REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARDS

FOR

APPLIED BIOLOGY

LEVEL 6

TVET CDACC
P.O. BOX 15745-00100
NAIROBI

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FOREWORD

The provision of quality education and training is fundamental to the Government's overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya's development blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010 and this resulted to the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for the purpose of developing a competency-based curriculum for Applied Biology. These Occupational Standards will also be the bases for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for Applied Biologyk9 sector's growth and development.

PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING
MINISTRY OF EDUCATION

PREFACE

Kenya's Vision 2030 aims to transform the country into a newly industrializing, "middle-income country providing a high-quality life to all its citizens by the year 2030". Kenya intends to create a globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through life-long education and training. TVET has a responsibility of facilitating the process of inculcating knowledge, skills and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labor force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Science Laboratory Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for Applied Biology. These standards will be the bases for development of competency-based curriculum for Applied Biology.

The occupational standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

I am grateful to the Council Members, Council Secretariat, Science Laboratory SSAC, expert workers and all those who participated in the development of these Occupational Standards.

Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. EngTech.
CHAIRMAN, TVET CDACC

ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am thankful to the management of these organizations for allowing their staff to participate in this course. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to Science Laboratory Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards.

I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

CHAIRMAN
SCIENCE LABORATORY SECTOR SKILLS ADVISORY COMMITTEE

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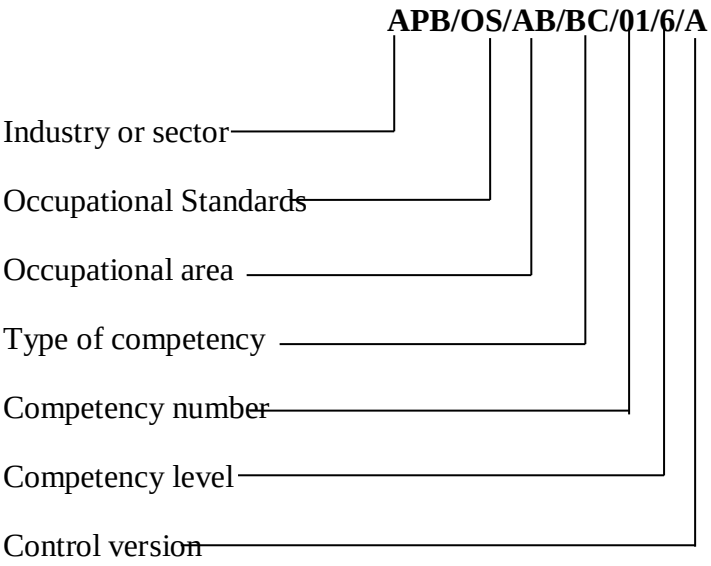
ACRONYMS

A	Control Version
BC	Basic Competency
CBET	Competency-Based Education and Training
CC	Common Competency
CDACC	Curriculum Development, Assessment and Certification Council
CNS	Central Nervous System
CR	Core Competency
CU	Curriculum
DNA	Deoxyribonucleic Acid
ICT	Information communication technology
IPM	Integrated Pest Management
MOALF	Ministry of Agriculture Livestock and Fisheries
NEMA	National Environment Management Authority
OSH	Occupational Safety and Health
PPEs	Personal Protective Equipment
PNS	Peripheral Nervous System
RNA	Ribonucleic Acid
SOPs	Standard Operating Procedures

KEY TO UNIT CODE



OVERVIEW

Applied Biology Certificate level 6 qualification consists of competencies that a person must achieve to enable him/her to effectively discharge Applied Biology works and contributes towards meeting Applied Biology requirements.

The units of competency leading to Applied Biology certificate level 6 qualification include the following seven basic, four common and twelve core competencies:

BASIC UNITS OF COMPETENCY

UNIT OF COMPETENCY CODE	UNIT OF COMPETENCY TITLE
APB/OS/AB/BC/01/6/A	Demonstrate communication skills
APB/OS/AB/BC/02/6/A	Demonstrate numeracy skills
APB/OS/AB/BC/03/6/A	Demonstrate digital literacy
APB/OS/AB/BC/04/6/A	Demonstrate understanding of entrepreneurship
APB/OS/AB/BC/05/6/A	Demonstrate employability skills
APB/OS/AB/BC/06/6/A	Demonstrate environmental literacy
APB/OS/AB/BC/07/7/A	Demonstrate Occupational safety and health practices

COMMON UNITS OF COMPETENCY

UNIT OF COMPETENCY CODE	UNIT OF COMPETENCY TITLE
APB/OS/AB/CC/01/6/A	Perform anatomy and physiology studies
APB/OS/AB/CC/02/6/A	Apply standard laboratory practices
APB/OS/AB/CC/03/6/A	Carry out microscopy
APB/OS/AB/CC/04/6/A	Conduct laboratory research

CORE UNITS OF COMPETENCY

UNIT OF COMPETENCY CODE	UNIT OF COMPETENCY TITLE
APB/OS/AB/CR/01/6/A	Carry out cytological and histological techniques
APB/OS/AB/CR/02/6/A	Carry out microbiological techniques
APB/OS/AB/CR/03/6/A	Perform taxonomic studies
APB/OS/AB/CR/04/6/A	Apply Herbarium, Museum, Aquarium and Vivarium techniques
APB/OS/AB/CR/05/6/A	Carry out ecological and soil studies
APB/OS/AB/CR/06/6/A	Carry out animal husbandry
APB/OS/AB/CR/07/6/A	Carry out plant husbandry
APB/OS/AB/CR/08/6/A	Apply entomological techniques

APB/OS/AB/CR/09/6/A	Carry out parasitological techniques
APB/OS/AB/CR/10/6/A	Perform immunology techniques
APB/OS/AB/CR/11/6/A	Apply biochemical techniques
APB/OS/AB/CR/12/6/A	Perform pharmacological and toxicological techniques

BASIC UNITS OF COMPETENCY

DEMONSTRATE COMMUNICATION SKILLS

UNIT CODE: APB/OS/AB/BC/01/6/A

UNIT DESCRIPTION

This unit covers the competencies required in meeting communication needs of clients and colleagues; developing, establishing, maintaining communication pathways and strategies. It also covers competencies for conducting interview, facilitating group discussion and representing the organization in various forums.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Meet communication needs of clients and colleagues	1.1 Specific communication needs of clients and colleagues are identified and met 1.2 Different approaches are used to meet communication needs of clients and colleagues 1.3 Conflict is addressed promptly and in a timely way and in a manner, which does not compromise the standing of the organization
2. Develop communication strategies	2.1 Strategies for effective internal and external dissemination of information are developed to meet the organization's requirements 2.2 Special communication needs are considered in developing strategies to avoid discrimination in the workplace 2.3 Communication ***strategies*** are analyzed, evaluated and revised where necessary to make sure they are effective
3. Establish and maintain communication pathways	3.1 Pathways of communication are established to meet requirements of organization and workforce 3.2 Pathways are maintained and reviewed to ensure personnel are informed of relevant information
4. Promote use of communication strategies	4.1 Information is provided to all areas of the organization to facilitate implementation of the strategy 4.2 Effective communication techniques are articulated and modelled to the workforce

	4.3 Personnel are given guidance about adapting communication strategies to suit a range of contexts
5. Conduct interview	5.1 A range of appropriate communication strategies are employed in ***interview situations*** 5.2 Records of interviews are made and maintained in accordance with organizational procedures 5.3 Effective questioning, listening and nonverbal communication techniques are used to ensure that required message is communicated
6. Facilitate group discussion	6.1 Mechanisms which enhance ***effective group interaction*** is defined and implemented 6.2 Strategies which encourage all group members to participate are used routinely 6.3 Objectives and agenda for meetings and discussions are routinely set and followed 6.4 Relevant information is provided to group to facilitate outcomes 6.5 Evaluation of group communication strategies is undertaken to promote participation of all parties 6.6 Specific communication needs of individuals are identified and addressed
7. Represent the organization	7.1 When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization 7.2 Presentation is clear and sequential and delivered within a predetermined time 7.3 Appropriate media is utilized to enhance presentation 7.4 Differences in views are respected 7.5 Written communication is consistent with organizational standards 7.6 Inquiries are responded in a manner consistent with organizational standard

RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Variable	**Range**
Communication strategies include but not limited to:	• Language switch • Comprehension check • Repetition • Asking confirmation • Paraphrase • Clarification request • Translation • Restructuring • Approximation • Generalization
Interview situations include but not limited to:	• Establishing rapport • Eliciting facts and information • Facilitating resolution of issues • Developing action plans • Diffusing potentially difficult situations
Effective group interaction includes but not limited to:	• Identifying and evaluating what is occurring within an interaction in a nonjudgmental way • Using active listening • Making decision about appropriate words, behavior • Putting together response which is culturally appropriate • Expressing an individual perspective • Expressing own philosophy, ideology and background and exploring impact with relevance to communication

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Effective communication

- Active listening
- Giving/receiving feedback
- Interpretation of information
- Role boundaries setting
- Negotiation
- Establishing empathy
- Openness and flexibility in communication
- Communication skills required to fulfill job roles as specified by the organization
- Writing communications strategy
- Applying key elements of communications strategy

Required Knowledge

The individual needs to demonstrate knowledge of:

- Communication process
- Dynamics of groups and different styles of group leadership
- Communication skills relevant to client groups
- Flexibility in communication
- Key elements of communications strategy

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Developed communication strategies to meet the organization requirements and applied in the workplace 1.2 Established and maintained communication pathways for effective communication in the workplace 1.3 Used communication strategies involving exchanges of complex oral information
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through:

	3.1 Direct Observation/Demonstration with Oral Questioning 3.2 Written Examination
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE NUMERACY SKILLS

UNIT CODE: APB/OS/AB/BC/02/6/A

UNIT DESCRIPTION

This unit describes the competencies required by a worker in order to apply a wide range of mathematical calculations for work; apply ratios, rates and proportions to solve problems; estimate, measure and calculate measurement for work; Use detailed maps to plan travel routes for work; Use geometry to draw and construct 2D and 3D shapes for work; Collect, organize and interpret statistical data; Use routine formula and algebraic expressions for work and use common functions of a scientific calculator

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
1. Apply a wide range of mathematical calculations for work	1.1 Mathematical information embedded in a range of workplace tasks and texts is extracted 1.2 Mathematical information is interpreted and comprehended 1.3 A range of mathematical and problem solving processes are select and used 1.4 Different forms of fractions, decimals and percentages are flexibly used 1.5 Calculation performed with positive and negative numbers 1.6 Numbers are expressed as powers and roots and are used in calculations 1.7 Calculations done using routine formulas 1.8 Estimation and assessment processes are used to check outcome 1.9 Mathematical language is used to discuss and explain the processes, results and implications of the task
2. Use and apply ratios, rates and proportions for work	2.1 Information regarding ratios, rates and proportions extracted from a range of workplace tasks and texts 2.2 Mathematical information related to ratios, rate and proportions is analyzed 2.3 Problem solving processes are used to undertake the task 2.4 Equivalent ratios and rates are simplified

	2.5 Quantities are calculated using ratios, rates and proportions 2.6 Graphs, charts or tables are constructed to represent ratios, rates and proportions 2.6 The outcomes reviewed and checked 2.7 Information is record using mathematical language and symbols
3. Estimate, measure and calculate measurement for work	3.1 Measurement information embedded in workplace texts and tasks are extracted and interpreted 3.2 Appropriate workplace measuring equipment are identified and selected 3.3 Accurate measurements are estimate and made 3.4 The area of 2D shapes including compound shapes are calculated 3.5 The volume of 3D shapes is calculated using relevant formulas 3.6 Sides of right angled triangles are calculated using Pythagoras' theorem 3.7 conversions are perform between units of measurement 3.8 Problem solving processes are used to undertake the task 3.9 The measurement outcomes are reviewed and checked 3.10 Information is recorded using mathematical language and symbols appropriate for the task
4. Use detailed maps to plan travel routes for work	4.1 Different types of maps are identified and interpreted 4.2 Key features of maps are identified 4.3 Scales are identified and interpreted 4.4 Scales are applied to calculate actual distances 4.5 Positions or locations are determined using directional information 4.6 Routes are planned by determining directions and calculating distances, speeds and times 4.7 Information is gathered and identified and relevant factors related to planning a route checked 4.8 Relevant equipment is select and checked for accuracy and operational effectiveness 4.9 Task is planned and recorded using specialized mathematical language and symbols appropriate for the task
5. Use geometry to draw 2D shapes and	5.1 A range of 2D shapes and 3D shapes and their uses in work contexts is identified 5.2 Features of 2D and 3D shapes are named and described 5.3 Types of angles in 2D and 3D shapes are identified

construct 3D shapes for work	5.4 Angles are drawn, estimated and measured using geometric instruments 5.5 Angle properties of 2D shapes are named and identified 5.6 Angle properties are used to evaluate unknown angles in shapes 5.7 Properties of perpendicular and parallel lines are applied to shapes 5.8 Understanding and use of symmetry is demonstrated 5.9 Understanding and use of similarity is demonstrated 5.10 The workplace tasks and mathematical processes required are identified 5.11 2D shapes is drawn for work 5.12 3D shapes is constructed for work 5.13 The outcomes are reviewed and checked 5.14 Specialized mathematical language and symbols appropriate for the task are used
6. Collect, organize, and interpret statistical data for work	6.1 Workplace issue requiring investigation are identified 6.2 Audience / population / sample unit is determined 6.3 Data to be collected is identified 6.4 Data collection method is selected 6.5 Appropriate statistical data is collected and organized 6.6 Data is illustrated in appropriate formats 6.7 The effectiveness of different types of graphs are compared 6.8 The summary statistics for collected data is calculated 6.9 The results / findings are interpreted 6.10 Data is checked to ensure that it meets the expected results and content 6.11 Information from the results including tables, graphs and summary statistics is extracted and interpreted 6.12 Mathematical language and symbols are used to report results of investigation
7. Use routine formula and algebraic expressions for work	7.1 Understanding of informal and symbolic notation, representation and conventions of algebraic expressions is demonstrated 7.2 Simple algebraic expressions and equations are developed 7.3 Operate on algebraic expressions 7.4 Algebraic expressions are simplified 7.5 Substitution into simple routine equations is done

