Australian Government

Department of Education, Employment and Workplace Relations

MSL974006A Perform biological procedures

Revision Number: 1

MSL974006A Perform biological procedures

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the ability to interpret work requirements, prepare samples, conduct pre-use and calibration checks on equipment and perform routine biological procedures, including sample preparation. These procedures may involve several steps and are used to classify cell types, species and biologically active compounds by analysing their biological and chemical characteristics. This unit includes data processing, interpretation of results and troubleshooting obvious departures from standard procedures.

Application of the Unit

Application of the unit	This unit of competency is applicable to technical assistants working in the biomedical, environmental, biotechnology and education 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

Prerequisite units		
	MSL973004A	*Perform aseptic techniques*
	MSL973007A	*Perform microscopic examination*

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. Interpret and schedule work requirements	1.1. Review work request to identify samples, required procedures and materials/equipment/instruments involved 1.2. Identify hazards and enterprise control measures associated with the sample, preparation methods, reagents and/or equipment 1.3. Plan parallel work sequences to optimise throughput of multiple sets of samples, if appropriate
2. Receive and prepare biological 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 in accordance with testing requirements 2.4. Ensure traceability of sample from receipt to reporting of results
3. Perform techniques that assist in the classification of a cell or species	3.1. Select suitable techniques in accordance with enterprise requirements and methods 3.2. Set up and use equipment and reagents in accordance with the method 3.3. Perform techniques in accordance with the method
4. Perform techniques that analyse biological activity	4.1. Select suitable techniques in accordance with enterprise requirements and methods 4.2. Set up and use equipment and reagents in accordance with the method 4.3. Perform techniques in accordance with the method
5. Process and interpret data	5.1. Record test data noting atypical observations 5.2. Construct calibration graphs, if appropriate, and compute results for all samples from these graphs 5.3. Ensure calculated values are consistent with expectations 5.4. Record and report results in accordance with enterprise procedures 5.5. Estimate and document uncertainty of measurement in accordance with enterprise procedures, if required 5.6. Interpret trends in data and/or results and report out of specification or atypical results promptly to appropriate personnel 5.7. 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 6.3. Ensure the safe disposal of biohazardous wastes 6.4. Clean, care for and store equipment and reagents as required
7. Maintain laboratory records	7.1. Record approved data into enterprise 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

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Required skills include:

- using instruments for qualitative and/or quantitative analysis
- sample preparation and separation techniques
- performing calibration checks
- metrology techniques underpinning test/procedure including estimating uncertainty
- maintaining and evaluating reagents
- troubleshooting basic equipment/method
- preparingand using calibration graphs 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:

- hazards and risks in biological laboratories
- principles and concepts related to equipment/instrument operation and testing
- function of key components of the equipment/instrument and/or reagents
- effects of modifying equipment/instrument variables
- basic equipment/method troubleshooting procedures
- calculation steps to give results in appropriate units and precision
- sources of uncertainty in measurement and methods for control
- importance and appropriate use of controls and certified reference materials
- enterprise and/or legal requirements for traceability
- relevant health, safety and environmental 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 test procedures accurately • prepare and test samples using procedures appropriate to the nature of sample • perform calibration checks (if required) • safely operate test equipment to enterprise standards and/or manufacturer's specification • prepare calibration graphs and calculate results in appropriate units and precision • apply basic theoretical knowledge to interpret gross features of data and make relevant conclusions • identify atypical results as out of normal range or an artefact using reference material or quality control sera • trace and source obvious causes of an artefact • communicate problems to a supervisor or outside service technician • record and communicate results according to enterprise procedures • maintain security, integrity, traceability and identity of samples, sub-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: • *MSL924001A Process and interpret data* • *MSL974003A Perform chemical tests and procedures*. Resources may include: • standard laboratory equipped with appropriate test equipment and instruments, reagents and materials • SOPs and testing methods.
Method of assessment	The following assessment methods are suggested:

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	• review of results obtained by the candidate over a period of time to ensure accuracy, consistency and timeliness • review of testing records and workplace documentation completed by the candidate • observation of candidate conducting a range of biological procedures • feedback from peers and supervisors • oral or written questioning of biological concepts, principles 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. **Biomedical** (**1**) A laboratory technician conducts a screening test for parasites in stool samples. She/he checks the sample identification details, cross-checks the sample barcode with the request slip and the data entry in the laboratory information management system (LIMS). The technician locates the test method and then examines the sample container to ensure that it has not leaked and that there is sufficient volume for the test. She/he prepares the sample by adding solvent to a portion and shaking it before placing it in a centrifuge. After satisfactory separation, she/he pipettes a small quantity of the top layer of solvent onto a glass slide and adds iodine as a stain. The technician carefully views the slide using x40

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	magnification and searches for eggs. She/he enters a nil result in the LIMS and disposes of the sample in accordance with enterprise procedures. **Biomedical** (**2**) A technical officer is requested to determine the total protein concentration of a blood sample using colorimetry. After checking the condition of the sample, she/he collects the Biuret reagent from the refrigerator, the required number of tubes and protein control samples and standards specified in the method. The officer labels the tubes and then accurately dispenses the correct volumes of reagent, standards, controls and samples into them. The solutions are thoroughly mixed using a vortex mixer and allowed to stand for five minutes for the reaction to occur. She/he records absorbance readings for each tube and prepares a calibration curve. The officer reads the concentration values from the graph for the control and test samples and checks the control data against the expected values. As these fall within the accepted range, she/he enters the test results into the LIMS.

