Australian Government

MSL975018 Perform complex tests to measure chemical properties of materials

Release: 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

MSL975018 Perform complex tests to measure chemical properties of materials

Modification History

Release 1. Supersedes and is equivalent to MSL975018A Perform complex tests to measure chemical properties of materials

Application

This unit of competency covers the ability to isolate analytes from complex matrices and perform multi-staged and multi-component analyses on them. The unit requires personnel to apply detailed knowledge of analytical chemistry to plan the analysis, prepare and measure samples, analyse and report results and make approved adjustments to procedures as required. Personnel are required to recognise atypical test data and results and troubleshoot common analytical procedure and equipment problems.

This unit of competency is applicable to technical working in all industry sectors. All operations must comply with relevant standards, appropriate procedures and workplace requirements. Although a supervisor may not always be present, the technician will follow standard operating procedures (SOPs) that clearly describe the scope of permitted practice, including varying workplace/test procedures and communicating results to people outside the laboratory.

While no specific licensing or certification requirements apply to this unit at the time of publication, laboratory operations are governed by relevant legislation, regulations and/or external accreditation requirements. Local requirements should be checked.

Pre-requisite Unit

MSL975009 Perform routine chromatographic techniques

AND

MSL974003 Perform chemical tests

OR

MSL974006 Perform biological procedures

OR

MSL975020 Apply routine spectrometric techniques

AND

MSL974003 Perform chemical tests

OR

MSL974006 Perform biological procedures

Competency Field

Testing

Unit Sector

Elements and Performance Criteria

Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
1	**Develop an analysis plan with supervisor**	1.1	Liaise with client or sample provider to determine test requirements and sample characteristics
		1.2	Record sample description, compare with specification, record and report discrepancies
		1.3	Confirm suitable sample preparation methods, quantification and analytical techniques with supervisor
		1.4	Schedule analysis using workplace procedures
2	**Reduce the complexity of the sample**	2.1	Obtain a representative analytical portion of the laboratory sample
		2.2	Prepare validation checks for analytical portions
		2.3	Use workplace procedures to simplify the sample matrix
		2.4	Conduct tests to ensure that sample preparation is complete

3	**Apply quantification method**	3.1	Add modifiers to remove/minimise interferences
		3.2	Conduct preliminary analysis to estimate analyte concentration
		3.3	Match the concentration of analyte in the sample with the working range of the instrument
		3.4	Prepare calibration standards to suit quantification method
4	**Perform analysis**	4.1	Set up and optimise instruments to suit sample/test requirements
		4.2	Measure analyte response for standards, validation checks and samples
		4.3	Conduct sufficient measurements to obtain reliable data
		4.4	Return instruments to standby or shutdown condition as required
5	**Process and analyse data**	5.1	Confirm data is the result of valid measurements
		5.2	Perform required calculations and ensure results are consistent with estimations and expectations
		5.3	Record results with the appropriate accuracy, precision units and uncertainty
		5.4	Analyse trends in data and/or results and report out-of-specification or atypical results promptly to appropriate personnel
		5.5	Troubleshoot analytical procedure or equipment problems which have led to atypical data or results
6	**Maintain a safe work environment**	6.1	Identify risks/hazards, safety equipment and control measures associated with sample handling, preparation and test methods
		6.2	Use personal protective equipment (PPE) and safety

			procedures as specified for test method and materials to be tested
		6.3	Minimise the generation of waste and environmental impact
		6.4	Ensure the safe disposal of laboratory waste
		6.5	Clean, care for and store equipment and consumables in accordance with workplace procedures
7	**Maintain laboratory records**	7.1	Enter approved data and results into laboratory information management system (LIMS)
		7.2	Maintain security, integrity and traceability of samples and documentation
		7.3	Maintain equipment and logs in accordance with workplace procedures

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Standards, codes, procedures and/or workplace requirements

Standards, codes, procedures and/or workplace requirements include the latest version of one or more of:

- Australian and international standards covering the requirements for the competence of testing and calibration laboratories, laboratory design and construction, physical containment levels and facility types, laboratory safety, and quality and environmental management
- national work health and safety (WHS) standards and codes of practice, and national measurement regulations and guidelines
- Australian and international standards and guidelines covering chemical analysis, specialised spectrometric and chromatographic analysis, accuracy of measurement methods and results, expression of uncertainty and quantifying uncertainty
- specific codes, guidelines, procedures and methods, such as the Australian code of good manufacturing practice for medicinal products (GMP), principles of good laboratory practice (GLP), Association of Analytical Communities International (AOAC International) Official Methods of Analysis, and American Society for Testing and Materials (ASTM)
- workplace documents, such as SOPs; quality and equipment manuals; calibration and maintenance schedules; material safety data sheets (MSDS) and safety procedures; material, production and product specifications; production and laboratory schedules; data quality procedures; workplace recording and reporting procedures; waste minimisation and safe disposal procedures; cleaning, hygiene and personal hygiene requirements; and stock records and inventory
- sampling procedures (labelling, preparation, storage, transport and disposal)
- test procedures (validated and authorised)

