

**REPUBLIC OF KENYA**

**MINISTRY OF LABOUR AND SOCIAL PROTECTION**

**STATE DEPARTMENT FOR LABOUR AND SKILS DEVELOPMENT**

**NATIONAL OCCUPATIONAL STANDARD**

**FOR**

**APPLIED BIOLOGIST LEVEL 6**

**OCCUPATIONAL STANDARD CODE: 0511 554A**

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# PREFACE

Kenya 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. The State Department for labour and Skills Development is mandated, under executive order No. 1 of 2023, to oversee skills and development among actors; establish sector specific skills councils; and establish and manage the institutional framework for linking industry, skills development, and training. It is in this context that the department has established NSSACs to entrench the sectoral approach to skills development in Kenya.

Among the functions of the NSSACs is to develop NOS to ensure skills development is aligned to demands of the labour market. To ensure uniformity in the development of NOS in Kenya, the State Department of Labour and Skills Development has developed the guidelines for Development of National Occupational Standard in Kenya.

It is in this context the Ministry of Labour and Social Protection spearheaded development of Applied Biologist Level 6 National Occupational Standard (NOS) to inform development of market driven curriculum and assessment frameworks.

This Occupational Standard is designed and organized with clear performance criteria for each element of a unit of competency. This standard also outlines the required knowledge and skills as well as evidence guide.

It is my believe that this occupational standard will form an important reference document for all stakeholders involved in training, assessment and certification of Applied Biologist Level 6 in Kenya.

**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 the 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. These reforms resulted to the formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No.14 of 2012). 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, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

The reforms also demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. This Occupational Standards will thus inform the development of Competency-Based Education and Training (CBET) curriculum for Applied Biology level 6. This Occupational Standards will also be the basis for the assessment of an individual for competency certification.

It is my conviction that this Occupational Standard will play a great role in the development of a competent human resource for sustainable growth and development.

# ACKNOWLEDGMENT

This Occupational Standard was developed through combined effort of various stakeholders from private and public organizations. My appreciation goes to the multi-sectoral working group who spearheaded the Applied Biologist Level 6 National Occupational Standard.

**TABLE OF CONTENTS**

# ACRONYMS

|  |  |
| --- | --- |
| CNS | Central Nervous system |
| DNA | Deoxyribonucleic acid |
| ELISA | Enzyme Linked Immunosorbent Assay |
| GLP | Good Laboratory Practice |
| GCLP | Good Clinical Laboratory Practice |
| OSH | Occupational Safety and Health |
| PNS | Peripheral Nervous System |
| RNA | Ribonucleic Acid |
| TVETA | Technical and Vocational Education and Training Authority |

**KEY TO UNIT CODE**

**Sector / Industry**

**Sub Sector**

**Occupational Area**

**Version Control**

**Unit of Competence Number**

**ISCED level, Programme Orientation and Level of Completion**

xx

x

xxx

x

xx

x

# OCCUPATIONAL STANDARD OVERVIEW

Applied Biology Technologist Level 6 Occupational Standard consists of competencies that a person must achieve to enable him or her to effectively work in the industry. The core competencies include performing techniques in microbiology, parasitology, entomology, ecology, pharmacology, toxicology, histology, cytology and immunology. The technologist shall also acquire competencies in performing museum, herbarium, aquarium, and vivarium techniques as well as conducting biochemical analysis. Lastly, the technologist is expected to carry out laboratory animal husbandry and plant husbandry.

The units of competency include four basic units, six common units, and ten core units.

