



Australian Government

Department of Education, Employment and Workplace Relations

MSL975021A Apply routine electrometric techniques

Revision Number: 1

MSL975021A Apply routine electrometric techniques

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the ability to analyse samples using routine electrometric 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.
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Application of the Unit

Application of the unit	This unit of competency is applicable to technical officers and analysts 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, at the end of this unit of competency under the section "This competency in practice"
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		
	MSL974003A	<i>Perform chemical tests and procedures</i>
		OR
	MSL974004A	<i>Perform food tests</i>
		OR
	MSL974006A	<i>Perform biological procedures</i>
	MSL973007A	<i>Perform microscopic examination</i>
	MSL973004A	<i>Perform aseptic techniques</i>
		AND
	MSL973002A	<i>Prepare working solutions</i>
		OR
	MSL4001A	<i>Prepare, standardise and use solutions</i>

Employability Skills Information

Employability skills	This unit contains employability skills.
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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.
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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
- safely setting up and shutting down equipment
- checking the calibration/qualification status of equipment
- preparing standards and samples
- choosing and optimising procedures and equipment settings to suit sample/test requirements
- 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 make relevant conclusions
- recording and reporting data/results in accordance with enterprise procedures
- maintaining security, integrity and traceability of samples and documentation
- following occupational health and safety (OHS) procedures and principles of good laboratory practice (GLP)

Required knowledge

Required knowledge includes:

- redox and electrical principles and concepts related to instrumentation operation and testing
- handling of unstable or hazardous chemicals and samples and/or the fragile/labile nature of biological material
- sample preparation procedures
- use of various electrometric techniques for qualitative and quantitative analysis
- function of key components of the instrument
- effects on outputs and results of modifying instrumental variables such as voltage and current ranges
- procedure for optimising equipment by changing operation parameters such as drop rate and scan speed
- 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 optimise procedures and equipment settings to suit sample/test requirements
- 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 make 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 routine electrometric equipment, laboratory reagents and equipment
- SOPs and test methods.

Method of assessment

The following assessment methods are suggested:

- review of test data/results obtained by the candidate

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	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 electrometric techniques • oral or written questioning of chemical principles and concepts, electrometric 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 Quality control tests on toothpaste require the monitoring of the soluble fluoride in the product. To analyse a sample, the technician uses an ultrasonic bath to disperse the paste in a buffer which controls ionic strength and pH (known as TISAB). He/she then measures the fluoride content using a fluoride ion-selective electrode which has been calibrated against a range of fluoride in TISAB standards. Environmental A technician routinely analyses effluent samples from a copper smelter for their lead and zinc content using differential pulse polarography. The samples require no

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pre-treatment other than the addition of solid KCl as electrolyte. The technician programmes the polarograph to analyse multiple samples on a carousel and to perform standard additions automatically by drawing aliquots from a concentrated standard of the two metals.

Food processing

One of the important quality tests for a wine is its total acidity (principally tartaric acid). Because of the colour of red wine, it is not possible to perform a titration using an indicator for endpoint detection. The technician is required to calibrate a pH electrode and titrate aliquots of the wine to a pH of 8.4 with standardised NaOH. The endpoint pH is the generally accepted one for wines of all types.

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
 - 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 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

RANGE STATEMENT	
	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 electrometric techniques	Routine electrometric techniques may include use of: • ion-selective electrodes • potentiometric titrations • conductometric titrations • amperometry • polarography
Tests	Tests may include: • control of starting materials, in-process materials and finished products • environmental monitoring • therapeutic drug analysis • determination of enzyme activity • routine determination of chemical analytes such as fluoride, nitrate, water hardness, lead,

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	copper and quinine troubleshooting enterprise processes
Sample preparation	Sample preparation may include: - identification of any hazards associated with samples and/or analytical chemicals - grinding, mulling, digestion, dissolving, ashing, refluxing, extraction, filtration, evaporation, flocculation, precipitation, washing, drying and centrifugation - determination of and, if appropriate, removal of any contaminants or impurities
Common analytical procedure and equipment problems	Common analytical procedure and equipment problems may include: - matrix interferences such as formation of complexes - physical damage to electrodes
Hazards	Hazards may include: - electric shock - biohazards, such as microbiological organisms and agents associated with soil, air, water, blood and blood products, and human or animal tissue and fluids - chemicals: - acids (e.g. sulphuric, perchloric and hydrofluoric) - heavy metals and pesticides - anions (e.g. fluoride) - hydrocarbons (e.g. phenol, toluene, benzene and mono-aromatics) - ammonium persulphide - sharps and broken glassware - aerosols from broken centrifuge tubes and pipetting - flammable liquids and gases - cryogenics such as dry ice and liquid nitrogen - sources of ignition - disturbance or interruption of services
Addressing hazards	Addressing hazards may involve: use of MSDS

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	• labelling of samples, reagents, aliquoted samples and hazardous materials • use of personal protective equipment, such as gloves, safety glasses and coveralls • 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 • 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 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
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Competency field

Competency field	
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Co-requisite units

Co-requisite units		