Australian Government

Department of Education, Employment and Workplace Relations

MSL975020A Apply routine spectrometric techniques

Revision Number: 1

MSL975020A Apply routine spectrometric techniques

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the ability to analyse samples using routine spectrometric techniques. The unit also includes establishing client needs for routine and non-routine samples, optimising enterprise procedures and instruments for specific samples, obtaining valid and reliable data and reporting test results. Personnel are required to recognise atypical test data/results and troubleshoot common analytical procedure and equipment problems.

Application of the Unit

Application of the unit	This unit of competency is applicable to technical officers working in all industry sectors, government agencies and research laboratories. All operations and analytical methods must comply with relevant standards, appropriate procedures and/or enterprise 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 enterprise/test procedures and communicating results to people outside the laboratory. 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 can be found at the end of this unit of competency under the section 'This competency in practice'.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		
	MSL974003A	*Perform chemical tests and procedures*
		OR
	MSL974004A	*Perform food tests*
		OR
	MSL974006A	*Perform biological procedures*
	MSL973007A	*Perform microscopic examination*
	MSL973004A	*Perform aseptic techniques*
		AND
	MSL973002A	*Prepare working solutions*
		OR
	MSL974001A	*Prepare, standardise and use solutions*

Employability Skills Information

Employability skills	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 performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish client needs and schedule analysis	1.1. Liaise with client or sample provider to determine client needs and sample history 1.2. Record sample description, compare with specification and record and report discrepancies 1.3. Identify non-routine samples and the possible need to vary enterprise procedures 1.4. Seek advice from supervisor about any proposed variations and document all approved changes 1.5. Schedule analysis using enterprise procedures
2. Prepare samples and standards	2.1. Obtain a representative analytical portion of the laboratory sample 2.2. Prepare sample in accordance with testing requirements 2.3. Prepare validation checks for analytical portion
3. Set up and optimise instrument	3.1. Perform pre-use and safety checks in accordance with enterprise procedures 3.2. Start up and condition the instrument using enterprise procedures 3.3. Optimise instrumental parameters to suit sample and test requirements 3.4. Check calibration status of instrument and perform calibration using specified standards and procedures, if applicable
4. Perform analysis	4.1. Measure analyte response for standards, validation checks and samples 4.2. Conduct sufficient measurements to obtain reliable data 4.3. 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 standards or estimations and expectations 5.3. Record results with the appropriate accuracy, precision, uncertainty and units 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

ELEMENT	PERFORMANCE CRITERIA
	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 analytical method 6.2. Use personal protective equipment and safety procedures specified for test method and materials to be tested 6.3. Minimise the generation of wastes and environmental impacts 6.4. Ensure the safe disposal of laboratory wastes 6.5. Clean, care for and store equipment and consumables in accordance with enterprise procedures
7. Maintain laboratory records	7.1. Enter approved data and results into laboratory information management system (LIMS) 7.2. Maintain equipment logs in accordance with enterprise procedures 7.3. Maintain security, integrity and traceability of samples and documentation 7.4. Communicate results to appropriate personnel

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Required skills include:

- interpreting client requests, test methods and procedures accurately
- safely setting up and shutting down equipment using enterprise procedures
- checking calibration/qualification status of equipment
- identifying and calculating potential sources of uncertainty
- preparing standards and samples appropriately
- choosing and optimising procedures and equipment settings to suit sample/test requirements, such as selection of wavelength maxima and position of burner
- operating equipment to obtain valid and reliable data
- making approved adjustments to procedures for non-routine samples
- recognising atypical data/results
- troubleshooting common analytical procedure and equipment problems
- applying theoretical knowledge to interpret data and making relevant conclusions
- recording and reporting data/results
- maintaining security, integrity and traceability of samples and documentation
- followingoccupational health and safety (OHS) procedures and principles of good laboratory practice (GLP)

Required knowledge

Required knowledge includes:

- spectrometric principles and concepts related to instrumentation operation and testing
- relationship of chemical structure to electromagnetic radiation absorption
- handling of unstable or hazardous chemicals and samples and/or the fragile/labile nature of biological material
- sample preparation procedures
- use of spectroscopy for qualitative and quantitative analysis
- function of key components of the equipment
- effects on spectra of modifying and/or optimising instrumental variables, such as wavelength, slit width, burner position and lamp voltage
- basic procedure and equipment troubleshooting techniques
- preparation and use of calibration charts and/or standards
- calculation steps to give results in appropriate accuracy, precision, uncertainty and units
- enterprise and/or legal traceability requirements