# SUMMARY OF UNITS OF COMPETENCY

|  |  |
| --- | --- |
| **BASIC UNITS OF COMPETENCY** | |
| **UNIT CODE** | **UNIT TITLE** |
| 0611 551 01A | Apply digital literacy |
| 0031 541 02A | Apply communication skills |
| 0417 541 03A | Apply work ethics and practices |
| 0413 541 04A | Apply entrepreneurial skills |
| **COMMON UNITS OF COMPETENCY** | |
| 0511 551 05A | Apply Genetics Principles |
| 0511 551 06A | Apply Taxonomical Concepts |
| 0541 551 07A | Apply Mathematics in Applied Biology |
| 0511 551 08A | Apply Animal Anatomy and Physiology Concepts |
| 0588 5511 09A | Conduct Scientific Research |
| 0511 5511 10A | Apply Laboratory Practice Principles |
| **CORE UNITS OF COMPETENCY** | |
| 0912 551 11A | Conduct Histological and Cytological Techniques |
| 0511 551 12A | Perform Microbiological Techniques |
| 0511 551 13A | Perform Parasitological and Entomological techniques |
| 0511 551 14A | Perform Ecological Techniques |
| 0512 551 15A | Perform Pharmacological and Toxicological Techniques |
| 0912 551 16A | Perform Immunological Techniques |
| 0511 551 17A | Conduct Biochemical Analysis |
| 0511 551 18A | Perform Museum, Herbarium, Aquarium and Vivarium Techniques |
| 0511 551 19A | Carry out Laboratory Animal husbandry |
| 0511 551 20A | Carry out Plant Husbandry |

