



Australian Government

Department of Education, Employment and Workplace Relations

PMLTEST402B Prepare, standardise and use solutions

Release: 1

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Modification History

Unit Descriptor

This unit of competency covers the ability to prepare, standardise and use solutions to monitor the quality of prepared solutions.

This unit of competency has no prerequisites.

This unit of competency is applicable to laboratory technicians working in all industries.

Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These are found at the end of this unit of competency under the section This competency in practice.

Application of the Unit

Licensing/Regulatory Information

Pre-Requisites

Employability Skills Information

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance Criteria describe the level of performance required to demonstrate achievement of the element.

Elements and Performance Criteria

Elements and Performance Criteria

Element	Performance Criteria
1 Prepare solutions	1.1 Select appropriate procedure for solution preparation 1.2 Select equipment, materials and solvent of specified purity 1.3 Measure appropriate quantities of reagents for solution preparation and record data.

- 1.4 Select and assemble specified laboratory equipment and appropriate grade of glassware
 - 1.5 Perform specified dilutions
 - 1.6 Prepare solutions to achieve homogeneous mix of the specified concentration
 - 1.7 Label and store solutions to maintain identity and stability
- 2 Standardise and use volumetric solutions
 - 2.1 Assemble appropriate laboratory equipment
 - 2.2 Perform serial dilutions as required
 - 2.3 Standardise the solution to the required specified range and precision
 - 2.4 Label and store solutions to maintain identity and stability
 - 2.5 Use standard volumetric solutions to determine concentration of unknown solutions
- 3 Calculate and record data
 - 3.1 Calculate specified concentrations
 - 3.2 Use authorised procedure if data is to be modified
 - 3.3 Record all relevant details as per laboratory procedures and report results
 - 3.4 Report concentration with appropriate units
- 4 Monitor the quality of laboratory solutions
 - 4.1 Check solutions for visual deterioration and expiry date
 - 4.2 Restandardise or dispose of dated or deteriorated solutions
 - 4.3 Record details and label solutions as per laboratory procedures.
- 5 Maintain a safe work environment
 - 5.1 Use established safe work practices and personal protective equipment to ensure personal safety and that of other laboratory personnel
 - 5.2 Clean up spills using appropriate techniques to protect personnel, work area and environment
 - 5.3 Minimise generation of waste and environmental

impacts

- 5.4 Ensure the safe collection of laboratory and hazardous waste for subsequent disposal
- 5.5 Store equipment and reagents as required.

Required Skills and Knowledge

Evidence Guide

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

Critical aspects of competency

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

- use balances and volumetric glassware appropriately
- select and use primary and secondary standards appropriately
- select and use indicators appropriately
- select and care for electrodes appropriately
- perform QA checks for solution performance (for example, enzyme activity, ferric chloride for phenolic solutions, isotonicity for saline)
- perform titrations using laboratory procedures with required accuracy and precision and within required timelines
- calculate the concentration of the solution given the chemical reaction for the titration
- recognise control results that are not within acceptable range
- record results to enterprise standards
- label and store solutions in accordance with enterprise procedures
- interpret and follow enterprise standard operating procedures (SOPs)
- interpret and use safety information, such as that provided by material safety data sheets (MSDSs) and follow relevant safety procedures.

Underpinning knowledge

Competency includes the ability to apply and explain:

- solution terminology, chemistry of acids, bases, buffers, redox reactions and complexometric reactions
- grades of glassware, reagents and their use
- reactions used for standardisation and desirable characteristics
- determination of equivalence points using indicators and graphical methods
- calculation methods, including appropriate units, uncertainties and balancing equations
- enterprise communication and reporting procedures
- OHS procedures, including those for using corrosive materials
- relevant health, safety and environment requirements.

Assessment context and methods

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

The following assessment methods are suggested:

- inspection and/or testing of solutions prepared by the candidate
- review of records and workplace documentation completed by candidate
- review of work outputs by the candidate over time to ensure accuracy, consistency and timeliness
- feedback from peers and supervisors
- observation of the candidate preparing, standardising and using a range of solutions
- oral or written questioning.

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

Interdependent assessment of unit

This unit of competency may be assessed with:

PMLTEST400 and **PMLTEST500** series units dealing with sampling, tests and measurements.

Resource implications

Resources may include:

standard laboratory equipped with appropriate volumetric equipment

laboratory reagents and equipment

standard operating procedures (SOPs) and testing methods.