REQUIRED SKILLS AND KNOWLEDGE
• basic equipment maintenance procedures • relevant health, safety and environment requirements

Evidence Guide

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.	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors should ensure that candidates can: • interpret client requests, test methods and procedures accurately • safely set up and shut down equipment using enterprise procedures • check calibration/qualification status of equipment • prepare standards and samples appropriately • choose and optimises procedures and equipment settings to suit sample/test requirements, such as selection of wavelength maxima and position of burner) • operate equipment to obtain valid and reliable data • make approved adjustments to procedures for non-routine samples • recognise atypical data/results • troubleshoot common analytical procedure and equipment problems • apply theoretical knowledge to interpret data and makes relevant conclusions • record and report data/results in accordance with enterprise procedures • maintain security, integrity and traceability of samples and documentation • follow OHS procedures and principles of GLP.
Context of and specific resources for assessment	This unit of competency is to be assessed in the workplace or simulated workplace environment. This unit of competency may be assessed with: • *MSL925001A Analyse data and report results*. Resources may include: • standard laboratory equipped with appropriate spectrometers, laboratory reagents and equipment • SOPs and test methods.
Method of assessment	The following assessment methods are suggested:

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	• review of test data/results obtained by the candidate over time to ensure accuracy, consistency and timeliness of results • inspection of test records and workplace documentation completed by the candidate • feedback from peers and supervisors • observation of candidate applying a range of routine spectrometric techniques • oral or written questioning of chemical principles and concepts, spectrometric techniques and enterprise procedures. 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. Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. Access must be provided to appropriate learning and/or assessment support when required. The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work like environment.
This competency in practice	Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. **Manufacturing** Ultraviolet (UV) spectroscopy is a sensitive technique for measuring polycyclic hydrocarbons. Because polycyclic hydrocarbons are considered carcinogenic, they are strictly regulated, and technicians making these measurements must follow enterprise procedures when handling samples. A technician conducting such an analysis noted variable results. After some discussion with the laboratory scientist, it was determined that the standard materials were light sensitive and were being degraded. The technician suggested that they change the light in the work space to yellow. When the lighting was changed, the standard remained stable and the

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	measurements for polycyclic hydrocarbons were carried out successfully. **Biotechnology** DNA can be extracted from human blood for subsequent identification of inherited genetic disorders, paternity disputes or forensic investigations. It is not a difficult procedure and is performed by technical officers in diagnostic molecular biology laboratories and those working in university research laboratories. In such a procedure, the DNA is separated from the haemoglobin and blood cells, the protein in the plasma and the fat by a series of enzymic digests and phenol/chloroform extractions. The last purification step involves precipitation by clod ethanol and dissolving the DNA in TRIS buffer. The yield from 10mL of human blood is about 12-20mg of DNA if all is well. The yield is determined by spectrometric absorption at 260 and 280nm. The two wavelengths are used to determine the DNA extract and the degree of protein contamination. The technical officer will carry out this step before proceeding. Too small a yield will make further testing impractical and a polymerase chain reaction (PCR) will then be used to amplify the DNA in the sample. **Food processing** A technician was determining the amount (by mass) of (-carotene in imported tomato paste. The technician extracted a known mass of the paste into acidified ether, evaporated off the solvent and measured the absorbance of the remaining material by spectrometry. After reference to the Australian Food Additive Guide, the technician was able to report the tomato paste met the requirements of the Australian standard.