**BASIC UNITS OF COMPETENCY**

APPLY DIGITAL LITERACY

**UNIT CODE: 0611 541 01A**

**UNIT DESCRIPTION:**

This unit covers the competencies required to demonstrate digital literacy. It involves operating computer devices, solving tasks using the Office suite, accessing online/offline data and information, performing online communication and collaboration, applying cybersecurity skills and performing jobs online. It also involves applying job entry techniques.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace functions | **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. Operate computer devices | * 1. **C*omputer device*** usage is determined as per workplace requirements.   2. ***Computer hardware*** is identified according to job requirements.   3. ***Computer software***is identified according to workplace requirements.   4. Computer devices are turned on or off as per the correct workplace procedure.   5. ***Mouse techniques*** are applied in solving tasks as per workplace requirements.   6. Keyboardtechniques are applied in solving tasks as per workplace requirements.   7. Computer files and folders are created and managed as per workplace requirements.   8. ***Internet connection option*s** are identified and applied in connecting computer devices to the Internet.   9. ***External devices*** are identified and connected to the computer devices as per the job requirement. |
| 1. Solve tasks using Office suite | 1. ***Word processing concepts***are applied in solving workplace tasks as per job requirements. 2. Worksheet data is entered and prepared in accordance with work procedures. 3. Worksheet data is built and edited in accordance with workplace procedures on a worksheet is undertaken in accordance with work. 4. ***Data manipulation*** requirements. 5. Worksheets are saved and printed in accordance with job requirements. 6. ***Electronic presentation concepts***are applied in solving workplace tasks as per job requirements. |
| 1. Manage data and information | * 1. Office ***internet services*** are identified and applied in accordance with office procedures.   2. ***Internet access applications*** are determined in accordance with office operation procedures.   3. Internet search is performed as per job requirements.   4. Online digital content is downloaded in accordance with workplace requirements.   5. Digital content is identified and backed up in accordance with workplace procedures. |
| 1. Perform online communication and collaboration | * 1. Netiquette principles are observed as per work requirements.   2. Electronic mail communication is executed in accordance with workplace policy.   3. Digital content copyright and licenses are identified and applied according to workplace policies and regulatory requirements.   4. ***Online* *collaboration tools*** are applied in accordance with workplace policies and regulatory requirements. |
| 1. Apply cybersecurity skills | * 1. ***Data protection* and *privacy***is classified in accordance with workplace policies and regulatory requirements.   2. ***Internet security threats*** are identified as per workplace policies and regulatory requirements.   3. Computer threats and crimes are detected in accordance to Information Management security guidelines   4. ***Cybersecurity control measures*** are applied in accordance with workplace policies and regulatory requirements. |
| 1. Perform online jobs | * 1. ***Online job platforms*** are identified as per the job requirements.   2. Online accounts and profiles are created in accordance with the work requirements.   3. Online jobs are identified according to the bidder’s skillset.   4. Online digital identity is managed according to industry best practices.   5. Online job bidding is done as per the specific job requirements.   6. Online tasks are executed according to the job requirements.   7. Personal online payment account is managed in accordance with financial regulations. |
| 1. Apply job entry techniques | * 1. ***Job******opportunities***are sought based on competencies.   2. A winning resume/CV is developed as per job advertisement.   3. An application/cover letter is developed based on the job advertisement.   4. *C****ertificates and testimonials*** are organized as per resume.   5. ***Interview skills*** are demonstrated as per job advertisement. |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Computer devices may include but are not limited to: | * Desktops * Laptops * Smartphones * Tablets * Smartwatches |
| 1. Computer hardware may include but are not limited to: | * The System Unit E.g., Motherboard, CPU, casing, * Input Devices e.g., Pointing, keying, scanning, voice/speech recognition, direct data capture devices. * Output Devices e.g., hardcopy output and softcopy output * Storage Devices e.g., main memory e.g., RAM, secondary storage (Solid state devices, Hard Drives, CDs & DVDs, Memory cards, Flash drives * Computer Ports e.g., HDMI, DVI, VGA, USB type C etc. |
| 1. Computer software may include but are not limited to: | * System software e.g., Operating System (Windows, Macintosh, Linux, Android, iOS) * Application Software e.g., Word Processors, Spreadsheets, Presentations etc. * Utility Software e.g., Antivirus programs |
| 1. External devices may include but are not limited to: | * Printers * Projectors * Smart Boards * Speakers * External storage drives * Digital/Smart TVs |
| 1. Word processing concepts may include but are not limited to: | * Creating word documents * Editing word documents * Formatting word documents * Saving word documents * Printing word documents |
| 1. Mouse techniques may include but are not limited to: | * Clicking * Double-clicking * Right-clicking * Drag and drop |
| 1. Internet connection options may include but are not limited to: | * Mobile Networks/Data Plans * Wireless Hotspots * Cabled (Ethernet/Fiber) * Dial-Up * Satellite * ISDN (Integrated Services Digital Network) |
| 1. Data manipulation may include but are not limited to: | * Use of formulae * Use of functions * Sorting * Filtering * Visual representation using charts |
| 1. Electronic presentation concepts may include but are not limited to: | * Creating slides * Editing slides * Formatting slides * Applying slide effects and transitions * Creating and playing slideshows * Saving presentations * Printing slides and handouts |
| 1. Internet services may include but are not limited to: | * Communication Services * Information Retrieval Services * File Transfer * World Wide Web Services * Web Services * Directory Services * Automatic Network Address Configuration * Newsgroup * Ecommerce |
| 1. Internet access applications/software may include but are not limited to: | * Browsers * Email Apps * eCommerce Apps |
| 1. Online collaboration tools may include but are not limited to: | * Online Storage * Online productivity applications * Online meetings, * Online learning environments, * Online calendars * Social networks |
| 1. Data protection and privacy may include but not limited to: | * Confidentiality of data/information * Integrity of data/information * Availability of data/information |
| 1. Internet security threats may include but not limited to: | * Malware attacks * Social engineering attacks * Software supply chain attacks * Advanced persistent threats (APT) * Distributed denial of service (DDoS) * Man-in-the-middle attack (MitM) * Password attacks * IoT Attacks * [Phishing Attacks](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#phishing-attacks) * [Ransomware](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#ransomware) |
| 1. Security threats control measures may include but not limited to: | * Counter measures against cyber terrorism * Physical Controls * Technical/Logical Controls * Operational Controls |
| 1. Online job platforms may include but are not limited to: | * Remo task * Data annotation. tech * cloud worker * Upwork * Oneforma * Appen |
| 1. Job opportunities may include but not limited to: | * Self-employment * Service provision * product development * salaried employment |
| 1. Certificates and testimonialsmay include but not limited to: | * Academic credentials * Letters of previous employments/ services rendered * Letters of commendation * Certifications of participation * Awards |
| 1. Interview skills may include but not limited to: | * Listening skills * Grooming * Language command * Articulation of issues * Body language * Time management * Honesty * Generally knowledgeable in current affairs and technical area |