	7.6 Routine formulas used for work tasks are identified and comprehended 7.7 Routine formulas are evaluate by substitution 7.8 Routine formulas transposed 7.9 Appropriate formulas are identified and used for work related tasks 7.10Outcomes are checked and result of calculation used
8. Use common functions of a scientific calculator for work	8.1 Required numerical information to perform tasks is located 8.2 The order of operations and function keys necessary to solve mathematical calculation are determined 8.3 Function keys on a scientific calculator are identified and used 8.4 Estimations are referred to check reasonableness of problem solving process 8.5 Appropriate mathematical language, symbols and conventions are used to report results

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	**Range**
1 Geometry includes but not limited to:	1.1 Scale drawing 1.2 Triangles 1.3 Simple solid 1.4 Round 1.5 Square 1.6 Rectangular 1.7 Triangle 1.8 Sphere 1.9 Cylinder 1.10 Cube 1.11 Polygons 1.12 Cuboids

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Applying Fundamental operations (addition, subtraction, division, multiplication)
- Using calculator
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of:

- Types of common shapes
- Differentiation between two dimensional shapes / objects
- Formulae for calculating area and volume
- Types and purpose of measuring instruments
- Units of measurement and abbreviations
- Fundamental operations (addition, subtraction, division, multiplication)
- Rounding techniques
- Types of fractions
- Different types of tables and graphs
- Meaning of graphs, such as increasing, decreasing, and constant value
- Preparation of basic data, tables & graphs

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1. 1. Applied a wide range of mathematical calculations for work 1. 2. Used and applied ratios, rates and proportions for work 1. 3. Estimated, measured and calculated measurement for work 1. 4. Used detailed maps to plan travel routes for work 1. 5. Used geometry to draw 2D shapes and construct 3D shapes for work 1. 6. Collected, organized, and interpreted statistical data for work

	1. 7. Used routine formula and algebraic expressions for work 1. 8. Used common functions of a scientific calculator for work
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 3.1 Direct Observation/Demonstration with Oral Questioning 3.2 3.2 Written Examination
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE DIGITAL LITERACY

UNIT CODE: APB/OS/AB/BC/03/6/A

UNIT DESCRIPTION

This unit covers the competencies required to effectively use digital devices such as smartphones, tablets, laptops and desktop PCs. It entails identifying and using digital devices such as smartphones, tablets, laptops and desktop PCs for purposes of communication, work performance and management at the work place.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Identify appropriate computer software and hardware	1.1 Concepts of ICT are determined in accordance with computer equipment 1.2 Classifications of computers are determined in accordance with manufacturers specification 1.3 ***Appropriate computer software*** is identified according to manufacturer's specification 1.4 ***Appropriate computer hardware*** is identified according to manufacturer's specification 1.5 Functions and commands of operating system are determined in accordance with manufacturer's specification
2. Apply security measures to data, hardware, software in automated environment	2.1 ***Data security and privacy are classified*** in accordance with the prevailing technology 2.2 ***Security threats*** are identified ***and control measures*** are applied in accordance with laws governing protection of ICT 2.3 Computer threats and crimes are detected. 2.4 Protection against computer crimes is undertaken in accordance with laws governing protection of ICT
3. Apply computer software in solving tasks	3.1 ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation

	3.2 ***Word processing utilities*** are applied in accordance with workplace procedures 3.3 Worksheet layout is prepared in accordance with work procedures 3.4 Worksheet is built and data manipulated in the worksheet in accordance with workplace procedures 3.5 Continuous data manipulated on worksheet is undertaken in accordance with work requirements 3.6 Database design and manipulation is undertaken in accordance with office procedures 3.7 Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures
4. Apply internet and email in communication at workplace	4.1 Electronic mail addresses are opened and applied in workplace communication in accordance with office policy 4.2 Office internet functions are defined and executed in accordance with office procedures 4.3 ***Network configuration*** is determined in accordance with office operations procedures 4.4 Official World Wide Web is installed and managed according to workplace procedures
5. Apply Desktop publishing in official assignments	5.1 Desktop publishing functions and tools are identified in accordance with manufactures specifications 5.2 Desktop publishing tools are developed in accordance with work requirements 5.3 Desktop publishing tools are applied in accordance with workplace requirements 5.4 Typeset work is enhanced in accordance with workplace standards
6. Prepare presentation packages	6.1 Types of presentation packages are identified in accordance with office requirements 6.2 Slides are created and formulated in accordance with workplace procedures 6.3 Slides are edited and run in accordance with work procedures 6.4 Slides and handouts are printed according to work requirements

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
Appropriate computer software includes but not limited to:	A collection of instructions or computer tools that enable the user to interact with a *computer*, its hardware, or perform tasks.
Appropriate computer hardware includes but not limited to:	Collection of physical parts of a computer system such as; • Computer case, monitor, keyboard, and mouse • All the parts inside the computer case, such as the hard disk drive, motherboard and video card
Data security and privacy includes but not limited to:	• Confidentiality of data • Cloud computing • Integrity -but-curious data surfing
Security and control measures includes but not limited to:	• Counter measures against cyber terrorism • Risk reduction • Cyber threat issues • Risk management • Pass-wording
Security threats includes but not limited to:	• Cyber terrorism • Hacking
Word processing concepts includes but not limited to:	Using a special program to create, edit and print documents
Network configuration includes but not limited to:	Organizing and maintaining information on the components of a computer network

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Analytical skills
- Interpretation
- Typing

- Communication
- Computing (applying fundamental operations such as addition, subtraction, division and multiplication)
- Using calculator
- Basic ICT skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Software concept
- Functions of computer software and hardware
- Data security and privacy
- Computer security threats and control measures
- Technology underlying cyber-attacks and networks
- Cyber terrorism
- Computer crimes
- Detection and protection of computer crimes
- Laws governing protection of ICT
- Word processing;
    - ✓ Functions and concepts of word processing.
    - ✓ Documents and tables creation and manipulations
    - ✓ Mail merging
    - ✓ Word processing utilities
- Spread sheets;
    - ✓ Meaning, formulae, function and charts, uses and layout
    - ✓ Data formulation, manipulation and application to cells
    - ✓
- Database;
    - ✓ Database design, data manipulation, sorting, indexing, storage retrieval and security
- Desktop publishing;
    - ✓ Designing and developing desktop publishing tools
    - ✓ Manipulation of desktop publishing tools
    - ✓ Enhancement of typeset work and printing documents
- Presentation Packages;
    - ✓ Types of presentation Packages
    - ✓ Creating, formulating, running, editing, printing and presenting slides and handouts

- Networking and Internet;
  - ✓ Computer networking and internet.
  - ✓ Electronic mail and world wide web
- Emerging trends and issues in ICT;
  - ✓ Identify and integrate emerging trends and issues in ICT
  - ✓ Challenges posed by emerging trends and issues

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified and controlled security threats 1.2 Detected and protected computer crimes 1.3 Applied word processing in office tasks 1.4 Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures 1.5 Opened electronic mail for office communication as per workplace procedure 1.6 Installed internet and World Wide Web for office tasks in accordance with office procedures 1.7 Integrated emerging issues in computer ICT applications 1.8 Applied laws governing protection of ICT
2. Resource Implications	2.1 Tablets 2.2 Laptops and 2.3 Desktop PCs 2.4 Desktop computer 2.5 Lap top 2.6 Calculator 2.7 Internet 2.8 Smart phone 2.9 Operations Manuals
3. Methods of Assessment	Competency may be assessed through: 3.1 Written Test 3.2 Demonstration 3.3 Practical assignment 3.4 Interview/Oral Questioning

	3.5 Demonstration
4. Context of Assessment	Competency may be assessed in an off and on the job setting
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE UNDERSTANDING OF ENTREPRENEURSHIP

UNIT CODE: APB/OS/AB/BC/04/6/A

UNIT DESCRPTION

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship and self-employment. It also involves identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation and developing business innovative strategies.

ELEMENTS AND PERFORMANCE CRITERIA

RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Variable	**Range**
Strategic directions include but not limited to:	1.1 Business continuity and succession 1.2 Resource access security 1.3 Core competencies development 1.4 New developments e.g. technological change, new products
Business/Corporate plan includes but not limited to:	2.1 Action steps and responsibilities of departments and individual workers 2.2 Resource requirements and budget 2.3 Tactics and strategies to achieve objectives
Helpful mechanisms include but not limited to:	3.1 Wage and non-wage benefits 3.2 Employee awards and recognition systems 3.3 Employee rights and welfare policies 3.4 Full-disclosure/transparency policies

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Assessing a range of alternative products and strategies
- Critically analyzing information, summarizing and making sense of previous and current market trends
- Identifying changing consumer preferences and demographics
- Thinking "outside the box"
- Ensuring quality consistency
- Reducing lead time to product/service delivery
- Managing operations/ production
- Using formal problem-solving procedures, e. g., root-cause analysis, six sigma
- Communication skills
- Applying motivational principles, e. g., positive stroking, behavior modification
- Assessing range of alternatives rather than choosing the easiest option
- Achieving ownership and credibility for the enterprise vision
- Critically analyzing information, summarizing and making sense of previous and current market trends
- Developing solutions and practical strategies which are "outside the box"

Required Knowledge

The individual needs to demonstrate knowledge of:

- Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
- Conflict resolution
- Health, safety and environment (HSE) principles and requirements
- Public-relations strategies
- Basic cost-benefit analysis
- Basic financial management
- Business strategic planning
- Impact of change on individuals, groups and industries
- Employee assistance
- Government and regulatory processes
- Local and international market trends
- Product promotion strategies

- Mechanisms in the enterprise
- Market and feasibility studies
- Local and global supply chains Business models and strategies
- Government and regulatory processes
- Local and international business environment
- Concepts of change management
- Relevant developments in other industries
- Capital employed
- Regional/ County business expansion
- Innovation in business

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated ability to maintain a profitable and stable enterprise as shown by stakeholder feedback, employee testimonies and company financial statements 1.2 Demonstrated ability to conceptualize and plan a micro/small enterprise 1.3 Demonstrated ability to manage/operate a micro/small-scale business 1.4 Demonstrated basic marketing skills
2. Resource Implications	The following resources should be provided: 2.1 Interview guide for entrepreneurs 2.2 Enterprise workers and third parties 2.3 Materials and location relevant to the proposed activity and tasks
3. Methods of Assessment	3.1 Case problems 3.2 Interview 3.3 Portfolio 3.4 Third part reports

4. Context of Assessment	4.1 Competency may be assessed in workplace or in a simulated workplace setting 4.2 Assessment shall be observed while tasks are being undertaken whether individually or in-group
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE EMPLOYABILITY SKILLS

UNIT CODE: APB/OS/AB/BC/05/6/A

UNIT DESCRIPTON

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Conduct self-management	1.1 Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 1.2 Emotions are managed as per workplace requirements 1.3 Individual performance is evaluated and monitored according to the agreed targets. 1.4 Assertiveness is developed and maintained based on the requirements of the job. 1.5 Accountability and responsibility for own actions are demonstrated. 1.6 Self-esteem and a positive self-image are developed and maintained. 1.7 Time management, attendance and punctuality are observed as per the organization policy. 1.8 Goals are managed as per the organization's objective 1.9 Self-strengths and weaknesses are identified as per ***personal objectives*** 1.10 Critics are managed as per personal objectives
2. Demonstrate interpersonal communication	2.1 Listening and understanding is demonstrated as per communication policy

	2.2 Writing to the needs of the audience is demonstrated as per communication policy 2.3 Speaking, reading and writing is demonstrated as per communication policy 2.4 Negotiation skills are demonstrated as per communication policy 2.5 Empathizing is demonstrated as per the communication policy 2.6 Numeracy is applied as per the communication policy 2.7 Internal and external customers' needs are identified and interpreted as per the communication policy 2.8 Persuasion is demonstrated as per the communication policy 2.9 Communication networks are established as per the SOPs 2.10 Information is shared as per communication structure
3. Demonstrate critical safe work habits	3.1 Stress is managed in accordance with workplace procedures. 3.2 Punctuality and time consciousness is demonstrated in line with workplace policy. 3.3 Personal objectives are integrated with organization goals based on organization's strategic plan. 3.4 ***Resources*** are utilized in accordance with workplace policy. 3.5 Work priorities are set in accordance to workplace procedures. 3.6 Leisure time is recognized in line with organization policy. 3.7 Abstinence from ***drug and substance abuse*** is observed as per workplace policy. 3.8 Awareness of HIV and AIDS is demonstrated in line with workplace requirements. 3.9 Safety consciousness is demonstrated in the workplace based on organization safety policy. 3.10 ***Emerging issues*** are dealt with in accordance with organization policy.
4. Lead a workplace team	4.1 Performance expectations for the ***team*** are set 4.2 Duties and responsibilities are assigned in accordance with the organization policy. 4.3 Team parameters and ***relationships*** are identified according to set rules and regulations. 4.4 ***Forms of communication*** in a team are established according to office policy.

