



Australian Government

MSL974005A Perform physical tests

Release 2

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Modification History

Release 2 - wording clarified in Required Skills and Evidence Guide. Equivalent outcomes.

Unit Descriptor

This unit of competency covers the ability to interpret physical test requirements, prepare samples, conduct pre-use and calibration checks on equipment and perform routine physical tests. These tests will involve several measurement steps. The unit includes data processing and interpretation of results and tracking of obvious test malfunctions where the procedure is standardised. However, personnel are not required to analyse data, optimise tests/procedures for specific samples or troubleshoot equipment problems where the solution is not apparent.

Application of the Unit

This unit of competency is applicable to laboratory or technical assistants and instrument operators working in the manufacturing, environment, food and construction materials testing industry sectors.

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'.

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 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. Interpret and schedule test requirements	1.1. Review test request to identify samples to be tested, test method and equipment/instruments involved 1.2. Identify hazards and enterprise control measures associated with the sample, preparation/test methods and/or equipment 1.3. Plan work sequences to optimise throughput of multiple samples, if appropriate
2. Receive and prepare samples	2.1. Log samples using standard operating procedures (SOPs) 2.2. Record sample description, compare with specification and note and report discrepancies 2.3. Prepare samples and standards in accordance with physical testing requirements 2.4. Ensure traceability of samples from receipt to reporting of results
3. Check equipment before use	3.1. Set up equipment/instruments in accordance with test method requirements 3.2. Perform pre-use and safety checks in accordance with relevant enterprise and operating procedures 3.3. Identify faulty or unsafe components and equipment and report to appropriate personnel 3.4. Check equipment calibration using specified procedures, if applicable 3.5. Quarantine out of calibration equipment/instruments
4. Test samples to determine physical properties	4.1. Operate equipment/instruments in accordance with test method requirements 4.2. Perform tests/procedures on all samples and standards, if appropriate, in accordance with specified methods 4.3. Shut down equipment/instruments in accordance with operating procedures
5. Process and interpret data	5.1. Record test data noting atypical observations 5.2. Ensure calculated values are consistent with expectations 5.3. Estimate and document uncertainty of measurement in accordance with enterprise procedures, if required 5.4. Record and report results in accordance with enterprise procedures 5.5. Interpret trends in data and/or results and report out of specification or atypical results promptly to appropriate personnel 5.6. Determine if obvious procedure or equipment

ELEMENT	PERFORMANCE CRITERIA
	problems have led to atypical data or results
6. Maintain a safe work environment	6.1. Use established safe work practices and personal protective equipment to ensure personal safety and that of other laboratory personnel 6.2. Minimise the generation of wastes and environmental impacts 6.3. Ensure the safe collection of laboratory and hazardous waste for subsequent disposal 6.4. Care for and store equipment and materials as required
7. Maintain laboratory records	7.1. Enter approved data into laboratory information management system 7.2. Maintain confidentiality and security of enterprise information and laboratory data 7.3. Maintain equipment and calibration logs in accordance with enterprise procedures

Required Skills and Knowledge

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

Required skills

Required skills include:

- using equipment/instruments for qualitative and/or quantitative analysis
- interpreting test methods and procedures
- sample preparation procedures
- performing calibration checks
- metrology techniques underpinning test/procedure including estimating uncertainty
- troubleshooting basic equipment/method
- preparing calibration graphs, if required, and calculating results using appropriate units and precision
- applying theoretical knowledge to interpret gross features of data and make relevant conclusions such as identifying atypical results as out of normal range or an artefact
- tracing and sourcing obvious causes of an artefact
- recording and communicating results in accordance with enterprise procedures
- maintaining security, integrity, traceability of samples, sub-samples, test data, results and documentation

Required knowledge

Required knowledge includes:

- physical principles and concepts underpinning the test/procedure
- purpose of tests
- function of key components of the equipment/instrument
- effects on test of modifying equipment/instrument variables
- sample preparation procedures
- concepts of metrology
- basic equipment/method troubleshooting procedures
- enterprise and/or legal traceability requirements
- relevant health, safety and environment requirements

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	Assessors should ensure that candidates can: • interpret test methods/procedures accurately • prepare and test samples in accordance with specified methods • ensure equipment/instrumentation is within calibration before use • safely operate test equipment/instruments to enterprise standards and/or manufacturer's specifications • apply basic knowledge of physical properties of materials to interpret gross features of data and make relevant conclusions • identify atypical results, such as out of normal range or an artefact • trace and source obvious causes of an artefact • communicate problems to a supervisor or outside service technician • calculate, record and communicate results in accordance with enterprise procedures • maintain security, integrity and traceability of samples, sub-samples, test data/results and documentation.
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: • <i>MSL924001A Process and interpret data.</i> Resources may include: • standard laboratory equipped with appropriate test equipment/instruments, standards and materials • enterprise procedures and standard methods.
Method of assessment	The following assessment methods are suggested: • review of test data/results obtained by the candidate over a period of time to check accuracy, consistency and timeliness of results • review of test records and workplace documentation completed by the candidate

