying glasses, telescope, microscope, cameras and/or slide projectors.

FOUNDATION SKILLS

| Skill | Description |
|----------------------------|--|
| Problem-solving skills to: | <ul style="list-style-type: none"> use ray tracing techniques use a scientific calculator determine relationships between the components of wave theory and their applications distinguish differences between waves |
| Reading skills to: | <ul style="list-style-type: none"> investigate different aspects of the behaviour of sound and light |
| Numeracy skills to: | <ul style="list-style-type: none"> use information about sound waves to undertake calculations calculate paths of light rays |

UNIT MAPPING



| INFORMATION | Code and Title Current Version | Code and Title Previous Version | Comments |
|--------------------|--------------------------------------|--------------------------------------|------------|
| | VU23276 Investigate waves and optics | VU22080 Investigate waves and optics | Equivalent |

Assessment Requirements

| | |
|------------------------------|---|
| TITLE | Assessment Requirements for VU23276 Investigate waves and optics |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply relevant scientific theories and laws to solve a range of problems and undertake a range of calculations related to waves and optics including: <ul style="list-style-type: none"> – comparing wave types and their motion – explaining the properties and behaviour of sound waves and light rays – investigating properties of the electromagnetic spectrum and application of the major bands – investigating how images are formed by mirrors and lenses. |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • main types of waves including transverse and longitudinal • scientific laws and theories to explain the behaviour of light and sound • relationship between velocity, frequency and wavelength • the properties and behaviour of sound waves • amplitude, period and phase • factors affecting light intensity • components of the electromagnetic spectrum and their relationship • critical angle and total internal reflection • optical fibres • terminology to describe wave theory and its application • purpose and safe use of scientific equipment in a physics laboratory |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • scientific calculator • equipment to complete tasks such as wave generator, slinky springs, ripple tanks, microwave generator, laser and accessories, Hodson's light box kits and optical bench • optical instruments • blackout facilities <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to</p> |

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| | this unit. |
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| UNIT CODE | | VU23277 | |
| UNIT TITLE | | Apply principles of kinematics | |
| APPLICATION | | <p>This unit describes the skills and knowledge to describe and use the principles of kinematics to represent and calculate the motion of an object.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of physics and related science disciplines</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Analyse the linear motion of an object | 1.1 | Describe the motion of an object using appropriate terminology |
| | | 1.2 | Distinguish the position, displacement and distance travelled by an object moving with linear motion. |
| | | 1.3 | Calculate the velocity and speed of an object given the displacement, distance and time |
| | | 1.4 | Calculate the acceleration of an object given the initial velocity, final velocity and time |
| | | 1.5 | Solve problems related to moving objects |
| | | 1.6 | Present data based on calculations |
| 2 | Draw and interpret kinematic graphs | 2.1 | Draw position-time and velocity-time graphs from experimental data |
| | | 2.2 | Calculate displacement and acceleration from a velocity-time graph |
| | | 2.3 | Draw position-time, velocity-time and acceleration-time graphs for objects moving with constant velocity and acceleration |
| | | 2.4 | Describe the motion of an object in a velocity-time graph using appropriate kinematic terminology |
| | | 2.5 | Present data based on calculations |

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| 3 | Define vector and scalar quantities | 3.1 | Explain the difference between vector and scalar quantities |
| | | 3.2 | Demonstrate vector quantities graphically |
| | | 3.3 | Resolve a vector into two right-angled components |
| | | 3.4 | Present data on calculations |
| 4 | Calculate the displacement and velocity of an object in two dimensions | 4.1 | Calculate the vector sum or subtraction of two displacement or velocity vectors that have directions parallel or perpendicular to each other |
| | | 4.2 | Solve vector addition problems |
| | | 4.3 | Present data on calculations |

RANGE OF CONDITIONS

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

Problems related to moving objects may include but are not limited to: those involving velocity, speed, displacement, distance and time for an object moving with constant velocity or those involving displacement, velocity, acceleration and time for an object moving with constant acceleration

Data may be presented by using appropriate S.I. units and converting where necessary and/or appropriate number of significant figures

Vector addition problems may include but are not limited to: those for two or more displacement or velocity vectors using the scale diagram and component methods and/or those involving relative velocities