**REQUIRED KNOWLEDGE AND SKILLS**

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

Required knowledge

The individual needs to demonstrate knowledge of:

* Computer Hardware and Software Concepts
* Computer Security Concepts (Data security and privacy)
* Cyber security threats and control measures
* Understanding Computer Crimes
* Detection and protection against computer crimes
* Laws governing protection of ICT in Kenya
* Digital Identity Management
* Netiquette Principles
* Fundamentals of Copyright and Licenses
* Word processing;
* Functions and concepts of word processing;
* Documents and tables creation and manipulations;
* Document editing;
* Document formatting;
* Word processing utilities
* Spreadsheets;
* Meaning, types and importance of spreadsheets;
* Components of spreadsheets;
* Functions, formulae, and charts, uses and layout;
* Data formulation, manipulation and application to cells;
* Editing & formatting spreadsheets;
* Presentation Packages;
* Types of presentation Packages.
* Creating, formulating, running, editing, printing and presenting slides and handouts
* Networking and Internet;
* Internet connectivity.
* Browser and digital content management;
* Managing data, information, and digital content
* Electronic mail and World Wide Web
* Fundamentals of Online Working;
* Online Profile Management;
* e-Portfolio Management;
* Online Jobs Bidding;
* Online Payment Systems;
* Job entry techniques
* Job searching sites
* Interview preparation skills
* Interview handling

**Required skills**

The individual needs to demonstrate the following skills:

* Active listening
* Keyboard Skills
* Mouse Skills
* Analytical skills
* Creativity
* Interpretation Skills
* Communication
* Spreadsheet operations (applying fundamental operations such as addition, subtraction, division and multiplication)
* Computer Use Safety Skills
* Document Editing Skills
* Document Formatting Skills
* Document Printing Skills
* Netiquette Skills
* Internet Browsing Skills
* Problem Solving Skills
* Online Collaboration Skills
* Cybersecurity Skills
* CV writing
* grooming

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | ***Assessment requires evidence that the candidate:***   * 1. Operated computer devices as per workplace policies and regulations.   2. Solved tasks using the office suite as per workplace policies and regulations.   3. Manage data and information as per workplace policies and regulations.   4. Performed online communication and collaboration as per workplace policies and regulations.   5. Applied cybersecurity skills in accordance with workplace policies and regulations.   6. Executed online tasks according to the job requirements.   7. Searched for job opportunity based on competencies.   8. Prepared job requirement documentations based on job opportunity.   9. Demonstrated interview skills based on the job opportunity. |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant work environments where assessment can take place.   3. Resources relevant to the proposed activities or task. |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party report   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of assessment | Competency may be assessed:   * 1. Workplace or simulated workplace. |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# APPLY COMMUNICATION SKILLS

**UNIT CODE: 0031 541 02A**

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate communication skills. It involves applying communication channels, written, non-verbal, oral, and group communication skills.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements that specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| --- | --- |
| 1. Apply communication channels | 1. Specific communication channels are identified and applied based on workplace requirements. 2. Challenges are identified and addressed as per the operational standards of the organization. 3. Communication channels are evaluated to meet workplace needs. |
| 1. Apply written communication skills | * 1. Types of written communication are identified and applied according to the workplace requirements.   2. Written communication needs are identified and implemented according to workplace procedures.   3. Written communication guidelines are analyzed, evaluated, and revised based on workplace needs. |
| 1. Apply non-verbal communication skills | 3.1 Existing non-verbal communication techniques are identified and applied based on organization policy.  3.2 Non-verbal communication techniques are articulated and modeled to enhance inclusivity according to workplace requirements. |
| 1. Apply oral communication skills | 4.1 Types of oral communication are identified and established as per organization policy.  4.2 Pathways of oral communication are identified and established as per organization policy.  4.3 Pathways of oral communication are reviewed according to organization procedures.  4.4 Pathways of oral communication are maintained according to the organization standards. |
| 1. Apply group communication skills | 1. Group communication strategies are appliedbased on the workplace needs. 2. Groups are organized in accordance with workplace procedures. 3. Effective questioning, listening and non-verbal communication techniques are used as per needs.   5.4 Group communication challenges are identified and addressed according to the workplace needs. |