	4.5 Communication is carried out as per workplace place policy and requirements of the job. 4.6 Team performance is supervised 4.7 ***Feedback*** on performance is collected and analyzed based on established team learning process 4.8 Conflicts are resolved between team members in line with organization rules and regulations. 4.9 ***Gender mainstreaming*** is undertaken in accordance with set regulations. 4.10 Human rights are adhered to in accordance with existing protocol. 4.11 Healthy relationships are developed and maintained for harmonious co-existence in line with workplace.
5. Plan and organize work	5.1 Task requirements are identified as per the workplace objectives 5.2 Task is interpreted in accordance with safety (OHS), environmental requirements and quality requirements 5.3 Work activity is organized with other involved personnel as per the SOPs 5.4 Resources are mobilized, allocated and utilized to meet project goals and deliverables. 5.5 Work activities are monitored and evaluated in line with organization procedures. 5.6 Job planning is documented in accordance with workplace requirements. 5.7 Planning and organizing of work activities is reviewed as per the workplace requirements 5.8 Time is managed achieve workplace set goals and objectives.
6. Maintain professional growth and development	6.1 Personal training needs are identified and assessed in line with the requirements of the job. 6.2 ***Training and career opportunities*** are identified and availed based on job requirements. 6.3 Resources for training are mobilized and allocated based organizations skills needs. 6.4 Licensees and certifications relevant to job and career are obtained and renewed. 6.5 ***Personal growth*** is pursued towards improving the qualifications set for the profession.

	6.6 Work priorities and commitments are managed based on requirement of the job and workplace policy. 6.7 Recognitions are sought as proof of career advancement in line with professional requirements.
7. Demonstrate workplace learning	7.1 Own learning is managed as per workplace policy. 7.2 Learning opportunities are sought and allocated based on job requirement and in line with organization policy. 7.3 Contribution to the learning community at the workplace is carried out. 7.4 ***Range of media for learning*** are established as per the training need 7.5 Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job 7.6 Enthusiasm for ongoing learning is demonstrated 7.7 Time and effort is invested in learning new skills-based job requirements 7.8 Willingness to learn in different context is demonstrated based on available learning opportunities arising in the workplace. 7.9 Awareness of Occupational Health and Safety procedures are demonstrated in use of technology in the workplace. 7.10 Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy. 7.11 New systems are developed and maintained in accordance with the requirements of the job. 7.12 Opportunities that are not obvious are identified and exploited in line with organization objectives. 7.13 Opportunities for performance improvement are identified proactively in area of work. 7.14 Awareness of personal role in workplace ***innovation*** is demonstrated.
8. Demonstrate problem solving skills	8.1 Creative, innovative and practical solutions are developed based on the problem 8.2 Independence and initiative in identifying and solving problems is demonstrated. 8.3 Team problems are solved as per the workplace guidelines 8.4 Problem solving strategies are applied as per the workplace guidelines

	8.5 Problems are analyzed and assumptions tested as per the context of data and circumstances
9. Manage workplace ethics	9.1 Policies and guidelines are observed as per the workplace requirements 9.2 Self-worth and profession is exercised in line with personal goals and organizational policies 9.3 Code of conduct is observed as per the workplace requirements 9.4 Personal and professional integrity is demonstrated as per the personal goals 9.5 Commitment to jurisdictional laws is demonstrated as per the workplace requirements

RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Range	**Variable**
Drug and substance abuse include but not limited to:	Commonly abused • Alcohol • Tobacco • Miraa • Over-the-counter drugs • Cocaine • Bhang • Glue
Feedback includes but not limited to:	• Verbal • Written • Informal • Formal

Relationships includes but not limited to:	• Man/Woman • Trainer/trainee • Employee/employer • Client/service provider • Husband/wife • Boy/girl • Parent/child • Sibling relationships
Forms of communication include but not limited to:	• Written • Visual • Verbal • Non verbal • Formal and informal
Team includes but not limited to:	• Small work group • Staff in a section/department • Inter-agency group
Personal growth includes but not limited to:	• Growth in the job • Career mobility • Gains and exposure the job gives • Net workings • Benefits that accrue to the individual as a result of noteworthy performance
Personal objectives include but not limited to:	• Long term • Short term • Broad • Specific

Trainings and career opportunities includes but not limited to	• Participation in training programs
	  ○ Technical
	  ○ Supervisory
	  ○ Managerial
	  ○ Continuing Education
	• Serving as Resource Persons in conferences and workshops

Resource include but not limited to:	• Human
	• Financial
	• Technology
	  ○ Hardware
	  ○ Software

Innovation include but not limited to:	• New ideas • Original ideas • Different ideas • Methods/procedures • Processes • New tools
Emerging issues include but not limited to:	• Terrorism • Social media • National cohesion • Open offices
Range of media for learning include but not limited to:	• Mentoring • peer support and networking • IT and courses

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Personal hygiene practices
- Intra and Interpersonal skills
- Communication skills
- Knowledge management
- Interpersonal skills
- Critical thinking skills
- Observation skills
- Organizing skills
- Negotiation skills
- Monitoring skills
- Evaluation skills
- Record keeping skills
- Problem solving skills
- Decision Making skills
- Resource utilization skills
- Resource mobilization skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Work values and ethics
- Company policies
- Company operations, procedures and standards
- Occupational Health and safety procedures
- Fundamental rights at work
- Personal hygiene practices
- Workplace communication
- Concept of time
- Time management
- Decision making
- Types of resources
- Work planning
- Resources and allocating resources
- Organizing work
- Monitoring and evaluation
- Record keeping
- Workplace problems and how to deal with them
- Negotiation
- Assertiveness
- Team work
- Gender mainstreaming
- HIV and AIDS
- Drug and substance abuse
- Leadership
- Safe work habits
- Professional growth and development
- Technology in the workplace
- Learning
- Creativity
- Innovation
- Emerging issues
    - Social media
    - Terrorism
    - National cohesion

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Conducted self-management 1.2 Demonstrated interpersonal communication 1.3 Demonstrated critical safe work habits 1.4 Demonstrated the ability to lead a workplace team 1.5 Planned and organized work 1.6 Maintained professional growth and development 1.7 Demonstrated workplace learning 1.8 Demonstrated problem solving skills 1.9 Demonstrated the ability to manage ethical performance
2. Resource Implications	The following resources should be provided: 2.1 Case studies/scenarios
3. Methods of Assessment	Competency in this unit may be assessed through: • Oral Interview • Observation • Third Party Reports • Written
4. Context of Assessment	4.1 Competency may be assessed in workplace or in a simulated workplace setting 4.2 Assessment shall be observed while tasks are being undertaken whether individually or in-group
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE ENVIRONMENTAL LITERACY

UNIT CODE: APB/OS/AB/BC/06/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to follow procedures for environmental hazard control, follow procedures for environmental pollution control, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, develop and adhere to environmental protection principles/strategies/guidelines, analyze resource use, develop resource conservation plans and implement selected plans.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Control environmental hazard	1.1 ***Storage methods*** for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS. 1.2 ***Disposal methods*** of hazardous wastes are followed at all times according to environmental regulations and OSHS. 1.3 ***PPE*** is used according to OSHS.
2. Control environmental Pollution control	2.1 Environmental pollution ***control measures*** are compiled following standard protocol. 2.2 Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999 2.3 Methods for minimizing ***noise pollution*** complied following environmental regulations.
3. Demonstrate sustainable resource use	3.1 Methods for minimizing wastage are complied with.

	3.2 Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle) 3.3 Methods for economizing or reducing resource consumption are practiced.
4. Evaluate current practices in relation to resource usage	4.1 Information on resource efficiency systems and procedures are collected and provided to the work group where appropriate. 4.2 Current resource usage is measured and recorded by members of the work group. 4.3 Current purchasing strategies are analyzed and recorded according to industry procedures. 4.4 Current work processes to access information and data is analyzed following enterprise protocol.
5. Identify Environmental legislations/conventions for environmental concerns	5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 5.2 Industrial standard/environmental practices are described according to the different environmental concerns
6. Implement specific environmental programs	6.1 Programs/Activities are identified according to organizations policies and guidelines. 6.2 Individual roles/responsibilities are determined and performed based on the activities identified. 6.3 Problems/constraints encountered are resolved in accordance with organizations' policies and guidelines 6.4 Stakeholders are consulted based on company guidelines
7. Monitor activities on Environmental protection/Programs	7.1 Activities are periodically monitored and Evaluated according to the objectives of the environmental program 7.2 Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations 7.3 Data gathered are analyzed based on Evaluation requirements

	7.4 Recommendations are submitted based on the findings 7.5 Management support systems are set/established to sustain and enhance the program 7.6 Environmental incidents are monitored and reported to concerned/proper authorities
8. Analyze resource use	8.1 All resource consuming processes are Identified 8.2 Quantity and nature of Resource consumed is determined 8.3 Resource flow is analyzed through different parts of the process. 8.4 Wastes are classified for possible source of resources.
9. Develop resource conservation plans	9.1 Efficiency of use/conversion of resources is determined following industry protocol. 9.2 Causes of low efficiency of use of resources are determined based on industry protocol. 9.3 Plans for increasing the efficiency of resource use are developed based on findings.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	**Range**
PPEs include but are not limited to	1.1. Mask 1.2. Gloves 1.3. Goggles 1.4. Safety hat 1.5. Overall 1.6. Hearing protector
Environmental pollution control measures include but are not limited to:	2.1 Methods for minimizing or stopping spread and ingestion of airborne particle 2.2 Methods for minimizing or stopping spread and ingestion of gases and fumes 2.3 Methods for minimizing or stopping spread and ingestion of liquid wastes

Wastes include but are not limited to:	3.1 Unnecessary waste 3.2 Necessary waste
Waste Management Procedures include but are not limited to:	4.1 Sorting 4.2 Storing of items 4.3 Recycling of items 4.4 Disposal of items
Resources include but are not limited to:	5.1 Electric 5.2 Water 5.3 Fuel 5.4 Telecommunications 5.5 Supplies 5.6 Materials
Workplace environmental hazards include but are not limited to:	1.1 Biological hazards 1.2 Chemical and dust hazards 1.3 Physical hazards
Organizational systems and procedures include but are not limited to:	7.1 Supply chain, procurement and purchasing 7.2 Quality assurance 7.3 Making recommendations and seeking approvals
Legislations/Conventions include but are not limited to:	8.1 EMCA 1999 8.2 Montreal Protocol 8.3 Kyoto Protocol
Environmental aspects/impacts include but are not limited to:	9.4 Air pollution 9.5 Water pollution 9.6 Noise pollution 9.7 Solid waste 9.8 Flood control 9.9 Deforestation/Denudation 9.10 Radiation/Nuclear /Radio Frequency/ Microwaves 9.11 Situation 9.12 Soil erosion (e.g. Quarrying, Mining, etc.) 9.13 Coral reef/marine life protection
Industrial standards / Environmental practices include but are not limited to:	10.1 ISO standards 10.2 Company environmental management systems (EMS)

Periodic includes but are not limited to:	11.1 hourly 11.2 daily 11.3 weekly 11.4 monthly 11.5 quarterly 11.6 yearly
Programs/Activities include but are not limited to:	12.1Waste disposal (on-site and off-site) 12.2Repair and maintenance of equipment 12.3Treatment and disposal operations 12.4Clean-up activities 12.5Laboratory and analytical test 12.6Monitoring and evaluation 12.7Environmental advocacy programs

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Following storage methods of environmentally hazardous materials
- Following disposal methods of hazardous wastes
- Using PPE
- Practicing OSHS
- Complying environmental pollution control
- Observing solid waste management
- Complying methods of minimizing noise Pollution
- Complying methods of minimizing wastage
- Employing waste management procedures
- Economizing resource consumption
- Listing of resources used
- Measuring current usage of resources
- Identifying and reporting workplace environmental hazards
- Conveying all environmental issues
- Following environmental regulations
- Identifying environmental regulations
- Assessing procedures for assessing compliance
- Collecting information on environmental and resource efficiency systems and procedures, and Providing information to the work group

- Measuring and recording current resource usage
- Analysing and recording current purchasing strategies.
- Analysing current work processes to access information and data and Assisting identifying areas for improvement
- Analysing resource flow
- Determining efficiency of use/conversion of resources
- Determining causes of low efficiency of use
- Developing plans for increasing the efficiency of resource use
- Checking resource use plans
- Complying to regulations/licensing requirements
- Determining benefit/cost of plans
- Ranking proposals based on benefit/cost compared to limited resources
- Checking proposals meet regulatory requirements
- Monitoring implementation
- Making adjustments to plan and implementation
- checking new resource usage

Required Knowledge

The individual needs to demonstrate knowledge of:

- Storage methods of environmentally hazardous materials
- Disposal methods of hazardous wastes
- Usage of PPE Environmental regulations
- OSHS
- Types of pollution
- Environmental pollution control measures
- Different solid wastes
- Solid waste management
- Different noise pollution
- Methods of minimizing noise pollution
- Methods of minimizing wstage
- Waste management procedures
- Economizing of resource consumption
- Principle of 3Rs
- Types of resources
- Techniques in measuring current usage of resources
- Calculating current usage of resources
- Types of workplace environmental hazards

- Environmental regulations
- Environmental regulations applying to the enterprise.
- Procedures for assessing compliance with environmental regulations.
- Collection of information on environmental and resource efficiency systems and procedures,
- Measurement and recording of current resource usage
- Analysis and recording of current purchasing strategies.
- Analysis current work processes to access information and data Analysis of data and information
- Identification of areas for improvement
- Resource consuming processes
- Determination of quantity and nature of resource consumed
- Analysis of resource flow of different parts of the resource flow process
- Use/conversion of resources
- Causes of low efficiency of use
- Increasing the efficiency of resource use
- Inspection of resource use plans
- Regulations/licensing requirements
- Determine benefit/cost for alternative resource sources
- Benefit/costs for different alternatives
- Components of proposals
- Criteria on ranking proposals
- Regulatory requirements
- Proposals for improving resource efficiency
- Implementation of resource efficiency plans
- Procedures in monitor implementation
- Adjustments of implementation plan
- Inspection of new resource usage

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Controlled environmental hazard 1.2 Controlled environmental pollution

	1.3 Demonstrated sustainable resource use 1.4 Evaluated current practices in relation to resource usage 1.5 Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns. 1.6 Described industrial standard environmental practices according to the different environmental issues/concerns. 1.7 Resolved problems/ constraints encountered based on management standard procedures 1.8 Implemented and monitored environmental practices on a periodic basis as per company guidelines 1.9 Recommended solutions for the improvement of the program 1.10 Monitored and reported to proper authorities any environmental incidents
2. Resource Implications	The following resources should be provided: 2.1 Workplace with storage facilities 2.2 Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags) 2.3 PPE, manuals and references 2.4 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection 2.5 Case studies/scenarios relating to environmental Protection
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Demonstration 3.2 Oral questioning 3.3 Written examination 3.4 Interview/Third Party Reports 3.5 Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad) 3.6 Simulations and role-play
4 Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5 Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