	• observation of candidate conducting a range of physical tests and procedures and sample preparation • feedback from peers and supervisors • oral or written questioning of physical principles and concepts, test methods 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 A technical assistant was measuring the specific density of a shipment of glycerol using a standard laboratory procedure. The result did not agree with the manufacturer's certificate of analysis. The assistant notified the manufacturer who came to the plant and checked the delivered material. It had been raining while the glycerol was in transit and rain water had entered the drum, diluting the glycerol. The drum was returned to the manufacturer and a new drum was supplied to the manufacturing plant. The manufacturer investigated the seals on the glycerol drums and took action to ensure that new seals would protect the product in transit. Food processing A technician was testing the melt flow index of a new type of polymer that was to be used as a sealant for packages of freeze dried coffee. The technician measured the melt flow rate and found it was much too high. The technician then checked the melt flow equipment as per

	the manufacturer's directions and found the machine was out of calibration. After recalibration using recommended standards, another sample was obtained and retested. This time, the polymer was within specification and was released for use in production.
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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 1000-1998 The international system of units (SI) and its application • 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 ISO 9000 Set:2008 Quality management systems set • Australian code of good manufacturing practice for medicinal products (GMP) • calibration and maintenance schedules • data quality procedures • enterprise recording and reporting procedures • equipment startup, operation and shutdown procedures • material safety data sheets (MSDS) • material, production and product specifications • national measurement regulations and guidelines • principles of good laboratory practice (GLP) • production and laboratory schedules • quality manuals, equipment and procedures manuals • SOPs

Physical principles and concepts underpinning the test/procedure	Physical principles and concepts underpinning the test/procedure may include: • matter, interatomic and intermolecular forces and states of matter • mass, weight, forces, pressure, energy, friction and slip resistance • properties of gases, pressure/volume/temperature, density, diffusion and compressibility • cohesive/adhesive forces, hydrostatic pressure, fluid flow, viscosity and friction • thermal expansion, thermal conductivity and coefficients of expansion • changes of state, energy content, enthalpy change and endothermic and exothermic processes • electromagnetic spectrum, primary/secondary colours, reflection, refraction diffraction and interference of light • electrical concepts, including electric field, voltage, current, resistance and AC/DC • electromagnetic concepts, including magnetic field and flux, and electromagnetic induction • sound concepts, including wave properties, amplitude, frequency and loudness (dB) • elasticity, hardness, strength of materials, plasticity, permeability and dispersion • electrical safety concepts including voltage, current, resistance, conductors/insulators and AC/DC
Preparation of samples	Preparation of samples may include processes, such as: • drying, washing, grinding, sieving, melting and moisture conditioning • cutting, trimming or machining of test specimens, etching
Physical tests and procedures	Physical tests and procedures may include: • precise measurement of position, orientation and dimensions: • three-dimensional setup of manufacturing tools using inclinometers, verniers and laser • thickness using vernier, X-ray and gamma ray • particle size using sieving and laser • dimensional stability involving expansion, contraction and weathering • movement using strain gauge and accelerometer

	• mass, density and specific gravity: • moisture/density relationship • compaction • loose and compacted density • thermal tests: • thermal conductivity • coefficients of expansion (e.g. linear and volume) • melt flow index • calorimetry, (e.g. specific heat and latent heat) • combustion properties (e.g. enthalpy and energy content) • drying times • thermal stability of products • optical tests: • flatness and surface finish • refractive index • optical rotation • transmission/absorption of filters • colour matching of products • acoustic tests: • absorption, reflection and transmission • intensity, attenuation and loudness (dB) • amplitude and frequency • electrical tests: • conductance, resistance and insulation • temperature dependence of dielectrics • magnetic tests: • permeability • retentivity, hysteresis loss and coercivity • intrinsic induction
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Test and sample preparation equipment/materials	Test and sample preparation equipment/materials may include: • crushers, mulchers, grinders, mills, riffles and sieves • moulds, bags and containers • ovens, microwaves and water baths • mass balances • microscopes • dimension apparatus (e.g. calipers and micrometer) • rammers, compression rigs and load cells • chemical reagents and volumetric glassware • temperature measuring devices, such as thermometers and thermocouples • pH and conductivity meters • analogue and digital meters, charts/recorders, data loggers and computers
Tests	Tests may include methods for: • control of starting materials, in-process materials and finished products • investigation of sources of construction materials • basic troubleshooting of enterprise processes
Hazards	Hazards may include: • microbiological organisms and agents, associated with soil, air and water • chemicals, such as acids and solvents • radiation, such as alpha, beta, gamma, X-ray and neutron • sharps, broken glassware and hand tools • flammable liquids and gases • cryogenics, such as dry ice and liquid nitrogen • fluids under pressure, such as steam and industrial gases • sources of ignition • burners and ovens • disturbance or interruption of services • crushing, entanglement and cuts associated with moving machinery (grinders)
Hazard control measures	Hazard control measures may include: • ensuring access to service shut-off points • recognising and observing hazard warnings and safety signs

	- labelling of samples and hazardous materials - handling and storage of hazardous materials and equipment in accordance with labelling, MSDS and manufacturer's instructions - identifying and reporting operating problems or equipment malfunctions - cleaning equipment and work areas regularly using enterprise procedures - using personal protective clothing and equipment, such as gloves, safety glasses, coveralls and safety boots - following established manual handling procedures - reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, vapour, fumes, odour and particulates to appropriate personnel
Records	Records may include: - test and calibration results - equipment use, maintenance and servicing history - faulty or unsafe equipment
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)

Competency field	
Unit sector	Testing

Competency field

Competency field	
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Co-requisite units

Co-requisite units		