RANGE

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

| Variable | Range |
| --- | --- |
| 1. Communication strategies may include but are not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrasing * Clarification request * Translation * Restructuring * Generalization |
| 1. Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a non-judgmental 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 |
| 1. Situations may include but are not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans |

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:

* Active listening
* Interpretation
* Negotiation
* Writing
* Oral skills
* Creative thinking
* Critical thinking
* Decision making
* Analytical
* Innovation
* Conflict skills
* Leadership
* Problem solving skills
* Management
* Organizational
* Teamwork

Required Knowledge

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups
* Styles of group leadership
* Key elements of communications strategy
* Principles of effective communication
* Turn-taking techniques
* Conflict resolution techniques
* Work planning
* Work organization
* Company policies
* Company operations and procedure standards
* Fundamental rights at the workplace
* Personal hygiene
* Accountability
* Workplace problems and how to deal with them

EVIDENCE GUIDE

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Identified and applied specific communication channels based on workplace requirements.   2. Identified and applied specific written communication correspondence according to the workplace requirements.   3. Applied and developed non-verbal strategies to communicate in all areas of the workplace requirements.   4. Established pathways of oral communication as per workplace policy.   5. Applied group communication strategies based on workplace needs. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place. 2. Appropriately simulated environment where assessment can take place. 3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party report   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY WORK ETHICS AND PRACTICES

**UNIT CODE: 0417 541 03A**

**UNIT DESCRIPTION**

This unit covers competencies required to effectively apply work ethics and practices. It involves the ability to: conduct self-management, promote ethical work practices and values, promote teamwork, manage workplace conflicts, maintain professional and personal development, apply problem-solving and promote customer care.

**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 Range*** |
| --- | --- |
| 1. Apply self-management skills | 1. Personal vision, mission and goals are formulated based on potential and concerning organization objectives and strategic plan 2. Self-esteem and a positive self-image are developed and maintained based on value 3. Emotional intelligence and stress management are demonstrated as per workplace requirements. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for one's actions are demonstrated based on workplace instructions. 6. Time management, attendance and punctuality are observed as per the organization’s policy. 7. Personal goals are managed as per the organization’s objective 8. Self-strengths and weaknesses are identified based on personal objectives 9. Motivation, initiative and proactivity are utilized as per the organization policy 10. Individual performance is evaluated and monitored according to the agreed targets. |
| 1. Promote ethical work practices and values | 1. Integrity is demonstrated as per acceptable norms 2. Codes of conduct is applied as per the workplace requirements 3. Policies and guidelines are observed as per the workplace requirements 4. Professionalism is exercised in line with organizational policies |
| 1. Promote Team work | 3.1 ***Teams*** are formed to enhance productivity based on organization’s objectives  3.2 Duties are assigned to teams under the organization policy.  3.3 Team activities are managed and coordinated as per set objectives.  3.4 Team performance is evaluated based on set targets as per workplace policy.  3.5 ***Conflicts*** are resolved between team members in line with organization policy.  3.6 Gender and diversity-related issues are identified and mainstreamed in accordance with workplace policy.  3.7 Healthy ***relationships*** are developed and maintained in line with the workplace.  3.8 Adaptability and flexibility are applied in dealing with team members as per workplace policies |
| 1. Maintain professional and personal development | 4.1 ***Personal growth and development*** needs are identified and assessed in line with the requirements of the job.  *4.2* ***Training and career opportunities*** are identified and utilized based on job requirements.  4.3 ***Resources*** for training are mobilized and allocated based on organizations and individual skills needs.  4.4 Licenses and certifications relevant to the job and career are obtained and renewed as per policy.  4.5 Recognitions are sought as proof of career advancement in line with professional requirements.  4.6 Work priorities and personal commitments are balanced and managed based on the requirements of the job and personal objectives.  4.7 Dynamism and on-the-job learning are embraced in line with the organization’s goals and objectives. |
| 1. Apply Problem solving skills | 5.1 ***Creative, innovative*** and practical solutions are developed based on the problem  5.2 Independence and initiative in identifying and solving problems are demonstrated based on the requirements of the job.  5.3 Team problems are solved as per the workplace guidelines  5.4 Problem-solving strategies are applied as per the workplace guidelines  5.5 Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 1. Promote Customer Care | 6.1 Customers' needs are identified based on their characteristics  6.2 Customer ***feedbac****k* is allowed and facilitated in line with organization policies.  6.3 Customer concerns and complaints are analyzed and resolved in line with the set organizational culture.  6.4 Proactive customer outreach programs are implemented as per organizational policies  6.5 Customer retention strategies are developed and implemented in line with the organizational policy |