UNIT CODE: APB/OS/AB/BC/07/6

UNIT DESCRIPTION

This unit specifies the competencies required to lead the implementation of workplace's safety and health program, procedures and policies/guidelines.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Identify workplace hazards and risk	1.1 ***Hazards*** in the workplace and/or its ***indicators*** of its presence, are identified 1.2 ***Evaluation and/or work environment*** measurements of OSH hazards/risk existing in the workplace is conducted by Authorized personnel or agency 1.3 ***OSH issues and/or concerns*** raised by workers are Gathered
2. Identify and implement appropriate control measures	2.1 Prevention ***and control measures***, including use of s***afety gears / PPE (personal protective equipment)*** for specific hazards identified and implemented 2.2 ***Appropriate risk controls*** based on result of OSH hazard evaluation is recommended. 2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures.
3. Implement OSH programs, procedures and policies/ guidelines	3.1 Information to work team about company OSH program, procedures and policies/guidelines are provided 3.2 Implementation of OSH procedures and policies/ guidelines are participated 3.3 Team members are trained and advised on OSH standards and procedures 3.4 Procedures for maintaining ***OSH-related records*** are implemented

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
• Hazards include but are not limited to:	.1 Physical hazards – impact, illumination, pressure, noise, vibration, extreme temperature, radiation 1.1 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects 1.2 Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors 1.3 Ergonomics Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles 1.4 Physiological factors – monotony, personal relationship, work out cycle 1.5 Safety hazards (unsafe workplace condition) -confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris 1.6 Unsafe workers' act (Smoking in off-limited areas, Substance and alcohol abuse at work)
• Indicators include but are not limited to:	2.1 Increased of incidents of accidents, injuries 2.2 Increased occurrence of sickness or health complaints/ symptoms 2.3 Common complaints of workers related to OSH 2.4 High absenteeism for work-related reasons
• Evaluation and/or work environment measurements include but are not limited to:	3.1 Health Audit 3.2 Safety Audit 3.3 Work Safety and Health Evaluation 3.4 Work Environment Measurements of Physical and Chemical Hazards
• OSH issues and/or concerns include but are not limited to:	4.1 Workers' experience/observance on presence of work hazards 4.2 Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks) 4.3 Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines

• Prevention and control measures include but are not limited to:	5.1 Eliminate the hazard (i.e., get rid of the dangerous machine 5.2 Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off) 5.3 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) 5.4 Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signages, rotation/shifting work schedule) 5.5 Use engineering controls to reduce the risk (i.e. use safety guards to machine) 5.6 Use personal protective equipment 5.7 Safety, Health and Work Environment Evaluation 5.8 Periodic and/or special medical examinations of workers
• Safety gears /PPE (Personal Protective Equipment) include but are not limited to:	6.1 Arm/Hand guard, gloves 6.2 Eye protection (goggles, shield) 6.3 Hearing protection (ear muffs, ear plugs) 6.4 Hair Net/cap/bonnet 6.5 Hard hat 6.6 Face protection (mask, shield) 6.7 Apron/Gown/coverall/jump suit 6.8 Anti-static suits High-visibility reflective vest
• Appropriate risk controls	Appropriate risk controls in order of impact are as follows: 7.1 Eliminate the hazard altogether (i.e., get rid of the dangerous machine) 7.2 Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) 7.3 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) 7.4 Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage) 7.5 Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users) 7.6 Use personal protective equipment (i.e., wear gloves and goggles when using the machine)

• Contingency measures include but are not limited to:	8.1 Evacuation 8.2 Isolation 8.3 Decontamination 8.4 (Calling designed) emergency personnel
• Emergency procedures include but are not limited to:	9.1 Fire drill 9.2 Earthquake drill 9.3 Basic life support/CPR 9.4 First aid 9.5 Spillage control 9.6 Decontamination of chemical and toxic 9.7 Disaster preparedness/management 9.8 se of fire-extinguisher
• Incidents and emergencies include but are not limited to:	10.1 Chemical spills 10.2 Equipment/vehicle accidents 10.3 Explosion 10.4 Fire 10.5 Gas leak 10.6 Injury to personnel 10.7 Structural collapse 10.8 Toxic and/or flammable vapours emission.
• OSH-related Records include but are not limited to:	11.1 Science/Health records 11.2 Incident/accident reports 11.3 Sickness notifications/sick leave application 11.4 OSH-related trainings obtained

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Skills on preliminary identification of workplace hazards/risks
- Knowledge management
- Critical thinking skills
- Observation skills
- Coordinating skills
- Communication skills
- Interpersonal skills
- Troubleshooting skills

- Presentation skills
- Training skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- General OSH Principles
- Occupational hazards/risks recognition
- OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)
- National OSH regulations; company OSH policies and protocols
- Systematic gathering of OSH issues and concerns
- General OSH principles
- National OSH regulations
- Company OSH and recording protocols, procedures and policies/guidelines
- Training and/or counselling methodologies and strategies

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identifies hazards/risks in the workplace and/or its indicators 1.2 Requests for evaluation and/or work environment measurements of OSH hazards/risk in the workplace 1.3 Gathers OSH issues and/or concerns raised by workers 1.4 Identifies and implements prevention and control measures, including use of PPE (personal protective equipment) for specific hazards 1.5 Recommends appropriate risk controls based on result of OSH hazard evaluation and OSH issues gathered 1.6 Establish contingency measures, including emergency procedures in accordance with organization procedures 1.7 Provides information to work team about company OSH program, procedures and policies/guidelines 1.8 Participates in the implementation of OSH procedures and policies/guidelines 1.9 Trains and advises team members on OSH standards and procedures

	1.10 Implements procedures for maintaining OSH-related records
2. Resource Implications	The following resources should be provided: 2.1 Workplace or assessment location 2.2 OSH personal records 2.3 PPE 2.4 Health records
3. Methods of Assessment	Competency may be assessed through: 3.1 Portfolio Assessment 3.2 Interview 3.3 Case Study/Situation 3.4 Observation/Demonstration and oral questioning
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

COMMON UNITS OF COMPETENCY

PERFORM ANATOMY AND PHYSIOLOGY STUDIES

UNIT CODE: APB/OS/AB/CC/01/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to perform anatomy and physiology studies. It involves demonstrating communication in plants and animals, demonstrating nutrition in plants and animals and demonstrating transport in plants and animals. It also involves applying support and locomotion in animals, demonstrating reproduction in plants and animals and demonstrating excretion in plants and animals.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Demonstrate communication in plants and animals	1.1 ***Structure*** and function of the nervous system is determined as per anatomical procedures 1.2 Structure and function of the ***sensory organs*** are determined as per anatomical procedures 1.3 Role of ***endocrine glands*** in communication is demonstrated as per anatomical and physiological procedures 1.4 Plant growth curves are illustrated as per anatomical procedures 1.5 Plant growth is measured as per anatomical procedures 1.6 Growth zones in plants are observed and drawn as per anatomical procedures 1.7 Tropic and tactic movements are demonstrated as per physiological procedures
2 Demonstrate nutrition in plants and animals	2.1 Structure and function of the leaf is identified as per anatomical procedures 2.2 Photosynthetic process is determined as per physiological procedures 2.3 ***Factors affecting photosynthesis*** are determined as per physiological procedures 2.4 Heterotrophic types of nutrition are determined as per physiological procedures

		2.5 ***Digestive enzymes*** are demonstrated as per physiological procedures 2.6 Dissection of a laboratory animal is carried out as per anatomical procedures
3	Demonstrate transport in plants and animals	3.1 Internal structure of the root and shoot is observed under the microscope as per laboratory procedures 3.2 Uptake of water and mineral salts in plants is demonstrated as per laboratory procedures 3.3 Translocation experiments are carried out as per laboratory procedures 3.4 ***Blood cells*** are observed and identified under the microscope as per laboratory procedures 3.5 Mammalian circulatory system is demonstrated as per anatomical procedures 3.6 ***Organs and tissues of lymphatic system*** are demonstrated as per anatomical procedures 3.7 ***Structures of gaseous exchange in plants and animals*** are identified and drawn as per anatomical procedures 3.8 Dissection of a laboratory animal is carried out to demonstrate transport and gaseous exchange as per anatomical procedures
4	Apply support and locomotion in animals	4.1 ***Types of muscles*** are demonstrated as per anatomical procedures 4.2 ***Types of skeletons*** are identified as per anatomical procedures 4.3 Structure and functions of skeletons are demonstrated as per anatomical procedures 4.4 Structure and functions of ***joints*** are demonstrated as per anatomical procedures
5	Demonstrate reproduction in plants and animals	5.1 Meiosis in plants is observed under the microscope as per laboratory procedures 5.2 Dissection of a flower is carried out to identify floral parts as per laboratory procedures. 5.3 Various seeds and fruits are identified and drawn as per anatomical procedures.

	5.4 Adaptations of seeds and fruits to dispersal is demonstrated as per anatomical and physiological procedures 5.5 Reproductive system in animals is demonstrated as per laboratory procedures. 5.6 ***Birth control methods*** are identified according to medical standards 5.7 Dissection of a laboratory animal is carried out as per anatomical procedures
6 Demonstrate excretion in plants and animals	6.1 Products of excretion in plants are collected and identified as per laboratory procedures 6.2 Mammalian excretory organs are identified as per anatomical procedures 6.3 Dissection of a laboratory animal is carried out to demonstrate excretory organs as per anatomical procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Structure include but are not limited to:	• Neuron • Central Nervous System (CNS) • Peripheral Nervous System (PNS)
Sensory organs include but not limited to:	• Eye • Ear • Nose • Tongue • Skin

Endocrine glands include but not limited to:	• Pituitary gland • Hypothalamus • Pineal gland • Thyroid gland • Parathyroid gland • Pancreas • Adrenal gland • Testes • Ovaries • Thymus
Factors affecting photosynthesis include but not limited to:	• Carbon dioxide • Light • Chlorophyll
Digestive enzymes include but not limited to:	• Amylase • Renin • Pepsin • Lipase • Peptidase • Trypsin • Sucrase
Blood cells include but not limited to:	• Red blood cells • White blood cells • Platelets
Organs and tissues of lymphatic system include but not limited to:	• Thymus • Bone marrow • Spleen
Structures of gaseous exchange in plants and animals include but not limited to:	• Lungs • Gills • Stomata • Lenticels
Types of muscles include but not limited to:	• Smooth • Skeletal • Cardiac
Types of skeletons include but not limited to:	• Exoskeleton • Endoskeleton • Hydro skeleton

Joints include but not limited to:	• Ball and socket • Saddle • Hinge
Birth control methods include but not limited to:	• Natural • artificial

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Maintenance
- Communication
- Interpersonal
- Analytical
- Critical thinking
- Problem solving
- First aid
- Innovation
- Creativity

Required Knowledge

The individual needs to demonstrate knowledge of:

- Microscopy
- Cytological techniques
- Cell growth and division
- Histological techniques
- Specimen collection methods
- Storage of specimens
- Tissue processing

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated communication in plants and animals 1.2 Demonstrated nutrition in plants and animals 1.3 Demonstrated transport in plants and animals 1.4 Demonstrated types of muscles 1.5 Identified types of skeletons 1.6 Demonstrated structure and functions of skeletons and joints 1.7 Demonstrated reproduction in plants and animals 1.8 Collected and identified products of excretion in plants 1.9 Identified mammalian excretory organs 1.10 Carried out dissection of laboratory animals to demonstrate excretory organs
2 Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory facility 2.2 Science laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 PPEs
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test
4 Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5 Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY STANDARD LABORATORY PRACTICES

UNIT CODE: APB/OS/AB/CC/02/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to apply standard laboratory practices. It involves Demonstrating laboratory layout and design, maintaining laboratory safety, maintaining laboratory equipment and apparatus and preparing laboratory reagents and chemicals. It also includes maintaining laboratory hygiene, preparing laboratory water, carrying out material control, managing laboratory animals, applying laboratory management and applying glass blowing techniques.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1. Demonstrate laboratory layout and design	1.1 ***Factors*** affecting laboratory layout and design are identified as science per science laboratory requirements 1.2 ***Laboratory fittings and services*** are identified and demonstrated as per science laboratory requirements 1.3 Laboratory gas supply is demonstrated as per science laboratory requirements 1.4 ***Laboratory ventilation methods*** are demonstrated as per science laboratory requirements
2. Maintain laboratory safety	2.1 ***Sources of laboratory hazards and risks*** are identified based on laboratory safety requirements 2.2 ***Laboratory safety*** procedures are developed according to science laboratory standards 2.3 Laboratory hazards are handled in accordance with safety procedures 2.4 Laboratory chemicals and reagents are handled and stored as per standard requirements 2.5 Harmful chemicals are identified and handled according to laboratory safety requirements 2.6 Types of injuries and their treatment are identified and determined according to standard laboratory safety

