



Australian Government

Department of Education, Employment and Workplace Relations

NWP553 Apply scientific principles to engineering problems

Release: 1

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Modification History

NWP553 Release 1: Primary release.

Unit Descriptor

This unit of competency sets out the knowledge and skills required to apply scientific principles to solve problems common to all engineering fields. This includes quantities and units, vector and scalar quantities, kinematics dynamics, heat and temperature, constitution of matter and error and uncertainty.

Application of the Unit

This unit applies to para-professionals in the engineering, manufacturing and construction environments where the application of scientific principles can provide a solution to standard engineering problems.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the tasks you need to be able to perform, to demonstrate that you can achieve the element. Where ***bold italicised*** text is used, further information is detailed in the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

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|---|--|
| 1 Identify the scientific principles embedded in an engineering problem | <p>1.1 Determine the engineering problem through requests, design briefs or equivalent, and clarify with the appropriate personnel.</p> <p>1.2 Seek expert advice, when appropriate, regarding the statistical task and according to enterprise procedures.</p> <p>1.3 Consult appropriate personnel to ensure the work is co-ordinated effectively with others involved at the work site.</p> |
| 2 Apply scientific principles in the analysis or design of an engineering solution | <p>2.1 Interpret and understand industry codes, regulations and technical documentation relevant to the statistical task.</p> <p>2.2 Identify and use sources of computational data.</p> <p>2.3 Make and record appropriate underlying assumptions of the engineering problem.</p> <p>2.4 Select the most appropriate analytical, computational or design methodology.</p> <p>2.5 Identify, obtain and check resources as fit for purpose.</p> |
| 3 Verify, present and interpret outcomes | <p>3.1 Record and document results of the analysis or design in accordance with requirements and enterprise procedures.</p> <p>3.2 Discuss and verify the outcomes of analysis with appropriate personnel.</p> <p>3.3 Present outcomes as required by initial request or brief and organisational requirements.</p> |

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills:

- read and interpret industry codes, regulations and technical documentation relevant to water industry engineering
- chemical laboratory techniques including correct use of balances, heating devices, and measuring devices such as pipettes, burettes and measuring cylinders
- complete gas reaction calculations

Required knowledge:

- basic chemistry including elements, compounds, and mixtures, states of matter, basic structure of matter, the periodic table of elements
- chemical laws including Boyle's law, Charles's law, the combined gas law, Gay-Lussac's law, and Avogadro's law
- electromagnetic waves including the electromagnetic spectrum, frequency, periodicity, and wavelength
- the SI system of units used in water industry engineering

- linear motion including displacement, velocity and acceleration, equations of linear motion, and free falling bodies
- circular motion including angular displacement, velocity and acceleration
- concepts of work, energy, and power
- simple machines concepts including mechanical advantage, velocity ratio, centrifugal force, levers, gears, belts and chain drives, wheel and axle devices, and systems of ropes and pulleys
- dynamics of linear motion
- principle of conservation of momentum
- heat and temperature kinetic theory phase transition specific heat latent heat temperature scales temperature measurement

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

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

The candidate should demonstrate the ability to:

- apply principles of mechanics to standard engineering problems
- apply scientific principles to solve engineering problems on at least two occasions, requiring application of different scientific principles

Context of and specific resources for assessment

Access to the workplace and resources including:

- documentation that should normally be available in a water industry organisation
- workplace specific equipment and technology
- supervision and experienced team members to provide observations, feedback and third party reports
- enterprise operating procedures and work allocation
- relevant codes, standards, and government regulations

Where applicable, physical resources should include equipment modified for people with disabilities.

Access must be provided to appropriate learning and/or assessment support when required.

Assessment processes and techniques must be culturally appropriate, and appropriate to the language and literacy capacity of the candidate and the work being performed.

Validity and sufficiency of evidence require that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice
- a decision of competence should only be made when the assessor has complete confidence in the person's competence over time and in various contexts
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
- where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be

authenticated and show that it represents competency demonstrated over a period of time

- assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit

In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in a manner appropriate to the skill levels of the candidate, any cultural issues that may affect responses to the questions, and reflecting the requirements of the competency and the work being performed.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Appropriate personnel may include:

- supervisor
- colleague
- foreman
- team leader
- supervising engineer
- teacher

Enterprise procedures may include:

- the use of tools and equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs
- reporting and communication
- manufacturers' specifications and operational procedures

Sources of computational data may include:

- tables
- graphs

Resources may include:

- computer
- scientific calculator
- engineering tables and graphs
- regulations and codes of practices

Unit Sector(s)

Not applicable.

Competency Field

General Engineering.