**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 |
| --- | --- |
| 1. Feedback may include but not limited to: | * Verbal * Written * Informal * Formal |
| 1. Conflicts include but are not limited to: | * Interpersonal Conflict. * Intrapersonal Conflict. * Intergroup Conflict. * Intragroup Conflict. |
| 1. Relationships may include but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| 1. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group * Virtual teams |
| 1. Personal growth may include 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 |
| 1. Personal objectives may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. Trainings and career opportunities may include but not limited to | * Participation in training programs * Serving as Resource Persons in conferences and workshops * Capacity building |
| 1. Resource may include may but not limited to: | * Human * Financial * Technology |
| 1. Creative and innovative may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| 1. Emerging issues may include but not limited to: | * Artificial Intelligence * Data confidentiality * National cohesion * Open offices |

**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:

* Active listening
* Critical thinking
* Organizational
* Negotiation
* Monitoring
* Evaluation
* Problem solving
* Decision Making
* Leadership
* Creative/innovative thinking
* Adaptability
* Conflict management
* Emotional intelligence
* Teamwork

Required Knowledge

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies and procedures
* Company operations, procedures and standards
* Flexibility and adaptability
* Concept of time and leisure time
* Decision making
* Work planning
* Organizing work
* Monitoring and evaluation
* Record keeping
* Gender and diversity mainstreaming
* Drug and substance abuse
* Professional growth and development
* creativity
* Innovation
* problem solving
* customer care
* mentoring and coaching.
* Emerging 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 require evidence that the candidate:   * 1. Applied self-management skills as per organizational procedures.   2. Promoted ethical practices and values as per organizational procedures.   3. Promoted Teamwork as per workplace assignments.   4. Maintained professional and personal development as per organizational procedures.   5. Applied Problem-solving skills based on work requirements.   6. Identified customer needs based on their characteristics.   7. Gave back Customer feedback in line with organization policies. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place. 3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY ENTREPRENEURIAL SKILLS