		2.7 First aid procedures are reviewed and updated periodically according to safety guidelines
3.	Maintain science laboratory equipment and apparatus	3.1 ***Laboratory equipment and apparatus*** are identified based on laboratory analysis requirements 3.2 ***Preparation of laboratory ware*** is carried out based on standard manuals requirements 3.3 ***Preventive maintenance*** of laboratory equipment is undertaken according to standard procedures
4.	Prepare laboratory reagents and chemicals	4.1 ***Laboratory reagents*** are determined according to science laboratory tests and standard procedures 4.2 Methods of preparation are identified and used based on standard procedures 4.3 Personal protective equipment is selected and used as per laboratory safety requirements 4.4 Laboratory reagents and chemicals are used and stored according to manufacturer's instruction and standard requirements 4.5 Records are kept and maintained based on standard requirements
5.	Maintain laboratory hygiene	5.1 Laboratory working areas, benches and equipment are routinely decontaminated and cleaned according to set laboratory procedures 5.2 Laboratory wastes are segregated and disposed as per standard procedures 5.3 Laboratory records are kept and maintained according to standard laboratory procedures
6.	Prepare laboratory water	6.1 Water sources are identified as per science laboratory requirements 6.2 ***Methods of water treatment*** are identified as per the standard procedures 6.3 Water treatment is carried out as per the standard procedures
7.	Carry out material control	7.1 ***Types of stores*** are identified and demonstrated as per science laboratory procedures 7.2 ***Purchasing methods*** are identified as per science laboratory procedures 7.3 ***Purchasing documents*** are identified and demonstrated as per science laboratory procedures 7.4 Inventorie***s*** are identified and demonstrated as per science laboratory procedures

		7.5 Stocktaking is carried out as per science laboratory procedures 7.6 ***Laboratory store documents*** are identified and used appropriately according to science laboratory requirements
8.	Manage laboratory animals	8.1 Laboratory animals housing and caging is identified and demonstrated as per animal requirements 8.2 Handling of laboratory animals is carried out according to laboratory animal type 8.3 Sexing and breeding of laboratory animals is carried out according to laboratory animal type 8.4 ***Use of anaesthetics*** is demonstrated according pharmacological principles 8.5 ***Humane killing methods*** are demonstrated as per laboratory animal procedures 8.6 Animal carcass ***disposal methods*** are demonstrated according to science laboratory procedures
9.	Apply laboratory management	9.1 Laboratory ***management principles*** are identified according management principles 9.2 ***Functions of laboratory management*** are identified and demonstrated as per management procedures 9.3 Role of a laboratory manager is demonstrated as per science laboratory requirements
10.	Apply glass blowing techniques	10.1 ***Types of laboratory glass*** are identified as per science laboratory requirements 10.2 ***Glass blowing safety measures*** are observed as per science laboratory requirements 10.3 ***Glass blowing tools and equipment*** are identified and used as per science laboratory requirements 10.4 ***Glass apparatus*** of different sizes and shapes are produced as per science laboratory procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Factors include but not limited to:	• Available capital • Number of laboratory users • Use of the laboratory
Laboratory fittings and services include but not limited to:	Fittings • Benches • Lab stools • Sinks • Fume chamber Services • Water • Electricity • Gas
Laboratory ventilation methods include but not limited to:	• Artificial ventilation • Natural ventilation

Sources of laboratory hazards and risks include but not limited to:	• Operational hazards
	• Fire
	• Electrical hazards
	• Chemical
	  ○ Corrosiveness
	  ○ Carcinogens
	  ○ Radioactive
	  ○ Inflammable
	  ○ Fuming
	  ○ Poisons
	  ○ Explosives
	• Biological hazards
	  ○ Microbes
	  ○ Poisonous plants
	  ○ Poisonous animals

Laboratory safety
includes but not limited to:
	• Personal Protective Equipment (PPEs)
	• Proper handling
	• Proper choice of glass
	• Flame polishing
	• Acid dilution procedures
	• Laboratory rules
	• Regular checks of regulating devices, gauges and valves
	• Proper storage of chemicals
	• Precautions against naked flames
	• Firefighting materials and equipment
	• Proper handling of potentially explosive chemicals
	• Proper storage of radioactive materials
	• Proper wiring
	• Good housekeeping
	  ○ General cleanliness
	  ○ Personal cleanliness

Laboratory equipment and apparatus includes but not limited to:	• Glass slides • Test tubes • Microscope • Microtome • Centrifuge • Autoclave • Safety devices • Refrigerators • Freezers • Incubators

Preparation of laboratory ware includes but not limited to:	• Cleaning
	  ○ Physical
	  ○ Chemical
	  ○ Biological
	• Drying

Preventive maintenance includes but not limited to:	• Cleaning
	  ○ Dusting
	  ○ Wiping
	• Lubrication
	• Storage
	• Oiling and greasing

Laboratory reagents include but not limited to:	• Molar solutions • Normal solutions • Part per million • Percentage solutions • Fixatives
Methods of water treatment include but not limited to:	• Sedimentation • Filtration • Distillation • De- ionization • Reverse osmosis
Types of stores include but not limited to:	• Main stores • Central stores • Departmental stores
Purchasing methods include but n limited to:	• Centralized • Departmental
Purchasing documents include bu not limited to:	• Quotation • Catalogues • Letter of inquiry • Local purchase order • Delivery note • Invoice
Laboratory store documents include but not limited to:	• Bin cards • Location cards
Use of anaesthetics include but nc limited to:	• Local anaesthetics • General anaesthetics

Humane killing methods include but not limited to:	Chemical methods • Carbon dioxide gas • Overdose of chloroform • Overdose of di ethyl ether Physical methods • Stunning • Pithing • Beheading • Cervical dislocation • Gunshot
Disposal methods include but not limited to:	• Incineration • Burying
Management principles include b not limited to:	• Unity of command • Scalar chain • Delegation of authority • Organization structure
Functions of laboratory management include but not limited to:	• Staffing • Coordinating • Planning
Types of laboratory glass include but not limited to:	• Soda glass • Pyrex glass • Borosilicate glass
Glass blowing tools and equipme include but not limited to:	• Diamond glass cutter • Iron wire • Rimming, bordering and flaring tools • Carbon plate • Annealing oven
Glass blowing safety measures include but not limited to:	• Eye shield • Asbestos gloves • Laboratory coat
Glass apparatus includes but not limited to:	• Centre bulb tube • End bulb tube • Y shaped tube • T shaped tube

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Technical
- Maintenance
- Computer
- First aid
- Communication
- Observation
- Critical thinking
- Problem solving

Required Knowledge

The individual needs to demonstrate knowledge of:

- Laboratory ware and equipment maintenance
- Science laboratory safety
- Laboratory safety designs
- Laboratory waste disposal
- Management
- Laboratory ethical standards
- Good laboratory practices
- Record maintenance
- Laboratory hygiene
- Laboratory animals
- Laboratory layout and design
- Material control

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate 1.1 Identified factors affecting laboratory design 1.2 Identified and demonstrated laboratory fittings and services 1.3 Identified laboratory ventilation 1.4 Identified sources of laboratory hazards and risks

	1.5 Handled laboratory hazards, chemicals and reagents 1.6 Identified and determined injuries and their treatment 1.7 Identified and maintained laboratory equipment and apparatus 1.8 Prepared laboratory chemicals and reagents 1.9 Applied material control procedures 1.10 Prepared laboratory water 1.11 Maintained laboratory store documents 1.12 Managed laboratory animals 1.13 Applied laboratory management principles 1.14 Applied glassblowing techniques
2. Resource Implications	The following resources should be provided: 2.1 Well-equipped functional laboratory facility 2.2 Standard laboratory procedures manual 2.3 Laboratory ware and equipment 2.4 Laboratory reagents and chemicals 2.5 Computer 2.6 PPEs
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CARRY OUT MICROSCOPY

UNIT CODE: APB/OS/AB/CC/03/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to carry out microscopy. It involves applying types of microscopy, determining parts of a microscope, carrying out micrometry and carrying out care and maintenance of microscopes

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up **workplace function**.	**PERFORMANCE CRITERIA** These are **assessable** statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Apply types of microscopy	1.1 Bright field microscopy is identified and demonstrated as per science laboratory procedure 1.2 Dark field microscopy is demonstrated as per science laboratory procedures 1.3 Fluorescent microscopy is demonstrated as per science laboratory procedures 1.4 Electron microscopy is demonstrated as per science laboratory procedures 1.5 Digital microscope is identified and demonstrated as per science laboratory procedures
2. Determine parts of a microscope	2.1 ***Occular parts*** are identified and demonstrated as per science laboratory procedures 2.2 ***Mechanical parts*** are identified and demonstrated as per science laboratory procedures 2.3 Handling of a microscope is carried out as per science laboratory procedures
3. Carry out micrometry	3.1 Specimen preparation is carried out as per science laboratory procedures 3.2 Microscopic observation of the specimen is carried out as per science laboratory procedures 3.3 ***Micrometry*** of the prepared specimen is carried out as per science laboratory procedures

4. Carry out care and maintenance of microscopes	4.1 Microscopes are dusted and cleaned as per science laboratory requirements 4.2 Microscopes are lubricated as per science laboratory requirements 4.3 Microscopes are stored according to science laboratory requirements 4.4 Microscopes are regularly calibrated based on science laboratory standards.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variables	**Range**
Occular parts include but not limited to:	• Eye piece lenses • Objective lenses
Mechanical parts include but not limited to:	• Stage • Mechanical adjustment knobs • Coarse adjustment knobs • Fine adjustment knobs
Micrometry include but not limited to:	• Use of a graticule • Use of micrometer stage • Use of a ruler

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Organizing skills
- Interpersonal skills
- Communication skills
- Problem solving
- Critical thinking

Required Knowledge

The individual needs to demonstrate knowledge of:

- Care and maintenance of microscopes
- Parts of a microscope
- Micrometry
- Types of microscopes

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified the types of microscopes 1.2 Demonstrated the parts of a microscope 1.3 Carried out micrometry 1.4 Dusted and cleaned a microscope 1.5 Lubricated microscopes 1.6 Covered and stored microscopes 1.7 Regularly calibrated microscopes
2. Resource Implications	The following resources should be provided: 2.1 Well-equipped functional laboratory facility 2.2 Standard laboratory procedures manual 2.3 Micrometry apparatus 2.4 PPEs
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CONDUCT LABORATORY RESEARCH

UNIT CODE: APB/OS/AB/CC/04/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to conduct laboratory research**.** It involves preparing for laboratory research, carrying out laboratory research and analyzing the laboratory research findings. It also includes documenting and disseminating laboratory research findings.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1. Prepare for laboratory research	1.1 Laboratory research problem is identified based on science laboratory practices 1.2 Research objectives are developed according to research problem 1.3 Research questions are designed based on research problem 1.4 Research ***conceptual framework*** is developed in accordance with the research methodology 1.5 Research ***theoretical framework*** is established in accordance with the research methodology 1.6 Research proposal is developed
2. Carry out laboratory research	2.1 ***Scope*** is determined in accordance with research problem and research protocols 2.2 Sample size is determined based on the research methodology 2.3 ***Sampling techniques*** are determined in accordance with scope and research methodology 2.4 Research materials are identified based on scope and research methodology 2.5 Data collection is undertaken in accordance with

	research methodology
3. Analyze laboratory research findings	3.1 Standard data analytical methods are identified according to standard statistical requirements 3.2 Validity and reliability are determined in accordance to research methods 3.3 Ethical considerations are determined based on research methods utilized 3.4 Data analysis techniques are determined in accordance with data collected
4. Document the laboratory research process and findings	4.1 Process of research is documented in accordance with research protocols 4.2 Conclusions and recommendations of the study are provided based on the research findings 4.3 Research report is compiled in accordance with research protocols
5. Disseminate laboratory research	5.1 Stakeholders in science research are determined in accordance with the research purpose 5.2 Appropriate methods for dissemination are determined as per ***dissemination protocols***

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	**RANGE**
Conceptual framework includes but no limited to:	• Analytical tool • A diagram that shows causes and effects of a problem • Diagram that shows relationship between independent and dependent variables

Theoretical framework includes but no limited to:	• Structure that can hold or support a theory of a research study. • Introduces and describes the theory • Identification of theories that relate to a research problem • Context for explaining a problem

Scope includes but not limited to:	• Information or subject being analyzed
	  ○ Objectives of the research
	  ○ Time frame of the research
	  ○ Constraints of the research
	• Explanation of limitation of the research

Sampling techniques include but not limited to:	• Probability • Non-probability • Stratified • Random • Cluster • Multistage
Dissemination protocols include but nc limited to:	• Organizational procedures • Principles of dissemination • Ethical considerations in dissemination

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Analytical
- Communication
- Computer
- Creativity
- Critical
- Data collection
- Decision making
- Dissemination

- Observation
- Problem identification
- Problem solving
- Report writing
- Statistical

Required Knowledge

The individual needs to demonstrate knowledge of:

- Introduction to research
- Types of research
- Purposes of research
- Basic terms in research
- Problem identification
- Literature review
- Research design
- Data collection and analysis
- Research materials
- Research proposal
- Research report

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Prepared for science laboratory research 1.2 Determined research problem 1.3 Determined the objectives of the research 1.5 Determined the sample population 1.6 Identified research materials 1.7 Determined validity and reliability of the study 1.8 Determined data analysis techniques 1.9 Compiled the research report 1.10 Disseminated science laboratory research findings 1.11 Demonstrated understanding of science laboratory research
2 Resource Implications	The following resources should be provided: 2.1 Workstation

		2.2 Reporting tools 2.3 Stationery 2.4 Data analysis tools 2.5 PPEs
3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Observation 3.3 Written 3.4 Third party report 3.5 Case study
4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CORE UNITS OF COMPETENCY

CARRY OUT CYTOLOGICAL AND HISTOLOGICAL TECHNIQUES

UNIT CODE: APB/OS/AB/CR/01/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to carry out cytological and histological techniques. It involves applying cell biology and applying cell division and growth. It also involves carrying out specimen collection and processing tissue samples.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Apply cell biology	1.1 Plant and animal cell structure is demonstrated as per laboratory procedures 1.2 ***Solutions and apparatus*** for cell physiology are prepared according to laboratory procedures 1.3 ***Cell physiological processes*** are carried out using ***animal and plant tissues*** as per laboratory procedures
2 Apply cell division and growth	2.1 Mitosis in plants and animals is demonstrated as per laboratory manual procedures 2.2 Meiosis in animal cells is demonstrated as per laboratory manual procedures
3 Carry out specimen collection	3.1 Live and dead plant and animal specimens are collected as per laboratory procedures 3.2 Live and dead plant and animal specimens are labelled as per laboratory procedures 3.3 Storage of specimen is carried out as per laboratory procedures 3.4 ***Fresh tissue preparations*** are carried out for microscopic examination as per laboratory
4 Process tissue samples	4.1 ***Chemical fixation*** of tissues is carried out as per laboratory procedures 4.2 ***Tissue processing*** is carried out based on laboratory procedures