FOUNDATION SKILLS

| Skill | Description |
|-------------------------------|--|
| Oral communication skills to: | <ul style="list-style-type: none"> present scientific data |
| Numeracy skills to: | <ul style="list-style-type: none"> perform addition and subtraction of vectors represent and interpret experimental data calculate different aspects of linear motion |
| Problem-solving skills to: | <ul style="list-style-type: none"> represent and interpret data in graphic form calculate velocity, speed and acceleration of moving objects |
| Technology skills to: | <ul style="list-style-type: none"> use a scientific calculator |



| UNIT MAPPING INFORMATION | Code and Title Current Version | Code and Title Previous Version | Comments |
|--------------------------|--|--|------------|
| | VU23277 Apply principles of kinematics | VU22081 Apply principles of kinematics | Equivalent |

Assessment Requirements

| | |
|------------------------------|--|
| TITLE | Assessment Requirements for VU23277 Apply principles of kinematics |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply the principles of kinematics to represent and calculate the velocity and motion of objects and use, interpret and present data from calculations in an appropriate format • investigate and perform calculations of: <ul style="list-style-type: none"> – the linear motion of an object – the displacement and velocity of an object in two dimensions |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • concepts of position, displacement and distance to perform calculations • concepts of velocity, speed and acceleration to calculate linear motion • position, velocity and acceleration versus time graphs • differences between vector and scalar quantities • vector components • relative velocities • kinematic terminology to describe and calculate motion |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • drawing materials • scientific calculator • equipment such as such as ticker timers, linear air tracks and computer interfacing equipment with light gates and/or sonic ranger to complete tasks <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23278 | |
| UNIT TITLE | | Apply principles of electricity | |
| APPLICATION | | <p>This unit describes the skills and knowledge to apply the principles of electricity to analyse and explain the operation of simple electrical circuits, motors, generators and domestic electricity supply.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of physics and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Apply the concepts of charge and electric current | 1.1 | Calculate the electrical force between point charges |
| | | 1.2 | Solve problems involving charge, current and time |
| | | 1.3 | Use appropriate International System of Units (SI units), converting where necessary, to present data with the appropriate number of significant figures as it applies to charge and electric current |
| 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 | Identify and follow WHS requirements for assembling and measuring circuits |
| | | 2.5 | Follow a circuit diagram to assemble a simple electrical extra low voltage circuit |
| | | 2.6 | Measure voltage and resistance for components of an extra low voltage circuit |
| | | 2.7 | Use appropriate S.I. units, converting where |



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| | | | necessary, to present data with the appropriate number of significant figures as it applies to electric circuit comprising resistive elements |
| 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, converting where necessary, to present data with the appropriate number of significant figures as it applies to electromagnetism |
| 4 | Investigate the main features and safety components of domestic supply and household circuits | 4.1 | Determine the main components and stages of the transmission of electric power to the household |
| | | 4.2 | Investigate 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, converting where necessary, to present data with the appropriate number of significant figures as it applies to domestic supply and household circuits |

RANGE OF CONDITIONS

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

Calculation of electric force between point charges refers to using Coulomb's law and Ohm's law

Range of magnetic fields may be produced by a magnet, current carrying wire and/or solenoid

Simple devices may include but are not limited to: generators, motors, measuring instruments, transformers.

FOUNDATION SKILLS



| Skill | Description | | |
|---------------------------------|---|---|------------|
| Numeracy skills to: | <ul style="list-style-type: none"> • calculate 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 • measure voltage and current • interpret a circuit diagram to assemble a circuit | | |
| Problem-solving skills to: | <ul style="list-style-type: none"> • record and present data accurately and clearly • evaluate the quality of experimental data, both during the experiment and following simple error analysis • analyse experimental data and draw valid conclusions • list and classify the possible sources of errors encountered when making a measurement • apply concepts of electrical current to assemble electric circuits | | |
| Technology skills to: | <ul style="list-style-type: none"> • use a scientific calculator | | |
| UNIT MAPPING INFORMATION | Code and Title Current Version | Code and Title Previous Version | Comments |
| | VU23278 Apply principles of electricity | VU22082 Apply principles of electricity | Equivalent |