Test requirements

Test requirements include:

- specification of concentration and limits of analytes
- time and cost limitations

Sample preparation

Sample preparation includes identification of any hazards associated with the samples and/or analytical chemicals and use of techniques,

such as:

- grinding, mulling, preparation of disks, digestion, dissolving, ashing, refluxing, extraction, filtration, evaporation, flocculation, precipitation, washing, drying and centrifugation
- solid-phase micro-extraction
- determination of, and if appropriate, removal of any contaminants or impurities
- ultra-trace procedures requiring high purity solvents, clean rooms, ultra clean glassware and specialised glassware

Quantification techniques

Quantification techniques include, but are not limited to, one or more of:

- matrix matched standards
- standard additions
- international standards

Analytical techniques

Analytical techniques include, but are not limited to, one or more of:

- spectrometric techniques, such as inductively coupled plasma optical emission spectroscopy (ICP-OES) and inductively coupled plasma mass spectroscopy (ICP-MS)
- chromatographic techniques, such as gas chromatography mass spectroscopy (GC-MS) and ion chromatography (IC)
- electrometric techniques, such as ion selective electrodes, voltammetry (polarography) and anodic stripping voltammetry
- electrophoretic techniques, such as capillary electrophoresis

Typical analytes and samples requiring complex tests

Typical analytes and samples requiring complex tests include, but are not limited to, one or more of:

- contaminants in food, such as heavy metals and afflotoxins
- trace level (microgram and nanogram/litre) analytes
- forensic testing, and drug testing in body tissues and fluids
- multiple analytes, such as organochlorins and polyaromatic hydrocarbons
- environmental contaminants in water, soil and air (such as pesticides)
- sludge, wastewater and sewage
- samples with matrix interferences

Validation checks

Validation checks include:

- recovery checks
- use of standard/certified samples

Tests for completeness of sample preparation

Tests for completeness of sample preparation include, but are not limited to, one or more of:

- visual inspection for colour and solids
- odour
- pH and conductivity
- chemical tests for interferents, such as precipitation and colour forming
- basic screening instrumental tests, such as infrared, ultraviolet-visible (UV-VIS) and gas chromatography

Modifiers

Modifiers include, but are not limited to, one or more of:

- ionisation suppressants, such as Caesium for calcium (Ca), sodium (Na), and potassium (K) in atomic absorption spectroscopy (AAS)
- ionic strength and pH buffers, such as total ionic strength adjustment buffer (TISAB) for fluoride in ion-selective electrode (ISE)
- releasing agents, such as Lanthanum and Strontium for Ca in AAS
- volatility suppressants, such as phosphate for lead (Pb) in electrothermal AAS

Safety procedures

Safety procedures include, but are not limited to, one or more of:

- ensuring access to service shut-off points
- recognising and observing hazard warnings and safety signs
- labelling of samples, reagents, aliquoted samples and hazardous materials
- handling and storage of hazardous materials and equipment in accordance with labelling, MSDS and manufacturer instructions
- identifying and reporting operating problems or equipment malfunctions
- use of fumehoods and direct extraction of vapours and gases
- use of appropriate equipment, such as biohazard containers, laminar flow cabinets, Class I, II and III biohazard cabinets
- cleaning and decontaminating equipment and work areas regularly using workplace procedures
- using PPE, such as gloves, safety glasses, coveralls and gowns

- minimising exposure to radiation ionising, such as lasers, electromagnetic and UV radiation
- reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/wastewater, gases, smoke, vapour, fumes, odour and particulates, to appropriate personnel

WHS and environmental management requirements

WHS and environmental management requirements include:

- complying with WHS and environmental management requirements at all times, which may be imposed through state/territory or federal legislation. These requirements must not be compromised at any time
- applying standard precautions relating to the potentially hazardous nature of samples
- accessing and applying current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health, where relevant

Unit Mapping Information

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Links

MSA Training Package Implementation Guides - http://mskills.org.au/training-packages/info/