	4.3 ***Tissue sectioning*** is carried out as per laboratory procedures 4.4 ***Staining of sections*** is carried out as per laboratory procedures 4.5 ***Mounting of sections*** is carried out based on laboratory procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	**RANGE**
Solutions and apparatus include but are not limited to:	Solutions • Hypotonic solutions • Hypertonic solutions • Isotonic solutions Apparatus • Visking tubings • Semi permeable membrane • Glass wares • Cork borers • Rulers
Cell physiological processes include but are not limited to:	• Osmosis • Diffusion • Active transport • Phagocytosis • Pinocytosis
Animal and plant tissues include but not limited to:	• Red blood cells • Onion epidermal cells • Potato tubers
Fresh tissue preparations include but not limited to:	• Squash • Touch (impression) • Apposition • Teased preparation
Chemical fixation includes but not limited to:	• Simple fixatives • Compound fixatives

Tissue processing includes but not limited to:	• Dehydration • Clearing • Impregnation • Embedding
Tissue sectioning includes but not limited to:	• Rotary microtomes • Freezing microtomes • Floating bath • Use of adhesives

Staining of sections include but not limited to:	• Preparation of stains
	• Staining procedures
	  ○ Papanicoloau staining
	  ○ Haematoxyllin eosin

Mounting of sections includes but not limited to:	• Use of mountants
	  ○ Resinous mountants
	  ○ Aqueous mountants

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Maintenance
- Communication
- Interpersonal
- Analytical
- Critical thinking
- Problem solving
- First aid
- Innovation
- Creativity

Required Knowledge

The individual needs to demonstrate knowledge of:

- Cytological techniques
- Cell growth and division
- Histological techniques
- Specimen collection methods
- Storage of specimens
- Tissue processing

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated plants and animal cell structure 1.2 Prepared solutions and apparatus for cell physiology 1.3 Carried out cell physiological processes 1.4 Demonstrated mitosis in plants and animals 1.5 Demonstrated meiosis in animal cells 1.6 Collected and labelled and stored live and dead plant and animal specimens 1.7 Prepared fresh tissue for microscopic examination 1.8 Carried out chemical fixation of tissues 1.9 Carried out tissue processing and sectioning 1.10 Carried out staining and mounting of sections
2 Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory 2.2 Laboratory procedures manual 2.3 Histological reagents and chemicals 2.4 PPEs
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test

4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CARRY OUT MICROBIOLOGICAL TECHNIQUES

UNIT CODE: APB/OS/AB/CR/02/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to carry out microbiological techniques. It involves carrying out safety and sterilization, performing culture and bacteria identification, carrying out specimen collection, carrying out antibiotic sensitivity testing and applying food and water microbiology. It also involves applying industrial microbiology, performing mycological techniques and performing virology techniques.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Carry out safety and sterilization	1.1 Classes of laboratories are determined as per World Health Organization codes of practice 1.2 Laboratory acquired infections are determined as per laboratory procedures 1.3 Safety precautions in the laboratory are adhered to based on laboratory procedures 1.4 ***Sterilization methods*** are determined as per laboratory procedures 1.5 Sterilization is carried out as per laboratory procedures 1.6 ***Sterility indicators*** are identified as per laboratory procedures
2 Perform culture and bacteria identification	2.1 ***Bacterial growth requirements*** are determined as per laboratory procedures 2.2 ***Types of culture media*** are identified as per laboratory procedure 2.3 Media preparation is carried out as per laboratory procedures 2.4 ***Inoculation methods*** are determined as per microbiological procedures

		2.5 Inoculation is carried out based on microbiological procedures 2.6 ***Bacterial identification*** is carried out as per microbiological procedures
3	Carry out specimen collection	3.1 ***Types of specimen*** are identified as per laboratory procedures 3.2 Specimen is collected based on laboratory procedures 3.3 ***Specimen processing*** is carried out as per laboratory procedures 3.4 Microscopic examination is carried out as per laboratory procedures
4	Carry out antibiotic sensitivity testing	4.1 Classes of antibiotics are identified as per microbiological procedures 4.2 Antibiotic ***sensitivity testing techniques*** are carried out as per microbiological procedures 4.3 ***Methods of bacterial enumeration*** are determined as per microbiological procedures 4.4 Bacterial enumeration is carried out based on microbiological procedures
5	Apply food and water microbiology	5.1 Water sampling methods are identified as per microbiological procedures 5.2 Water sampling is carried out as per microbiological procedures 5.3 Causes of water pollution are identified as per laboratory procedures 5.4 Water treatment is carried out as per microbiological procedures 5.5 Sewage treatment is carried out according to microbiological procedures 5.6 Analysis of bacteria in food and water is carried out based on microbiological procedures 5.7 Food preservation methods are determined as per laboratory procedures
6	Apply industrial microbiology	6.1 Industrial micro-organisms are determined as per microbiological procedures 6.2 ***Food production processes*** are carried out as per microbiological procedures

	6.3 Bio-gas production is carried out as per microbiological procedures 6.4 ***Biodegradation*** is carried out as per laboratory procedures
7 Perform mycological techniques	7.1 Classification of fungi is determined as per laboratory procedures 7.2 Growth requirements are determined as per laboratory procedures 7.3 Culture and identification of fungi is carried out as per microbiological procedures 7.4 Mycotoxins are extracted and identified as per microbiological procedures
8 Perform virology techniques	8.1 ***Classification of viruses*** is determined as per microbiological procedures 8.2 ***Structure of viruses*** is determined as per microbiological procedures 8.3 Animal viral diseases are identified as per microbiological procedures 8.4 ***Viral diagnostic techniques*** are carried out as per microbiological procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	**RANGE**
Sterilization methods include but are not limited to:	• Dry heat • Moist heat • Radiation • Chemicals
Sterility indicators include but are not limited to:	• Autoclave tape • Brownie's tube • Biological control
Bacterial growth requirements include but are not limited to:	• Nutrition • Gaseous • Temperature

Types of culture media include but are not limited to:	• Solid • Liquid • Basal • Enriched • Selective • Differential • Transport • Storage
Inoculation methods include but are not limited to:	• Streaking • Stubbing • Pour plate • Slopes • Deep culture
Bacterial identification includes but are not limited to:	• Staining • Cultural characteristics • Biochemical tests
Types of specimen includes but are not limited to:	• Pus • Blood • Urine • Stool • Swabs
Specimen processing includes but are not limited to:	• Dilution • Culture
Sensitivity testing techniques includes but are not limited to:	• Disc diffusion • Dilution methods
Methods of bacterial enumeration include but not limited to:	• Most probable number • Tally counters
Food production processes include but not limited to:	• Yoghurt making • Beer making
Biodegradation include but not limited to:	• Biodeterioration • Bio fragmentation • Assimilation
Classification of viruses include but not limited to:	• RNA • DNA

Structure of viruses include but not limited to:	• Nucleic acid • Protein coat
Viral diagnostic techniques include but not limited to:	• Tissue culture • Cell monolayers • Microscopy

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Maintenance
- Communication
- Interpersonal
- Analytical
- Critical thinking
- Problem solving
- First aid
- Innovation
- Creativity

Required Knowledge

The individual needs to demonstrate knowledge of:

- Sterilization
- Safety
- Culture media
- Viruses
- Fungi
- Bacteria
- Water treatment
- Sewage treatment
- Fermentation
- Nucleic acids
- Antibiotics

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1	Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Carried out safety and sterilization 1.2 Performed culture and bacteria identification 1.3 Carried out specimen collection and processing 1.4 Carried out antibiotic sensitivity testing 1.5 Applied food and water microbiology 1.6 Applied industrial microbiology 1.7 Performed mycological techniques 1.8 Performed virology techniques
2	Resource Implications	The following resources should be provided: 2.1 Functional microbiology laboratory 2.2 Functional laboratory apparatus, equipment and materials 2.3 Microbiology laboratory manuals 2.4 PPEs
3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party report 3.5 Practical test
4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

PERFORM TAXONOMIC STUDIES

UNIT CODE: APB/OS/AB/CR/03/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to perform taxonomic studies. It involves applying principles of classification, carrying out kingdom monera survey, carrying out kingdom protista survey and carrying out kingdom fungi survey. It also involves carrying out kingdom animalia survey, carrying out kingdom plantae survey and carrying out construction of a dichotomous key.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Apply principles of classification	1.1 Specimens are collected as per laboratory procedures 1.2 Specimens are classified according to binomial nomenclature
2 Carry out kingdom monera survey	2.1 General characteristics of organisms are identified as per taxonomic classification system. 2.2 Sub groups of kingdom monera are identified as per taxonomic classification system. 2.3 ***Classification of kingdom monera*** is carried out based on taxonomic classification system. 2.4 Prepared slides are observed under the microscope as per laboratory procedures 2.5 ***Economic importance*** of kingdom monera is determined as per their uses
3 Carry out kingdom protista survey	3.1 General characteristics of organisms are identified as per taxonomic classification system 3.2 Sub groups of kingdom protista are identified as per taxonomic classification system 3.3 Specimens are collected, classified and identified according to taxonomic classification system. 3.4 Prepared slides are observed under the microscope as per taxonomic classification system

	3.5 Economic importance of kingdom protista is determined as per their uses.
4 Carry out kingdom fungi survey	4.1 General characteristics of organisms are identified as per taxonomic classification system 4.2 Sub groups of kingdom fungi are identified as per taxonomic classification system 4.3 Specimens are collected, classified and identified according to taxonomic classification system. 4.4 Economic importance of kingdom fungi is determined as per their uses.
5 Carry out kingdom animalia survey	5.1 General characteristics of organisms are identified as per taxonomic classification system. 5.2 Sub groups of kingdom animalia are identified as per taxonomic classification system. 5.3 Specimens are collected, classified and identified according to taxonomic classification system.
6 Carry out kingdom plantae survey	6.1 General characteristics of organisms are identified as per taxonomic procedures 6.2 Sub groups of kingdom plantae are identified as per taxonomic procedures 6.3 Specimens are collected, classified and identified according to taxonomic classification system.
7 Carry out construction of a dichotomous key	7.1 Dichotomous keys are constructed based on observable characteristics 7.2 Organisms are identified using dichotomous keys

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Classification of kingdom monera includes but not limited to:	Classified according to • Morphology • Air requirements • pH requirements • Temperature requirements • Nutrients requirements

Economic importance includes but not limited to:	• Clinical • Industrial • Food • Water

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Maintenance
- Communication
- Interpersonal
- Analytical
- Observation
- Critical thinking
- Problem solving
- First aid
- Innovation
- Creativity

Required Knowledge

The individual needs to demonstrate knowledge of:

- Microscopy
- Binomial nomenclature
- Classification systems
- Hierarchy of classification

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Collected and classified specimens 1.2 Carried out kingdom monera survey 1.3 Carried out kingdom protista survey

		1.4 Carried out kingdom fungi survey 1.5 Carried out kingdom animalia survey 1.6 Carried out kingdom plantae survey 1.7 Identified general characteristics of organisms 1.8 Determined economic importance of kingdom monera, kingdom Protista and kingdom fungi 1.9 Constructed a dichotomous key
2	Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory 2.2 Biology laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 PPEs
3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test
4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY HERBARIUM, MUSEUM, AQUARIUM AND VIVARIUM TECHNIQUES

UNIT CODE: APB/OS/AB/CR/04/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to apply herbarium, museum, aquarium and vivarium techniques. It involves carrying out herbarium techniques and carrying out museum techniques. It also involves carrying out aquarium techniques, applying aquaculture techniques and carrying out vivarium techniques.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Carry out herbarium techniques	1.1 A plant presser is constructed as per herbarium requirements 1.2 Plant specimens are collected as per herbarium requirements 1.3 Plants are pressed and dried as per herbarium procedures 1.4 Preservation and mounting of herbarium specimen are carried out according to herbarium procedures 1.5 Plant specimens are classified according to taxonomic classification system 1.6 Plant specimens are filed and maintained as per herbarium procedures
2 Carry out museum techniques	2.1 Specimen for museum work are identified as per museum procedures. 2.2 ***Museum specimens*** are collected as per museum requirements 2.3 Museum specimens are prepared as per museum requirements 2.4 ***Preservation*** of museum specimen is carried out according to museum procedures 2.5 Museum specimens are classified according to taxonomic classification system

	2.6 Museum specimens are maintained as per museum procedures
3 Carry out aquarium techniques	3.1 ***Components of an aquarium*** are identified as per aquarium requirements 3.2 An aquarium is set up as per aquarium requirements 3.3 Aquarium organisms are introduced in the aquarium as per aquarium requirements 3.4 ***Management of an aquarium*** is carried out as per aquarium requirements
4 Apply aquaculture techniques	4.1 Construction of a fish pond is carried out based on site requirements 4.2 ***Introduction of fish*** into the fish pond is carried out based on fish family 4.3 ***Fish feeding*** is carried out as per fish family requirements 4.4 Fish breeding is carried out based on fish species 4.5 Fish are harvested as per fishing requirements 4.6 Fish diseases are managed based on fish health requirements
5 Carry out vivarium techniques	5.1 Construction of vivarium is carried out based on type of organism. 5.2 Introduction of organisms is carried out based on type of vivarium. 5.3 Vivarium diseases are identified based on organism health requirements. 5.4 Management of vivarium is done based on type of vivarium.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Museum specimens includes but not limited to:	• Zoological • Botanical • Pathological • Pre-clinical