Assessment Requirements

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| TITLE | Assessment Requirements for VU23278 Apply principles of electricity |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • safely apply the principles and concepts of electricity to solve problems and perform calculations related to charge and electric current including: <ul style="list-style-type: none"> – calculating the electrical force between point charges – presenting data with the appropriate number of significant figures – safely assembling a simple electrical circuit – investigating a range of magnetic fields and their relationship to the production of electric current – explaining the main features and safety components of household circuits |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • elementary unit of charge • Coulomb's law and Ohm's law as they apply to charge and electric current • devices to measure voltage and current such as multimeters conventional current flow • the S.I. units to represent data related to electric current • difference between potential difference and electromotive force • definition of electrical power • the difference between AC and DC charges • how electric power is transmitted at high voltages • main components of household electric circuits and their function • WHS requirements to work with circuits and use equipment safely |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • a scientific calculator • equipment and resources such as <ul style="list-style-type: none"> – extra low voltage electrical power supplies – multimeters – various electrical components for circuit connection – electromagnetic practical kits • safety information for use of equipment <p>Assessor requirements</p> |



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| | No specialist vocational competency requirements for assessors apply to this unit. |
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| UNIT CODE | | VU23279 | |
| UNIT TITLE | | Apply dynamics and conservation principles | |
| APPLICATION | | <p>This unit describes the skills and knowledge to apply dynamics and conservation principles to an object and/or system. It includes 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.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of physics and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication</p> | |
| PREREQUISITE UNIT(S) | | VU23277 Apply principles of kinematics | |
| ELEMENTS | | 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. 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 | Use vectors to calculate 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, converting where necessary, to present 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, converting where necessary, to present data with the appropriate number of significant figures |
| 3 | Apply the conservation of | 3.1 | Calculate gravitational potential energy given mass and height |



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| | energy principles | 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 conservation of energy principles to determine relevant quantities |
| | | 3.5 | Use appropriate S.I. units, converting where necessary, to present data with the appropriate number of significant figures |
| 4 | Apply the impulse-momentum equation | 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, converting where necessary, to present 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, converting where necessary, to present data with the appropriate number of significant figures |
| 6 | Apply the principle of moments | 6.1 | Use levers to demonstrate the principle of moments |
| | | 6.2 | Use appropriate S.I. units, converting where necessary, to present 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, converting where necessary, to present data with the appropriate number of significant figures |
| RANGE OF CONDITIONS | | | |

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| <p>Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications.</p> <p>Conservation of energy principles may include everyday physical observations, human body movements and/or vehicle observations</p> <p>Applications of the impulse-momentum may include everyday physical observations, human body movements, vehicle observations and/or sporting movements and actions</p> <p>Levers may include human body movements, engineering equipment and/or construction equipment</p> | | | |
| FOUNDATION SKILLS | | | |
| Skill | Description | | |
| Numeracy skills to: | <ul style="list-style-type: none"> present data according to S.I requirements | | |
| Problem-solving skills to: | <ul style="list-style-type: none"> analyse experimental data, and draw valid conclusions 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 distinguish between the weight and mass of an object | | |
| Technology skills to: | <ul style="list-style-type: none"> use a scientific calculator to perform calculations | | |
| UNIT MAPPING INFORMATION | Code and Title Current Version | Code and Title Previous Version | Comments |
| | VU23279 Apply dynamics and conservation principles | VU22083 Apply dynamics and conservation principles | Equivalent |
| | | | |



Assessment Requirements

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|------------------------------|--|
| TITLE | Assessment Requirements for VU23279 Apply dynamics and conservation principles |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply dynamics and conservation principles and theories to perform a range of calculations related to energy and motion • present data using appropriate S.I. units |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • Newton's three laws of motion and their application • work and energy principle and its application • definition of potential energy and forms of energy resources • impulse and momentum equation and its application • law of conservation of momentum and its application • definition of the moment of force • the principle of moments and its application • methods of energy conservation • International System(SI) of Units |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • scientific calculator • equipment and resources to complete tasks such as <ul style="list-style-type: none"> - ticker timers, - linear air tracks - computer interfacing equipment with light gates and /or sonic ranger <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |



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| UNIT CODE | | VU23280 | |
| UNIT TITLE | | Operate simple analogue and digital electronic circuits | |
| APPLICATION | | <p>This unit describes the knowledge and skills to assemble, analyse and explain the operation of simple analogue and digital electronic circuits.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of physics and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication</p> | |
| PREREQUISITE UNIT(S) | | VU23278 Apply principles of electricity | |
| ELEMENTS | | 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. 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 |



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| | | 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 logic output of the logic gates |
| | | 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 integrated circuit packages 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 |



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| | | | pulses |
| 8 | Assemble and analyse the operation of a simple electronic circuit | 8.1 | Assemble a simple electronic circuit and demonstrate the operation of the circuit |
| | | 8.2 | Measure current, voltage, power and signal characteristics at various points of the circuit |

RANGE OF CONDITIONS

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

Logic output of the logic gates may include: AND, NAND, OR, NOR, NOT and XOR for all possible inputs

Simple electronic circuit may comprise a number of discrete electronic components and/or integrated circuits

FOUNDATION SKILLS

| Skill | Description |
|----------------------------|--|
| Problem-solving skills to: | <ul style="list-style-type: none"> assemble electrical components correctly in electrical circuits represent voltage signals graphically conduct a range of calculations related to the operation of electronic circuits interpret timing diagrams |
| Technology skills to: | <ul style="list-style-type: none"> use features of a scientific calculator use computer software packages for simulations |

UNIT MAPPING INFORMATION

| Code and Title Current Version | Code and Title Previous Version | Comments |
|---|---|------------|
| VU23280 Operate simple analogue and digital electronic circuits | VU22084 Operate simple analogue and digital electronic circuits | Equivalent |



Assessment Requirements

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| <p>TITLE</p> | <p>Assessment Requirements for VU23280 Operate simple analogue and digital electronic circuits</p> |
| <p>PERFORMANCE EVIDENCE</p> | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • assemble, use and analyse the operation of a range of circuits including: <ul style="list-style-type: none"> – 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 • conduct a range of calculations and measurements related to the operation of simple electronic circuits |
| <p>KNOWLEDGE EVIDENCE</p> | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • main components and operation 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 • terminology related to electric circuits and their operation • safety requirements to use equipment safely in a physics laboratory • circuit symbols |
| <p>ASSESSMENT CONDITIONS</p> | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • scientific calculators • formula sheets • equipment and resources to complete tasks such as: |



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| | <ul style="list-style-type: none">- 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 such as Crocodile Clips <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |
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| UNIT CODE | | VU23281 | |
| UNIT TITLE | | Investigate cell biology | |
| APPLICATION | | <p>This unit describes the skills and knowledge to apply cell theory to identify cell organelles and structures, state their functions and outline various cellular life-supporting processes.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of biology and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Investigate cell theory | 1.1 | Identify the characteristics of living things |
| | | 1.2 | Distinguish between living and non-living things |
| | | 1.3 | Describe the three tenets of cell theory |
| 2 | Investigate the structure and function of typical eukaryotic cells | 2.1 | Distinguish between prokaryotes and eukaryotes |
| | | 2.2 | Identify typical cell components in eukaryotic 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 |
| | | 2.6 | Outline the function of chromosomes for the storage of genetic information |
| 3 | Describe cellular processes and functions | 3.1 | Outline the main aspects of cellular processes |
| | | 3.2 | Describe diffusion, osmosis and active transport across cell membranes |
| | | 3.3 | Describe the metabolic pathways of cellular respiration and photosynthesis |
| 4 | Investigate cellular | 4.1 | Outline the cell cycle and apoptosis |

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| | reproduction | 4.2 | Describe the stages of mitosis |
| | | 4.3 | Discuss the biological significance of mitosis |
| | | 4.4 | Outline the functional and genetic differences between mitosis and meiosis |
| 5 | Prepare and stain tissue specimens for microscopic examination | 5.1 | Prepare slides of biological materials following agreed procedures. |
| | | 5.2 | Check specimen slides for clarity and accuracy against requirements |
| | | 5.3 | Use personal protective equipment and observe established safety procedures |
| | | 5.4 | Operate and maintain microscopes to obtain focussed images and to optimise performance |