**UNIT CODE : 0413 541 04A**

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate an understanding of entrepreneurship. It involves demonstrating an understanding of financial literacy, applying entrepreneurial concepts identifying entrepreneurship opportunities, applying business legal aspects, developing business innovative strategies, and developing business plans.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements that specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in Range*** |
| --- | --- |
| 1. Apply Financial Literacy Skills | 1. Sources of personal and business *funds* are identified as per financial procedures and standards 2. Personal finances are managed as per financial procedures and standards 3. Savings are managed as per financial procedures and standards 4. Debts are managed as per financial procedures and standards 5. Investments are undertaken as per financial procedures and standards 6. Insurance services are procured as per financial procedures and standards |
| 1. Apply entrepreneurial concept | 1. Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 3. Ways of becoming an entrepreneur are identified as per principles of Entrepreneurship 4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 5. Salaried employment and self-employment are distinguished as per principles of entrepreneurship 6. ***Requirements for entry into self-employment*** are identified according to business procedures and standards 7. Roles of an Entrepreneur in an enterprise are determined according to business procedures and standards 8. Contributions of entrepreneurship to National development are identified as per business procedures and standards |
| 1. Identify entrepreneurial opportunities | 1. Business ideas are identified as per business procedures and standards 2. Factors to consider when evaluating business opportunity viability are explored based on business procedure and standards 3. Entrepreneurial opportunities are evaluated as per business procedures and standards 4. Business ideas and opportunities are generated as per business procedures and standards 5. Business life cycle is analysed as per business procedures and standards |
| 1. Apply business legal aspects | 1. ***Forms of business ownership*** are identified as per legal procedures and practices 2. Business Registration and Licensing processes are identified as per legal procedures and practices 3. Types of Contracts and Agreements are analysed as per legal procedures and practices 4. Employment Laws are identified as per legal procedures and practices 5. Taxation laws are identified as per legal procedures and practices |
| 1. Innovate Business strategies | 1. Business innovation strategies are determined by the organization standards 2. Creativity in business development is demonstrated in accordance with business standards 3. ***Innovative business standards*** are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Business idea is described as per business procedures and standards 2. Business description is developed as per business plan format 3. Marketing plan is developed as per business plan format 4. Organizational/Management plan is prepared in accordance with business plan format 5. Production/operation plan is prepared in accordance with business plan format 6. Financial plan is prepared in accordance with the business plan format 7. Executive summary is prepared in accordance with business plan format 8. Business plan is presented as per best practice 9. Business ideas are incubated as per institutional policy. |

**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** |
| --- | --- |
| 1. Sources of personal funds may include but not limited to: | * Salary/Wages * Investments * Savings * Inheritance * Government Benefits |
| 1. Sources of business finance may include but not limited to: | * Equity Financing * Debt Financing, * Personal Savings/Investment * Retained Earnings * Grants and Subsidies * Crowdfunding * supplier Credit: * Leasing and Asset Financing: |
| 1. Types of entrepreneurs may include but not limited to: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| 1. Characteristics of Entrepreneurs may include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| 1. Requirements for entry into self-employment may include but not limited to | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| 1. Forms of businesses ownership may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. Innovative business standards may include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |

**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
* Management
* Problem-solving
* Root-cause analysis
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care standards
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Government and regulatory processes
* Local and international market trends
* Product promotion standards
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Relevant developments in other industries
* Regional/ County business expansion standards

**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. Identified Sources of personal and business finance as per financial procedures and standards 2. Managed Personal finances as per financial procedures and standards 3. Made Investment decisions as per financial procedures and standards 4. GeneratedBusiness ideas and opportunities based on business procedure and standards 5. Analysed business life cycle based on business procedure and standards 6. Determined business innovative standards as per business principles 7. Developed and presented a business plan as per regulatory framework. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   1. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON UNITS OF COMPETENCY

# APPLY GENETICS PRINCIPLES

**UNIT CODE: 0511 551 05A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to apply genetics principles. It involves applying cell division concepts, applying knowledge on structure of nucleic acids, applying Mendelian law of inheritance, applying protein synthesis knowledge and carrying out animal and plant breeding.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |  |
| --- | --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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 Cell division concepts | 1.1 Experiments on phenotypic variations are carried out as per Mendelian laws of inheritance  1.2 Experiments on mitosis are performed as per cytogenetic procedures  1.3 Experiments on meiosis are performed as per cytogenetic procedures | |
| 2. Apply knowledge on Structure of nucleic acids | 2.1 Chromosome structure concept is applied as per cytogenetic procedures  2.2 DNA structure and function concepts are applied as per molecular biology techniques  2.3 RNA structure and function concepts are applied as per molecular biology techniques  2.4 Mutation concepts is applied as per genetic principles  . | |
| 3. Apply Mendelian law of inheritance | 3.1 Genetic Inheritance concepts is applied as per Mendel’s law of inheritance  3.2 Allele Dominance concepts are applied as per Mendel’s Law of Inheritance  3.3 ***Inheritance disorders*** ***and diseases*** are identified as per genetic principles | |
| 4. Apply Protein synthesis knowledge | 4.1 DNA replication principles are applied as per genetic principles  4.2 DNA transcription principles are applied as per genetic principles  4.3 DNA translation principles are applied as per genetic principles | |
| 5.Carry out Animal and plant breeding | | 5.1 Animal and plant breeding materials are assembled as per work requirement  5.2 Animals and plants are bred as per work requirements  5.3 Animal and plant breeding results are reported as per Good Laboratory Practice |