Preservation includes but not limited to:	• Fluid • Dry • Treatment after preservation
Components of an aquarium include but not limited to:	• Air pump • Substrate • Thermometer • Aquatic plants • Filter • Heater • Decoration
Management of an aquarium include but not limited to:	• Feeding of fish • Hygiene • Temperature regulation
Introduction of fish includes but not limited to:	Fingerlings are introduced by use of • Nets • Containers
Fish feeding includes but not limited to:	• Dried stuff • Live foods

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Communication
- Analytical
- Maintenance
- Problem solving
- Technical
- Critical thinking
- Observation
- Interpretation
- Measurement

Required Knowledge

The individual needs to demonstrate knowledge of:

- Aquarium techniques

- Museum techniques
- Herbarium techniques
- Aquaculture techniques
- Vivarium techniques

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Constructed a plant presser 1.2 Collected plants specimens 1.3 Pressed and dried plants 1.4 Preserved and mounted herbarium specimens 1.5 Classified, filed and maintained plant specimens 1.6 Collected, prepared, preserved, classified and maintained museum specimens 1.7 Identified components of an aquarium 1.8 Set up an aquarium and introduced organisms in the aquarium 1.9 Managed an aquarium 1.10 Constructed a fish pond and introduced fish to the pond 1.11 Carried out fish feeding and breeding 1.12 Harvested fish 1.13 Managed fish diseases 1.14 Constructed a vivarium and introduced organisms in the vivarium 1.15 Managed a vivarium
2 Resource Implications	The following resources should be provided: 2.1 Well functional biology laboratory 2.2 Workshop tools 2.3 Laboratory chemicals and reagents 2.4 Biology laboratory manuals 2.5 PPEs
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Third party report

		3.4 Observation 3.5 Practical test
4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CARRY OUT ECOLOGICAL AND SOIL STUDIES

UNIT CODE: APB/OS/AB/CR/05/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to carry out ecological and soil studies. It involves applying ecological principles, applying population ecology, carrying out aquatic studies, carrying out terrestrial studies and applying soil formation. It also involves carrying out soil science and applying environmental conservation.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Apply ecological principles	1.1 ***Abiotic and biotic factors*** are identified as per ecological principles 1.2 Abiotic and biotic factors are measured as per ecological principles 1.3 Food chains and food webs are constructed based on type of ecosystem 1.4 Ecological pyramids are constructed based on type of ecosystem
2 Apply population ecology	2.1 ***Population estimation methods*** are determined based on the type of organisms 2.2 Population size estimation is carried out based on ecological principles 2.3 ***Population dynamics*** are determined based on type of organism
3 Carry out aquatic studies	3.1 Types of ***aquatic ecosystems*** are determined based on water quality 3.2 Aquatic organisms are collected and identified based on the type of ecosystem 3.3 Adaptive features of aquatic organisms are identified based on their observable features
4 Carry out terrestrial studies	4.1 Types of ***terrestrial ecosystems*** are determined based on water quality

	4.2 Terrestrial organisms are collected and identified based on the type of ecosystem 4.3 Adaptive features of terrestrial organisms are identified based on their observable features
5 Demonstrate biogeochemical cycles	5.1 Gaseous cycles are demonstrated as per ecological procedures 5.2 Hydrological cycle is demonstrated as per ecological procedures 5.3 Nutrient cycles are demonstrated as per ecological procedures
6 Apply soil formation	6.1 ***Soil components*** are determined based on type of soil 6.2 Soil formation process is determined based on the ecological zone 6.3 ***Soil profile*** is determined based on the ecological zone 6.4 Classification of soils is carried out based on biophysiochemical properties.
7 Carry out soil science	7.1 Soil structure and texture are determined based on the soil type 7.2 Soil water, air and temperature are determined based on soil type 7.3 ***Mineral elements*** in soil are analyzed based on soil type 7.4 Soil pH and cation exchange capacity are determined based on soil type 7.5 ***Soil organisms*** are isolated and identified based on observable features 7.6 Soil organic matter is determined based on soil type
8 Apply environmental conservation	8.1 Causes of ecosystem degradation are identified based on ecosystem type 8.2 ***Methods of environmental conservation*** are identified based on degradation cause 8.3 Environment conservation exercise is carried out based on degradation cause

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Abiotic and biotic factors include but are not limited to:	• Wind • Light • Water • Temperature • Humidity • Competition • Predation
Population estimation methods include but are not limited to:	• Capture-recapture • Direct count • Line transects • Belt transects • Quadrat
Population dynamics include but are not limited to:	• Predation • Competition • Migration • Edaphic factors
Aquatic ecosystems include but not limited to:	• Marine • Brackish water • Fresh • Wet land
Terrestrial ecosystems include but not limited to:	• Forest • Grassland • Range land • Arid and semi-arid
Soil components include but not limited to:	• Air • Water • Organic matter • Minerals
Soil profile includes but not limited to:	• Top soil • Sub soil • Parent rock

Mineral elements include but not limited to:	• Major elements • Trace elements
Soil organisms include but not limited to:	• Earthworms • Protozoa • Fungi • Nematodes • arthropods
Methods of environmental conservation include but not limited to:	• Re-afforestation • Control soil erosion • Building dams • Pollution control

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills

- Communication
- Interpersonal
- Analytical
- Critical thinking
- Problem solving
- First aid
- Innovation
- Creativity

Required Knowledge

The individual needs to demonstrate knowledge of:

- Biotic and abiotic factors
- Ecosystems
- Food chains
- Food webs
- Ecological pyramids
- Population
- Succession

- Aquatic ecology
- Terrestrial ecology
- Biogeochemical cycles
- Environmental conservation
- Soil science
- Soil conservation

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified and measured abiotic and biotic factors 1.2 Constructed food chains, food webs and ecological pyramids 1.3 Determined population estimation methods and population dynamics 1.4 Carried out population size estimation 1.5 Determined types of aquatic and terrestrial ecosystems 1.6 Collected and identified adaptive features of aquatic and terrestrial organisms 1.7 Determined soil components, soil formation process and soil profile 1.8 Carried out classification of soils 1.9 Determined soil structure, texture, water, air and temperature 1.10 Analyzed mineral elements in soil 1.11 Determined soil pH and cation exchange 1.12 Isolated and identified soil organisms 1.13 Determined soil organic matter based on soil type 1.14 Identified causes of ecosystem degradation 1.15 Identified methods of environmental conservation 1.16 Carried out environment conservation exercise
2 Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory facility 2.2 Biology laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 Laboratory tools and equipment 2.5 PPEs

3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test
4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CARRY OUT ANIMAL HUSBANDRY

UNIT CODE: APB/OS/AB/CR/06/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to carry out animal husbandry. It involves carrying out housing and hygiene of laboratory animals, carrying out handling of laboratory animals and carrying out feeding of laboratory animals. It also involves demonstrating breeding of laboratory animals and carrying out anaesthesia and euthanasia.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Carry out housing and hygiene of laboratory animals	1.1 Laboratory animal structures are designed as per laboratory animal requirements 1.2 Laboratory animal structures are constructed as per laboratory procedures 1.3 Laboratory animal structures are disinfected and cleaned as per laboratory procedures 1.4 Laboratory animal diseases are identified and managed as per laboratory animal requirements
2 Carry out handling of laboratory animals	2.1 Laboratory animals are handled as per laboratory procedures 2.2 Sexing of laboratory animals is carried out per laboratory procedures 2.3 Regulations governing handling of laboratory animals are determined as per laboratory animal rearing procedures
3 Carry out feeding of laboratory animals	3.1 ***Types of animal feeds*** are identified as per laboratory animal requirements. 3.2 ***Feed presentation methods*** are demonstrated as per laboratory animal requirements 3.3 Food containers are cleaned and disinfected as per laboratory procedures
4 Demonstrate breeding of laboratory animals	4.1 Laboratory animals for breeding are identified as per animal physical characteristic

	4.2 Oestrous cycle of laboratory animals is determined as per animal physiology 4.3 Gestation period of laboratory animals is determined as per animal physiology 4.4 Litter size of laboratory animals is determined based on the laboratory animal 4.5 Population control methods are identified and carried out as per laboratory animal requirement
5 Carry out anaesthesia and euthanasia	5.1 ***Anaesthetic agents*** are applied in laboratory animals as per pharmacological principles 5.2 Dissection of laboratory animals is carried out as per laboratory procedures 5.3 ***Humane killing methods*** are determined as per laboratory procedures 5.4 Animal carcass ***disposal methods*** are demonstrated as per laboratory procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	**RANGE**
Types of animal feeds include but not limited to:	• Water • Concentrates • Fodder
Feed presentation methods include but not limited to:	• Open bowl • Bottle method
Anaesthetic agents include but not limited to:	Local • Procain • Lidocain General • Barbituarates • Sodium pentobarbital

Humane killing methods include but not limited to:	Chemical • Carbondioxide gas • Chloroform Physical • Pithing • Beheading • Stunning • Gun shot
Disposal methods include but not limited to:	• Incineration • Burying

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Communication
- Interpersonal
- Analytical
- Critical thinking
- Problem solving
- Innovation
- Creativity
- Observation

Required Knowledge

The individual needs to demonstrate knowledge of:

- Microscopy
- Cytological techniques
- Histological techniques
- Specimen collection methods
- Storage of specimens
- Animal handling techniques
- Animal pathology

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Designed and constructed laboratory animal structures 1.2 Disinfected and cleaned laboratory animal structures 1.3 Identified and managed laboratory animal diseases 1.4 Handled laboratory animals properly 1.5 Sexed laboratory animals 1.6 Identified regulations governing handling of animals 1.7 Identified types of animal feeds 1.8 Demonstrated feed presentation methods 1.9 Identified laboratory animals for breeding 1.10 Determined oestrous cycle, gestation period and litter size of laboratory animal 1.11 Identified population control methods 1.12 Applied anaesthetic agents 1.13 Carried out dissection of laboratory animals 1.14 Determined humane killing methods 1.15 Demonstrated animal carcass disposal methods
2 Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory facility 2.2 Science laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 Workshop tools 2.5 PPEs
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test
4 Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5 Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CARRY OUT PLANT HUSBANDRY

UNIT CODE: APB/OS/AB/CR/07/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to carry out plant husbandry. It involves demonstrating plant propagation, managing a greenhouse facility, managing horticultural plants and demonstrating plant pathology. It also involves demonstrating use of plant hormones, applying tissue culture and demonstrating crop yield loss.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Demonstrate plant propagation	1.1 Planting materials are screened as per plant husbandry procedures. 1.2 Seed dormancy is broken as per plant husbandry procedures. 1.3 Seeds are germinated as per plant husbandry procedures. 1.4 Conditions for seed germination are demonstrated as per plant husbandry.
2 Managing a green house facility	2.1 Types of green houses are identified based on structure, shape and materials. 2.2 Green house is constructed as per the crop to be established. 2.3 Green house is managed as per plant husbandry procedures.
3 Manage horticultural plants	3.1 ***Horticultural plants*** are identified based plant husbandry practices. 3.2 ***Management*** of horticultural crops is demonstrated as per plant husbandry practices
4 Demonstrate plant pathology	4.1 Symptoms of ***plant fungal diseases*** are identified as per MoALF production manual. 4.2 Plant fungal diseases are controlled as per MoALF production manual

	4.3 Symptoms of ***plant bacterial diseases*** are identified as per MoALF production manual. 4.4 Plant bacterial diseases are controlled as per MoALF production manual 4.5 Symptoms of ***plant viral diseases*** are identified as per MoALF production manual. 4.6 Plant viral diseases are controlled as per MoALF production manual 4.7 Symptoms of plant nematode diseases are identified as per MoALF production manual. 4.8 Plant nematode diseases are controlled as per MoALF production manual
5 Demonstrate use of plant growth substances	5.1 ***Plant growth substances*** are identified as per plant husbandry practices. 5.2 Plant growth substances are applied as per plant husbandry practices.
6 Apply tissue culture	6.1 ***Tissue culture types*** are identified based on part of plant involved. 6.2 Tissue culture process are carried out based on standard tissue culture practices
7 Demonstrate crop yield loss	7.1 Causes of yield loss in crops are identified as per MoALF production manual 7.2 ***Methods of assessing yield loss*** in crops are determined as per MoALF production manual

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	**RANGE**
Horticultural plants include but are not limited to:	• Vegetable crops • Mushrooms • Fruits • flowers

Management include but are not limited to:	• Nursery establishment • Planting • Weeding • Pest & disease control • Watering • Harvesting • Post-harvesting
Plant fungal diseases include but are not limited to:	• Blight • Rust • Anthracnose • Smut • Gall • Mildew • Damping off • Wilt • mould
Plant bacterial diseases include but are not limited to:	• Bacterial wilt
Plant viral diseases include but are not limited to:	• Mosaic
Plant growth substances include but are not limited to:	• Auxins • Gibberellins • Cytokinin • Ethylene • Abscisic acid
Tissue culture types include but are not limited to:	• Seed • Embryo • Callus • Organ • Protoplast
Methods of assessing yield loss include but are not limited to:	• Experimental • Statistical

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Maintenance
- Communication
- Interpersonal
- Analytical
- Critical thinking
- Problem solving
- Innovation
- Creativity
- Observation

Required Knowledge

The individual needs to demonstrate knowledge of:

- Microscopy
- Cytological techniques
- Cell growth and division
- Histological techniques
- Specimen collection methods
- Storage of specimens
- Plant pathology

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Screened planting materials 1.2 Broke seed dormancy 1.3 Germinated seeds 1.4 Demonstrated conditions for seed germination 1.5 Identified types of green houses 1.6 Constructed a green house 1.7 Managed a green house

		1.8 Managed horticultural plants 1.9 Identified symptoms of plant fungal diseases, plant bacterial diseases, plant viral diseases and nematodes 1.10 Controlled symptoms of plant fungal diseases, plant bacterial diseases, plant viral diseases and nematodes 1.11 Demonstrated use of plant growth substances 1.12 Identified types of tissue culture 1.13 Carried out tissue culture process 1.14 Identified causes of yield loss in crops 1.15 Determined methods of assessing yield loss in crops
2	Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory facility 2.2 Laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 Workshop tools and equipment 2.5 PPEs
3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test
4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY ENTOMOLOGICAL TECHNIQUES