RANGE OF CONDITIONS

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

Typical cell components may include but are not limited to: cytoplasm, nucleus, cell membrane, ribosomes, vacuoles, endoplasmic, reticula, lysosomes, protein microtubules, basic structure of the macromolecules of cell structures

Eukaryotic cells may include plant and/or animal cells

Structure and function of chromosomes includes but is not limited to: segregation of chromosomes, chromosomes exist in pairs, the diploid or haploid of cells, arrangement of chromosomes

Cellular processes may include but are not limited to: the metabolic pathways of cellular respiration and photosynthesis, active transport, endocytosis, exocytosis, diffusion and osmosis

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

Procedures may include but are not limited to: preparation of whole live specimens, cutting sections and/or staining

Microscopes may include compound and/or stereo.

FOUNDATION SKILLS

| Skill | Description |
|----------------------------|--|
| Reading skills to: | <ul style="list-style-type: none"> locate and interpret information about cell biology |
| Problem-solving skills to: | <ul style="list-style-type: none"> apply cell theory to cellular processes and functions produce slide specimens |



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| | <ul style="list-style-type: none"> • check specimen slides against requirements | | |
| Technology skills to: | <ul style="list-style-type: none"> • use a microscope to perform microscopic examination of specimens | | |
| UNIT MAPPING INFORMATION | | | |
| | Code and Title Current Version | Code and Title Previous Version | Comments |
| | VU23281 Investigate cell biology | VU22085 Investigate cell biology | Equivalent |



Assessment Requirements

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|------------------------------|---|
| TITLE | Assessment Requirements for VU23281 Investigate cell biology |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • use cell theory to explain cellular structures, processes and functions including cellular reproduction and cellular respiration and photosynthesis • follow procedures to prepare clear slide specimens according to requirements • use a microscope to perform microscopic examination of specimens |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • name, structure and function of cellular characteristics common to both plants and animals • biological terms used to describe cell theory, cellular processes and reproduction • cellular processes • three tenets of cell theory • function of major microscope components • safety requirements and personal protective equipment to carry out microscopic examination • procedures to prepare specimen slides |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • scientific texts • audio visual resources • the internet to access information • microscopes • specimen slides <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23282 | |
| UNIT TITLE | | Investigate anatomy and physiology | |
| APPLICATION | | <p>This unit describes the skills and knowledge to explain the anatomy and physiology of living organisms and apply this knowledge to perform a simple dissection. Although the focus of this unit is on mammals, it is not a requirement that this includes humans.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of biology and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Research the key components and functions of major mammalian anatomical and physiological systems | 1.1 | Locate anatomical components within an organism with reference to anatomical planes and body cavities. |
| | | 1.2 | Explain the contribution of major organ systems to the working of the organism |
| | | 1.3 | Explain the basic mechanical, physical and biochemical functions of organ systems |
| | | 1.4 | Identify common illnesses or injuries of the major organ systems |
| | | 1.5 | Use anatomic terminology |
| 2 | Perform a simple dissection | 2.1 | Prepare dissection specimens and equipment according to required procedures |
| | | 2.2 | Locate and identify major anatomical organs and organ systems. |
| | | 2.3 | Perform the dissection according to work/occupational health and safety requirements including the use of personal protective equipment |
| | | 2.4 | Use scientific terminology related to anatomy and physiology |
| | | 2.5 | Follow clean up procedures after the dissection |



| RANGE OF CONDITIONS | | | | |
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| <p>Where possible, theoretical concepts should be supported by demonstrations and/or laboratory experiments to reinforce the links between theoretical knowledge and its practical applications.</p> <p>Anatomical planes may include sagittal either midsagittal or parasagittal, coronal and/or transverse</p> <p>Cavities may include but are not limited to: dorsal either cranial or spinal, ventral, thoracic either pleural or pericardial, abdominopelvic either abdominal or pelvic</p> <p>Organ systems may include but are not limited to: skeletal, muscular, integumentary, nervous, circulatory, lymphatic, digestive, respiratory, urinary, endocrine and/or reproductive</p> <p>Equipment may include but is not limited to: dissecting scissors, forceps, probe, dissecting pins and/or scalpel</p> | | | | |
| FOUNDATION SKILLS | | | | |
| Skill | | Description | | |
| Reading skills to: | | <ul style="list-style-type: none"> access and use information about mammalian anatomical and physiological systems apply WHS requirements when performing dissections | | |
| Problem-solving skills to: | | <ul style="list-style-type: none"> locate anatomical components in anatomical and physiological systems identify relationships between major mammalian anatomical and physiological systems use dissection instruments | | |
| Planning and organising skills to: | | <ul style="list-style-type: none"> prepare dissection specimens and equipment | | |
| UNIT MAPPING INFORMATION | | | | |
| | | Code and Title Current Version | Code and Title Previous Version | Comments |
| | | VU23282 Investigate anatomy and physiology | VU22086 Investigate anatomy and physiology | Equivalent |