Range Statement

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

Standards, **codes**, **procedures and/or enterprise requirements**	Standards, codes, procedures and/or enterprise requirements may include:
	• Australian and international standards, such as:
	  • AS ISO 17025-2005 General requirements for the competence of testing and calibration laboratories
	  • AS/NZS 2243 Set:2006 Safety in laboratories set
	  • AS/NZS 2982.1:1997 Laboratory design and construction - General requirements
	  • AS/NZS ISO 14000 Set:2005 Environmental management standards set
	  • AS/NZS ISO 9000 Set:2008 Quality management systems set
	  • AS ISO 1000-1998 The international system of units (SI) and its application
	  • AS 2134.1-1999 Recommended practice for chemical analysis by atomic absorption spectrometry - Flame atomic absorption spectrometry
	  • AS 3753-2001 Recommended practice for chemical analysis by ultraviolet/visible spectrophotometry
	  • ISO/IEC Guide 98-3:2008 Uncertainty of measurement - Part 3 Guide to the expression of uncertainty in measurement (GUM)
	• Eurachem/CITAC Guide CG4 Quantifying uncertainty in analytical measurement
	• Australian code of good manufacturing

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	practice for medicinal products (GMP) • calibration and maintenance schedules • cleaning, hygiene and personal hygiene requirements • data quality procedures • enterprise procedures, SOPs and operating manuals • enterprise recording and reporting procedures • equipment startup, operation and shutdown procedures • Guide to physical containment levels and facility types • incident and accident/injury reports • material safety data sheets (MSDS) • material, production and product specifications • national measurement regulations and guidelines • principles of GLP • production and laboratory schedules • quality manuals, equipment and procedure manuals • quality system and continued improvement processes • safety requirements for equipment, materials or products • sampling procedures (labelling, preparation, storage, transport and disposal) • schematics, work flows and laboratory layouts • statutory and enterprise OHS requirements • stock records and inventory • test procedures (validated and authorised) • training program contents • waste minimisation, containment, processing and disposal procedures
Routine spectrometric methods	Routine spectrometric methods may include: • ultraviolet-visible (UV-VIS) • infrared, including Fourier transform infrared and near infrared • atomic absorption spectroscopy (AAS) • fluorescence • flame emission spectroscopy

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Tests	Tests may include methods for: • control of starting materials, in-process materials and finished products (e.g. petroleum, food, mining and manufacturing) • environmental monitoring pollutants in air, water, soil and vegetation • forensic tests • therapeutic drug analysis • diagnostic pathology tests • determinations of enzyme activity • routine chemical analytes, such as starch, glucose, DNA, and therapeutic degradation products • troubleshooting enterprise processes
Preparation of sample	Preparation of sample includes processes, such as: • identification of any hazards associated with samples and/or analytical chemicals • grinding, mulling, preparation of discs, ashing, dissolving, refluxing, extraction, filtration, evaporation, precipitation, centrifugation, drying and washing • determination of and, if appropriate, removal of any contaminants, impurities or interfering substances
Common analytical procedure and equipment problems	Common analytical procedure and equipment problems may include: • dirty or contaminated sample cells • inappropriate selection of wavelength • problems with interfering or complexing substances • incomplete atomisation of analyte • poor resolution of peaks • poor sensitivity • need to dilute samples
Hazards	Hazards may include: • electric shock • radiation (UV) • biohazards: • microbiological organisms and agents

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	associated with soil, air, water, blood and blood products, and human or animal tissue and fluids • mycotoxins • acids (e.g. sulphuric and nitric) • hazardous materials (e.g. heavy metals and pesticides) • hydrocarbons (e.g. phenol, benzene, toluene and complex mixtures) • aerosols from broken centrifuge tubes and pipetting • sharps and broken glassware • flammable liquids and gases • fluids under pressure, such as acetylene in atomic absorption spectrometry (AAS) • sources of ignition • high temperature ashing processes • disturbance or interruption of services
Addressing hazards	Addressing hazards may involve: • use of MSDS • labelling of samples, reagents, aliquoted samples and hazardous materials • use of personal protective equipment, such as gloves, safety glasses and coveralls • use of fumehoods, direct extraction of vapours and waste gases • use of appropriate equipment, such as biohazard containers, laminar flow cabinets, Class I, II and III biohazard cabinets • use of Class PCII, PCIII and PCIV physical containment laboratories • handling and storage of all hazardous materials and equipment in accordance with labelling, MSDS and manufacturer's instructions
Occupational health and safety (OHS) and environmental management requirements	OHS and environmental management requirements: • all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these requirements must not be compromised at any

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	time • all operations assume the potentially hazardous nature of samples and require standard precautions to be applied • where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health

Unit Sector(s)

Unit sector	Testing

Competency field

Competency field	

Co-requisite units

Co-requisite units		