This competency in practice**Manufacturing**

A standard solution is used to determine the concentration of unknown solutions. The quality of these analyses is critically related to the accuracy with which the concentration of the standard solution is known. Therefore, laboratory technicians spend considerable effort to ensure that the materials and methods used for the preparation and standardisation will lead to a solution of accurately known concentration. For example, anhydrous sodium carbonate is often used to prepare solutions to determine the concentrations of acids. The sodium carbonate is heated at a suitable temperature to remove any trace of moisture and cooled in a dessicator. An appropriate quantity is dissolved in distilled water and made up to volume in a volumetric flask. This solution of known concentration is then titrated with acids of unknown concentration and the concentration of the acids determined.

Biotechnology

A technical officer arrived at work on Monday morning and discovered that the freezer had been turned off over the weekend and the restriction nucleases had thawed. These enzymes were to be used that morning. The technician needed to check the enzyme activity to determine whether the enzymes had been denatured by the rise in temperature. The technician quickly set up a digestion mix of affected enzyme with some viral DNA of known sequence. The digest produced DNA fragments of expected length, showing the enzyme still had activity. The technician reported the incident along with the results to the supervisor, who decided that the enzymes could be used for that day.

Environmental

A laboratory technician was required to determine the total acidity of a water sample as part of a quality control program. The total acidity was measured by titrating the water sample with sodium hydroxide of known concentration using an appropriate indicator. The concentration of the sodium hydroxide was determined via a volumetric titration against a primary standard of potassium hydrogen phthalate.

The value of the total acidity was determined by multiplying the volume of sodium hydroxide used with a numerical 'factor' which had been determined by the laboratory supervisor in order to save time. The value of the 'factor' was displayed on the titration equipment. However, a new technical assistant did the full calculation and found that his/her result differed slightly from that obtained using the 'factor'. After discussion with the laboratory supervisor it was agreed that the error was in the 'factor' and the assumption that each new batch of sodium hydroxide prepared was exactly the same concentration as all previous batches. This was incorrect as the concentration of each batch differed slightly and its actual concentration was determined accurate, using the primary standard. The procedure was changed so that the full calculation was required for all tests.

Key Competencies

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

Level (1) represents the competence to undertake tasks effectively

Level (2) represents the competence to manage tasks

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

Collecting, analysing and organising information	Communicating ideas and information	Planning and organising activities	Working with others and in teams	Using mathematical ideas and techniques	Solving problems	Using technology
Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2

Range Statement

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

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

This unit of competency describes the work conducted by laboratory technicians who prepare, standardise and use solutions and monitor the quality of the prepared solutions.

All operations must comply with relevant standards, appropriate procedures and/or enterprise requirements. These procedures may include or have been prepared from:

Australian and international standards, such as:

AS ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories

ISO 9000 series Quality management and quality assurance standards

AS 2243 Safety in laboratories

AS 2830 Good laboratory practice

Codes of Practice, such as GLP and GMP

material safety data sheets (MSDSs)

National Measurement Act

standard operating procedures (SOPs)

quality manuals, equipment and procedure manuals

enterprise and reporting procedures

production and laboratory schedules

material, production, product and solution specifications

waste minimisation and safe disposal procedures.

Solutions may include but are not limited to:

solutions of strong/weak acids and bases

oxidising/reducing agents

solutions used for complexometric or precipitation titrations

stains for cells and tissues, enzymes, buffers and antibodies

diluents for maintaining isotonicity

organic solutions and histological fixatives.

Apparatus and reagents which may be used to prepare standard solutions include:

balances

pipettes, burettes, volumetric glassware, weighing bottles

dessicators, filtering media

ovens, muffle furnaces

solutions, indicators, primary and secondary standards

auto titrators, pH meters and other related meters and electrodes for determining equivalence

points, top pan and analytical balances

magnetic stirrers and heaters, water baths.

Checking useability of solutions could include:

examining stained samples for correct staining reactions

performing pH checks

confirming enzyme activity

checking red cell suspensions for haemolysis.

Hazards may include:

chemicals, such as strong acids and bases, stains

sharps, broken glassware

burners, hot plates, ovens, furnaces.

Safe work practices may include:

use of material safety data sheets (MSDSs)

use of personal protective equipment, such as gloves, safety glasses, goggles, faceguards,

coveralls, gown

use of biohazard containers, laminar flow cabinets, fumehoods

correct labelling of reagents and hazardous materials

handling and storing hazardous materials and equipment in accordance with labels, MSDS,

manufacturer's instructions, enterprise procedures and regulations

regular cleaning and/or decontaminating of equipment and work areas.

Health, safety and environment

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

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

Unit Sector(s)