Assessment Requirements

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|------------------------------|--|
| TITLE | Assessment Requirements for VU23282 Investigate anatomy and physiology |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • investigate the physiological functions and relationships of major anatomical features of at least three body systems • apply knowledge of anatomical and physiological systems to prepare for and perform a simple dissection safely |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • major anatomical features of mammalian body systems • gross physiological functions of major anatomical structures • function of various organ systems • common illnesses and injuries affecting major organs • occupational health and safety requirements to perform dissections • terminology related to the structure of major anatomical and physiological systems • equipment required to perform dissections • personal protective equipment to perform dissections • clean up procedures for dissections |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • personal protective equipment to perform dissections • anatomical information such as charts and models • dissecting equipment • cleaning and safety materials <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |



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| UNIT CODE | | VU23283 | |
| UNIT TITLE | | Investigate introductory genetics | |
| APPLICATION | | <p>This unit describes the skills and knowledge to use introductory genetics concepts to investigate the key elements of genetically-related phenomena including DNA structure, function and replication; chromosomes; and genes.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of biology and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Investigate the relationship between genes, chromosomes, DNA and RNA | 1.1 | Define the terms DNA, chromosome and gene |
| | | 1.2 | Describe the functions and structure of DNA and RNA |
| | | 1.3 | Describe the process of protein synthesis and DNA replication |
| 2 | Research gamete formation and sex determination in humans | 2.1 | Outline the process & outcomes of meiosis |
| | | 2.2 | Outline the steps involved in genetic sex determination |
| | | 2.3 | Outline the factors involved in environmental sex determination |
| 3 | Investigate types and causes of genetic mutation and chromosomal disorders | 3.1 | Define the terms genetic mutation and chromosomal disorder |
| | | 3.2 | Identify and describe mutation types |
| | | 3.3 | Explain the causes of mutation and rates of variation |
| 4 | Analyse and apply Mendel's laws of inheritance | 4.1 | Use genetic terms relevant to Mendelian inheritance |
| | | 4.2 | Outline Mendelian laws |
| | | 4.3 | Illustrate the laws of inheritance using appropriate terminology |

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| 5 | Research current genetic engineering techniques | 5.1 | Define key terms related to genetic engineering |
| | | 5.2 | Explain procedures used in genetic engineering |
| | | 5.3 | Discuss issues surrounding emerging genetic technologies |

RANGE OF CONDITIONS

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

Functions and structure of DNA and RNA may include but is not limited to: four nucleotide bases pairs ---> A-T, C-G, biological function of and main differences/similarities between DNA, chromosomes and genes, steps involved in the replication of DNA and ultimate outcome of the protein synthesis process

Mutation types may include but are not limited to:

- base substitution, frame shift and/or deletion/insertion
- chromosomal abnormalities: addition, deletion, translocation
- effects of mutations on protein synthesis

Mendelian laws may include explanation and examples of:

- problems in Mendelian genetics for example monohybrid and dihybrid crosses, linkage and sex-linkage
- Mendelian traits such as sickle-cell anaemia, Tay-Sachs disease, cystic fibrosis and xeroderma pigmentosa.
- the laws of segregation and independent assortment

Procedures used in genetic engineering may include but are not limited to: current uses of bacterial restriction enzymes, separation of DNA fragments and/or genetic cloning