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 2134.1-1999 Recommended practice for chemical analysis by atomic absorption spectrometry - Flame atomic absorption spectrometry
	  • AS 2162.1-1996 Verification and use of volumetric apparatus - General - Volumetric glassware
	  • AS 3753-2001 Recommended practice for chemical analysis by ultraviolet/visible spectrophotometry
	  • 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
	• enterprise recording and reporting procedures
	• equipment manuals
	• equipment startup, operation and shutdown procedures
	• industry methods, such as Royal Australian

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	Chemical Institute (RACI) and/or American Association of Cereal Chemists (AACC) methods for inorganic constituents • material safety data sheets (MSDS) and safety procedures • material, production and product specifications • national measurement regulations and guidelines • principles of good laboratory practice (GLP) • production and laboratory schedules • quality manuals and equipment and procedure manuals • SOPs • waste minimisation and safe disposal procedures
Biological principles and concepts underpinning tests and procedures	Biological principles and concepts underpinning tests and procedures may include: • molecular interactions within the compounds of nucleic acids and nucleotides, proteins and amino acids, carbohydrates, lipids and vitamins, influencing structure, activity, chemical reactivity and physical properties, including solubility, energy levels and emission/absorption spectra • chemical and biochemical characteristics of lipids, carbohydrates, nucleic acids and proteins influencing structure, function and reactivity both in vitro and in vivo • chemical significance of biologically significant ions, such as calcium, zinc, iron, magnesium, sodium, potassium, chloride and phosphate • key metabolic pathways and the significance of initial nutrients, products and wastes on those pathways • structure and function of organelles, cells, plant and animal tissue and organs • interrelationships of biological systems (carbon cycle, energy cycle and the web of life) • classifications, such as bacteria, viruses, yeasts, single cell, multi-cellular, plants, animals, prions, helminths, prokaryotes and eukaryotes • phases of the cell cycle

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	• Mendelian genetics, such as inheritance, meiosis, karyotypes, dominant and recessive traits, genotypes and phenotypes, and pedigrees • significance of the genetic code and transcription and translation • cell membrane activity, including diffusion (passive, facilitated and active), osmosis, tonicity and plasmolysis • staining reactions involving acid/base, redox, complex ion formation, solubility and equilibrium

Techniques for preparation of samples	Techniques for preparation of samples may include:
	• dissection, such as preparation of thymus extracts from mice
	• extraction (e.g. solvent extraction)
	• filtration (e.g. filter water samples and plate the sediment onto agar plates for incubation and growth of E. coli)
	• separation (e.g. dialysis)
	• precipitation and flocculation
	• centrifugation (excluding ultra centrifugation)
	• chromatography:
	  • gel filtration chromatography (e.g. crude purification of proteins)
	  • affinity chromatography (e.g. purification of immunoglobulins)
	• electrophoresis:
	  • polyacrylamide gel electrophoresis for separation of DNA segments
	  • agarose gel electrophoresis
	  • capillary electrophoresis
	  • gradient gel electrophoresis

Techniques to classify cells or species	Techniques to classify cells or species may include: • classification of species according to taxa • classification of cells according to microscopic or staining characteristics • characteristics of bacterial colonies: • growth on differential media

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	• colony morphology (size and shape) • biochemical reactions, such as miniaturised test strips, redox reactions and sugar tests

Techniques to analyse chemical and biological characteristics	Techniques to analyse chemical and biological characteristics may include:
	• staining:
	  • Gram stain for gram negative and positive bacteria
	  • Romanowsky stain for blood films
	  • Haematoxylin and Eosin for tissue sections
	  • Oil red O for fatty cellular inclusions
	  • spore staining
	  • flagella staining
	• microscopic examination:
	  • light
	  • phase contrast
	  • bright field
	  • dark ground
	  • enumeration
	• colorimetry and spectrophotometry:
	  • ultraviolet/visible
	  • fluorimetric
	  • infrared
	  • flame emission
	  • atomic absorption spectrometry
	• electrochemistry:
	  • pH
	  • ion selective electrodes and polarography (e.g. concentration of chloride ions)
	• chromatography:
	  • column and thin layer analytical and preparative chromatography
	  • gas and liquid chromatography for purity, raw material and formulation checks

Hazards	Hazards may include: • microbiological organisms and agents, associated with soil, air, water, blood and blood products, and human or animal tissue and

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	fluids • chemicals, such as acids, solvents and stains • aerosols from broken centrifuge tubes and pipetting • sharps and broken glassware • flammable liquids and gases • cryogenics, such as dry ice and liquid nitrogen • fluids under pressure, such as steam, hydrogen in gas liquid chromatography and acetylene in atomic absorption spectrometry • sources of ignition • disturbance or interruption of services
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, reagents, aliquoted 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 and decontaminating equipment and work areas regularly using enterprise procedures • using personal protective clothing and equipment, such as gloves, safety glasses, coveralls and gowns • using containment facilities (PCII, PCIII and PCIV physical containment laboratories), containment equipment (biohazard containers, laminar flow cabinets, Class I, II and III biohazard cabinets) and containment procedures • 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

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Disposal of biohazardous wastes	Disposal of biohazardous wastes may include: • collection for sterilisation by autoclaving (e.g. autoclaving of microbiological plates) • appropriate storage (e.g. of waste containing radioactive isotopes) • use of biohazard waste containers
Records	Records may include: • test calibration results • equipment use, maintenance and servicing history • faulty or unsafe equipment • batch number, catalogue number and use by date for analytical kits
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

Competency field

Competency field	

Co-requisite units

Co-requisite units		