UNIT CODE: APB/OS/AB/CR/08/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to apply entomological techniques. It involves determining classification of insects, demonstrating anatomy and physiology of insects, and determining insect ecology. It also involves carrying out rearing of insects, demonstrating pest control and management and determining control of arthropod vectors

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Determine classification of insects	1.1 Classification of insects is carried out as per entomological procedures
2 Demonstrate anatomy and physiology of insects	2.1 External features of insects are identified and drawn as per anatomical procedures 2.2 ***Systems*** in insects are drawn as per physiological procedures 2.3 ***Life cycles*** of insects are determined as per entomological procedures
3 Determine insect ecology	3.1 ***Adaptations*** of insects is demonstrated based on the insect 3.2 Intrinsic rate of insects is determined as per entomological procedures 3.3 ***Methods of collecting insects*** are identified based on entomological procedures
4 Carry out rearing of insects	4.1 Insect cages are constructed based on the insects to be reared 4.2 ***Insects*** are reared as per entomological procedures 4.3 Insectary is managed as per entomological procedures
5 Demonstrate pest control and management	5.1 Insect pests are identified as per entomological procedures 5.2 ***Methods of pest control*** are determined as per entomological procedures

6 Determine control of arthropod vectors	6.1 Arthropod vectors are identified as per parasitological procedures 6.2 Transmission methods are identified as per parasitological procedures 6.3 Methods of control of arthropod vectors are determined as per parasitological procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Systems include but are not limited to:	• Digestive • Gaseous exchange • Endocrine
Life cycles include but are not limited to:	• Complete metamorphosis • Partial metamorphosis • Incomplete metamorphosis
Adaptations include but are not limited to:	• Anatomical • physiological
Methods of collecting insects include but are not limited to:	• Light traps • Sweep nets • Pit fall traps • Pheromones
Insects include but not limited to:	• Locust • Fruit fly
Methods of pest control include but not limited to:	• Cultural • Biological • Physical • Chemical • Integrated Pest Management (IPM)

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Maintenance
- Communication
- Interpersonal
- Analytical
- Critical thinking
- First aid
- Innovation
- Creativity

Required Knowledge

The individual needs to demonstrate knowledge of:

- Microscopy
- Cytological techniques
- Histological techniques
- Insect collection methods
- Storage of insects
- Rearing of insects
- Pest control and management

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Carried out classification of insects 1.2 Identified and drew external features and systems of insects 1.3 Determined life cycles of insects 1.4 Demonstrated adaptations of insects 1.5 Demonstrated intrinsic rate of insects 1.6 Identified methods of collecting insects 1.7 Constructed insect cages 1.8 Reared insects

	1.9 Managed insectary 1.10 Demonstrated pest control and management 1.11 Identified arthropod vectors 1.12 Identified transmission methods 1.13 Determined control methods of arthropod vectors
2 Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory facility 2.2 Science laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 Workshop tools and equipment 2.5 PPEs
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test
4 Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5 Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CARRY OUT PARASITOLOGICAL TECHNIQUES

UNIT CODE: APB/OS/AB/CR/09/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to carry out parasitological techniques. It involves carrying out protozoology and carrying out helminthology.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Carry out protozoology	1.1 ***Classification of protozoa*** is carried as per taxonomic principles 1.2 Life cycles of protozoans and pathological effects is determined as per parasitological procedures 1.3 Specimen are collected and observed under the microscope as per laboratory procedures. 1.4 Laboratory diagnosis of ***protozoan diseases*** is carried out as per laboratory procedures 1.5 Prevention and control measures of protozoan are carried out as per parasitological procedures
2 Carry out helminthology	2.1 ***Classification of helminthes*** is carried as per taxonomic principles 2.2 Life cycles of ***helminthes*** and pathological effects is determined as per parasitological procedures 2.3 Specimen are collected and observed as per laboratory procedures. 2.4 Laboratory diagnosis of helminthes is carried out as per laboratory procedures 2.5 Prevention and control measures are carried out as per parasitological procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Classification of protozoa include but are not limited to:	• Ciliate • Flagellates/mastigophore • Sarcodina • Sporozoa
Protozoan diseases include but are not limited to:	• Coccidiosis • Trypanasomiasis • Leishmaniasis • Malaria • *Toxoplasma gondii* • *Trichomonas vaginalis*
Classification of helminthes include but are not limited to:	• Cestodes • Trematodes • Nematodes
Helminthes include but are not limited to:	• *Ascaris lumbricoides* • Hook worms • *Wuchereria bancrofti* • *Taenia spp* • *Fasciola hepatica* • *Schistosoma spp*

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Communication
- Analytical
- Critical thinking
- Problem solving
- First aid
- Innovation

- Creativity
- Observation

Required Knowledge

The individual needs to demonstrate knowledge of:

- Microscopy
- Cytological techniques
- Histological techniques
- Specimen collection methods
- Storage of specimens
- Protozoan diseases
- Taxonomy

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1	Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Carried out classification of protozoa and helminthes 1.2 Determined life cycles of protozoans, helminthes and pathological effects 1.3 Collected and observed specimens under the microscope 1.4 Carried out laboratory diagnosis of protozoan diseases and helminthes 1.5 Carried out prevention and control measures of protozoan diseases
2	Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory 2.2 laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 PPEs
3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test

4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

PERFORM IMMUNOLOGICAL TECHNIQUES

UNIT CODE: APB/OS/AB/CR/10/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to perform immunological techniques. It involves demonstrating immunological tissues and cells and determining immunological reactions. It also involves carrying out immunodiagnostic methods and applying immunization procedures.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Demonstrate immunological tissues and cells	1.1 ***Immune cells and tissues*** are observed under the microscope as per laboratory procedures 1.2 Immune cells and tissues are identified as per laboratory procedure
2 Determine immunological reactions	2.1 ***Immunoglobulins are classified*** as per laboratory procedures. 2.2 Serial dilution is carried out as per laboratory procedures 2.3 Compliment fixation test is carried out as per immunological procedures 2.4 Hypersensitivity reactions are identified and demonstrated as per immunological procedures
3 Carry out immunodiagnostic methods	*3.1* ***Immunodiagnostic techniques*** are carried out as per immunological procedures. *3.2* ***Immune disorders*** are identified as per immunological procedures.
4 Apply immunization procedures	4.1 ***Vaccine types*** are identified as per WHO guidelines. 4.2 Immunization schedules are demonstrated as per WHO guidelines

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Immune cells and tissues include but are not limited to:	• Lymphoid tissues • Thymus • Spleen • Bone marrow • Lymph nodes
Immunoglobulins are classified include but are not limited to:	• Ig M • Ig G • Ig D • Ig A • Ig E
Immunodiagnostic techniques include but are not limited to:	• Agglutination • Precipitation • Immunodiffusion • Cell diffusion • Immune electrophoresis • Complement fixation test
Immune disorders include but are not limited to:	• Auto immune • Hypersensitivity • Immunosuppression
Vaccine types include but are not limited to:	• Live attenuated • Inactivated • Subunit • Toxoid • Conjugate • Recombinant vector • DNA

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Communication
- Interpersonal
- Analytical

- Critical thinking
- Problem solving
- Innovation
- Creativity
- Observation

Required Knowledge

The individual needs to demonstrate knowledge of:

- Microscopy
- Cytological techniques
- Histological techniques
- Specimen collection methods
- Storage of specimens
- Immune cells & tissues
- Antigen-antibody reactions
- Immunodiagnostic techniques
- Vaccines

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Observed and identified immune cells and tissues 1.2 Classified immunoglobulins 1.3 Carried out serial dilution 1.4 Carried out compliment fixation test 1.5 Identified and demonstrated hypersensitivity reactions 1.6 Carried out immunodiagnostic techniques 1.7 Identified immune disorders 1.8 Identified vaccine types 1.9 Demonstrated immunization schedules
2 Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory 2.2 Science laboratory procedures manual

		2.3 Laboratory reagents and chemicals 2.4 PPEs
3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test
4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY BIOCHEMICAL TECHNIQUES

UNIT CODE: APB/OS/AB/CR/11/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to apply biochemical techniques. It involves determining classification of bio-molecules and carrying out separation and qualitative analysis of bio-molecules. It also involves determining metabolism of bio-molecules and applying enzymology.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Determine classification of bio-molecules	1.1 ***Classification of bio-molecules*** is carried out as per international scientific standards 1.2 ***Types of biomolecules*** is determined as per international scientific standards.
2 Carry out separation and qualitative analysis of bio-molecules	2.1 ***Separation of biomolecules*** is carried out based on laboratory procedures. 2.2 ***Qualitative analysis of biomolecules*** is carried out as per international scientific standards.
3 Determine metabolism of bio-molecules	3.1 Carbohydrates metabolism is determined as per laboratory procedures. 3.2 Proteins metabolism is determined as per laboratory procedures 3.3 Lipids metabolism is determined as per laboratory procedures
4 Apply enzymology	4.1 ***Models on mechanism of enzyme action*** are demonstrated as per laboratory procedures. 4.2 ***Factors affecting enzyme action*** is demonstrated as per laboratory procedures.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Classification of bio-molecules include but are not limited to:	• Macro biomolecules Micro biomolecules
Types of biomolecules include but are not limited to:	• Carbohydrates • Lipids • Proteins • Nucleic acids
Separation of biomolecules include but are not limited to:	• Chromatography • electrophoresis
Qualitative analysis includes but is not limited to:	• Reducing sugars/Benedict's test • Iodine test • Translucent test • Biurets test
Models on mechanism of enzyme action include but are not limited to:	• Lock and key • Induced fit
Factors affecting enzyme action include but are not limited to:	• Temperature • pH • Enzyme concentration • Substrate concentration

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Communication
- Interpersonal
- Analytical
- Critical thinking

- Problem solving
- Creativity
- Observation

Required Knowledge

The individual needs to demonstrate knowledge of:

- Cytological techniques
- Histological techniques
- Specimen collection methods
- Storage of specimens
- Biology
- Chemistry
- Mathematics

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Carried out classification of bio-molecules 1.2 Determined types of biomolecules 1.3 Carried out separation of biomolecules 1.4 Carried out qualitative analysis of biomolecules 1.5 Determined carbohydrates, proteins and lipids metabolism 1.6 Demonstrated models on mechanism of enzyme action 1.7 Demonstrated factors affecting enzyme action
2 Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory facility 2.2 Science laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 PPEs
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test

4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

PERFORM PHARMACOLOGICAL AND TOXICOLOGICAL TECHNIQUES

UNIT CODE: APB/OS/AB/CR/12/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to perform pharmacological and toxicological techniques. It involves determining classification of drugs, applying pharmacodynamics and demonstrating chemotherapeutic agents. It also involves applying phamarcokinetic, carrying out extraction of toxins and carrying out toxicity testing.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the **key outcomes** which make up workplace function (to be stated in active)	**PERFORMANCE CRITERIA** These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice) ***Bold and italicized terms are elaborated in the Range***
1 Determine classification of drugs	1.1 Drugs are classified as per Pharmacy and Poisons Board (PPB) regulations. 1.2 ***Classes of drugs*** are identified based on their mechanisms of action
2 Apply pharmacodynamics	2.1 Drugs are administered in animals as per pharmacological procedures. 2.2 Drugs are administered in an organ as per pharmacological procedures. 2.3 Effects of drugs are observed as per laboratory procedures.
3 Demonstrate chemotherapeutic agents	3.1 ***Classes of chemotherapeutic agents*** are identified as pharmacological procedures. 3.2 Mode of action of chemotherapeutic agents is identified as per pharmacological procedures. 3.3 Testing of chemotherapeutic agents is carried out as per laboratory procedures
4 Apply pharmacokinetics	4.1 Methods of drug absorption are identified as pharmacological procedures 4.2 Drug metabolism and excretion is demonstrated as per pharmacological procedures 4.3 Levels of drug in the body of laboratory animals is determined as per laboratory procedures.

5 Carry out extraction of toxins	5.1 Plant and animal samples are collected as per laboratory procedures. 5.2 Toxins are extracted from the samples as per laboratory procedures. 5.3 Toxins are isolated and identified as per laboratory procedures.
6 Carry out toxicity testing	6.1 Toxicity tests are carried out as per laboratory procedures 6.2 Half-life of toxic substances is determined as per laboratory procedures.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Classes of drugs include but are not limited to:	• Chemical basis • Disease condition • Organ system • Generation • Agonist and antagonist receptor
Classes of chemotherapeutic agents	• Antibiotics • Anti-fungals • Anti-protozoans • Anti helminthes • Anti-virals

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skill

- Communication
- Interpersonal
- Analytical

- Critical thinking
- Problem solving
- First aid
- Innovation
- Observation
- manipulative

Required Knowledge

The individual needs to demonstrate knowledge of:

- Classification of drugs
- Extraction techniques
- Cell structure
- Pharmacology
- Toxicology
- Chemistry
- Mathematics

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Classified and identified classes of drugs 1.2 Administered drugs in animals and in an organ 1.3 Observed effects of drugs 1.4 Identified classes of chemotherapeutic agents 1.5 Identified mode of action of chemotherapeutic agents 1.6 Carried out testing of chemotherapeutic agents 1.7 Identified methods of drug absorption 1.8 Demonstrated drug metabolism and excretion 1.9 Determined levels of drug in the body of laboratory animals 1.10 Collected plant and animal samples 1.11 Extracted toxins from the samples 1.12 Isolated and identified toxins 1.13 Carried out toxicity tests 1.14 Determined half-life of toxic substances
2 Resource Implications	The following resources should be provided: 2.1 Well-equipped biology laboratory

		2.2 Science laboratory procedures manual 2.3 Laboratory reagents and chemicals 2.4 PPEs
3	Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral 3.2 Written 3.3 Observation 3.4 Third party 3.5 Practical test
4	Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.