FOUNDATION SKILLS

| Skill | Description |
|-------------------------------|--|
| Reading skills to: | <ul style="list-style-type: none"> • construct and interpret information related to genetic processes • research issues in genetics |
| Writing skills to: | <ul style="list-style-type: none"> • write genetic terminology |
| Oral communication skills to: | <ul style="list-style-type: none"> • analyse and discuss issues related to genetic disorders and genetic engineering • use genetic terminology |
| Problem-solving skills to: | <ul style="list-style-type: none"> • identify relationships between different genetic components • link the steps in genetic processes |

UNIT MAPPING



| INFORMATION | Code and Title Current Version | Code and Title Previous Version | Comments |
|--------------------|---|---|------------|
| | VU23283 Investigate introductory genetics | VU22087 Investigate introductory genetics | Equivalent |



Assessment Requirements

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|------------------------------|---|
| TITLE | Assessment Requirements for VU23283 Investigate introductory genetics |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply knowledge of the theories of genetics, to describe and present information on genetic processes, laws of inheritance and mutations • present and discuss issues related to genetic engineering |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • relevant scientific terminology and definitions related to genetics • genetic processes such as DNA replication and sex determination • sequence and outcomes of meiosis including sequence and stages of the first and second divisions of meiosis and/or interphase I, prophase I, metaphase I, anaphase I and telophase I and/or metaphase II, anaphase II and telophase II • Mendel's laws of inheritance • types of mutations • functions and structure of DNA and RNA • effects of human chromosomal abnormalities such as Turner Syndrome, Down Syndrome, Klinefelter Syndrome • causes of genetic mutation and chromosomal disorders including spontaneous mutation and/or mutagenic agents such as radiation and chemical substances • genetic technology related to genetic engineering • issues surrounding emerging genetic technologies such as ethical, social and/or legal issues |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • scientific texts related to genetics • resources such as charts and sample/models • the internet to access information <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23284 | |
| UNIT TITLE | | Investigate ecology | |
| APPLICATION | | <p>This unit describes the skills and knowledge to apply key ecological principles underpinning issues of concern about any specific type of environment.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of biology and related science disciplines.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. Assessment of performance is to be consistent with the evidence guide. | |
| 1 | Explain the levels of classification used in plant and animal taxonomy | 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 | Apply correct use of dichotomous classification keys for both plants and animals |
| 2 | Investigate the general characteristics of ecosystems | 2.1 | Identify the major components and terminologies associated with any type of ecosystem |
| | | 2.2 | Identify the biotic and abiotic features and other major components in specific ecosystem contexts |
| 3 | Analyse energy flow, nutrient recycling and relationships in living systems | 3.1 | Categorise specific features and major components of food chains and webs |
| | | 3.2 | Describe energy flow through an ecosystem |
| | | 3.3 | Identify and analyse the different types of symbiotic relationships that can occur within an ecosystem |
| | | 3.4 | Describe nutrient recycling through living systems |
| | | 3.5 | Identify the various trophic levels within an ecosystem and the relationships between them |
| 4 | Research major ecological problems | 4.1 | Analyse major ecological problems caused by human activity |
| | | 4.2 | Select and analyse a major ecological problem and |

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| | | | its environmental impact using appropriate scientific terminology |
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RANGE OF CONDITIONS

Major levels of classification may include: kingdom, phylum (division), class, order, family, genus and species

Major components and terminologies associated with ecosystems may include niche, community, population, biotic and abiotic factors, competition or symbiosis

Type of ecosystem may include but is not limited to: aquatic, marine or terrestrial which includes forests, grasslands, deserts, tundra

Food chains and webs may include: aquatic, marine and/or terrestrial

Symbiotic relationships may include: parasitism, mutualism and/or commensalism

Nutrients may include: water, carbon, nitrogen and/or phosphorus

Trophic levels within an ecosystem or tropism includes but is not limited to: primary and secondary consumers, relationship, and the energy flow between them.

Major ecological problems may include but are not limited to: global warming, land degradation, air, water or land pollution, biomagnification of poisons and/or salinity

Environmental impact may include but is not limited to: horticultural or food production, water supply, disease, erosion and/or salination

FOUNDATION SKILLS

| Skill | Description |
|-------------------------------|--|
| Reading skills to: | <ul style="list-style-type: none"> access and interpret information about eco systems categorise information about food chains and webs research a major ecological problem |
| Oral communication skills to: | <ul style="list-style-type: none"> discuss and analyse current ecological issues |
| Problem-solving skills to: | <ul style="list-style-type: none"> apply classification keys analyse the relationships within ecosystems |

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| UNIT MAPPING INFORMATION | Code and Title | Code and Title | Comments |
| | Current Version | Previous Version | |
| | VU23284 Investigate ecology | VU22088 Investigate ecology | Equivalent |



Assessment Requirements

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| TITLE | Assessment Requirements for VU23284 Investigate ecology |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply key ecological principles to: <ul style="list-style-type: none"> – the classifications used in plant and animal taxonomy – analyse the components of ecosystems including food chains and webs and their relationships – analyse a current ecological issue and its impacts |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • levels of classification used in plant and animal taxonomy • classification keys for plants and animals • general characteristics of ecosystems and their relationships • features and components of food chains and webs • terminology related to ecosystems |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • scientific texts • resources such as charts and samples/models • the internet to access information <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |

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| UNIT CODE | | VU23285 | |
| UNIT TITLE | | Work mathematically with statistics and calculus | |
| APPLICATION | | <p>This unit describes the skills and knowledge to determine and use statistical relationships between bivariate data, the normal distribution, sets applied to problems, probability and differential calculus.</p> <p>This unit applies to learners who wish to develop their knowledge and skills in the area of statistics and calculus as they apply to different fields of maths and science.</p> <p>No occupational licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p> | |
| ELEMENTS | | 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. 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 bivariate data on a scatter diagram and estimate trends and the degree of correlation by inspection |
| | | 1.2 | Calculate 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 | Calculate the equations of regression lines from bivariate data |
| | | 1.5 | Use the equations of regression lines to make predictions in practical situations |
| | | 1.6 | Investigate practical problems 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 | 3.1 | Calculate theoretical probabilities for simple and complementary events and compare them with |



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| | mathematics problems | | experimental results |
| | | 3.2 | Infer probabilities from experiments for events which cannot be predicted theoretically |
| | | 3.3 | Identify and describe mutually exclusive and independent events |
| | | 3.4 | Determine the probability of compound events using the addition and multiplication principles |
| | | 3.5 | Define and distinguish between permutations and combinations and evaluate 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 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 |

RANGE OF CONDITIONS

Bivariate data includes data relating to the simultaneous measurement of two variables, for example, age and income

Calculations may be performed using a calculator and/or a software package

Calculate the equations of regression lines may include using a calculator/software package and/or plotting the regression line on a scatter diagram

Practical situations and problems may include looking at patterns over time, with different groups of people, for example, disease in different age groups over time



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| Theoretical probabilities include conditional probability. | | | |
| FOUNDATION SKILLS | | | |
| Skill | Description | | |
| Reading skills to: | <ul style="list-style-type: none"> interpret information from surveys, experiments and sampling procedures | | |
| Writing skills to: | <ul style="list-style-type: none"> record scientific information in charts, diagrams and graphs produce scientific information in charts, diagrams and graphs | | |
| Numeracy skills to: | <ul style="list-style-type: none"> 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) use tables and/or calculator to determine probabilities and applications use appropriate keys on a scientific calculator | | |
| Problem-solving skills to: | <ul style="list-style-type: none"> 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 | | |
| UNIT MAPPING INFORMATION | Code and Title Current Version | Code and Title Previous Version | Comments |
| | VU23285 Work mathematically with statistics and calculus | VU22089 Work mathematically with statistics and calculus | Equivalent |



Assessment Requirements

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| TITLE | Assessment Requirements for VU23285 Work mathematically with statistics and calculus |
| PERFORMANCE EVIDENCE | <p>The candidate must demonstrate the ability to complete tasks outlined in the elements and performance criteria of this unit. Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> • apply a range of theories and techniques to solve applied mathematical problems and make predictions • 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 |
| KNOWLEDGE EVIDENCE | <p>The learner must be able to apply knowledge required to effectively perform the task outlined in elements and performance criteria of this unit. This includes knowledge of:</p> <ul style="list-style-type: none"> • 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. |
| ASSESSMENT CONDITIONS | <p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> • a scientific calculator • real/authentic or simulated tasks, materials and texts <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p> |