**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** |
| 1. Inheritance disorders and diseases include but not limited to: | * Sickle cell anaemia * Albinism * Down’s syndrome * Klinefelter’s syndrome * Turner’s Syndrome * Erythroblastis foetalis |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy
* Animal Anatomy and physiology

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving
* Digital literacy
* Communication
* Critical thinking
* Interpersonal
* First aid
* Photography
* Report writing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Performed experiments on mitosis as per cytogenetic procedures   2. Performed experiments on meiosis as per cytogenetic procedures   3. Applied DNA structure and function concepts as per molecular biology techniques   4. Applied RNA structure and function concepts as per molecular biology techniques   5. Applied Genetic Inheritance concepts as per Mendel’s law of inheritance   6. Applied DNA replication principles as per genetic principles   7. Applied DNA transcription principles as per genetic principles   8. Applied DNA translation principles as per genetic principles   9. Bred animals and plants as per work requirements |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   2.3 Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Projects   3. Oral assessment   4. Portfolio of evidence   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## APPLY TAXONOMICAL CONCEPTS

**UNIT CODE: 0511 551 06A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to apply taxonomical concepts. It involves applying principles of classification, carrying out kingdom Monera survey, carrying out kingdom Protoctista survey, carrying out kingdom fungi survey, carrying out kingdom plantae survey, carrying out kingdom animalia survey, and constructing dichotomous key

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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 principles of classification | 1.1 Collection instruments are selected as per specimen requirements.  1.2 Living organisms are collected as per laboratory manual   * 1. Specimen is classified according to taxonomy manual |
| 2.Carry out kingdom monera   survey | * 1. General characteristics of kingdom Monera are identified as per taxonomic classification system.   2. Kingdom Monera organisms are classified based on taxonomic classification system.   3. kingdom Monera samples are examined as per good laboratory practices   4. Kingdom Monera ***economic importance*** knowledge is applied as per taxonomy manual. |
| 3.Carry out kingdom Protoctista   survey | * 1. General characteristics of kingdom Protoctista are identified as per taxonomic classification system.   2. Protists are classified based on taxonomic classification system.   3. Protists samples are examined as per good laboratory practices   4. Protistseconomic importance knowledge is applied as per taxonomy manual. |
| 4. Carry out kingdom Fungi   survey | * 1. General characteristics of kingdom Fungi are identified as per taxonomic classification system.   2. Fungi are classified based on taxonomic classification system.   3. Fungal samples are examined as per good laboratory practices   4. Fungi economic importance knowledge is applied as per taxonomy manual. |
| 5.Carry out kingdom Plantae   survey | 5.1 General characteristics of organisms are identified as per taxonomic procedures  5.2Plant specimens are collected and classified according to taxonomic classification system.  5.3 Plants economic importance knowledge is applied as per botanical procedures |
| 6.Carry out kingdom Animalia survey | * 1. General characteristics of organisms are identified as per taxonomic classification system.   2. Sub groups of kingdoms animalia are identified as per taxonomic classification system.   3. Specimens are collected, classified and identified according to taxonomic classification system.   4. Economic importance of kingdom Animalia is determined as per their uses |
| 7.Construct dichotomous key | 7.1 Characteristics of living organism is identified as per laboratory manual procedures  7.2 Dichotomous key is constructed as per laboratory manual procedures  7.3 Steps in dichotomous key is identified as per laboratory manual procedures   * 1. Specimen is identified in the dichotomous key as per laboratory manual procedures |

**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** |
| Economic importance includes but not limited to: | * Diseases * Ecological relationships * Food * Industrial |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Plant Anatomy
* Animal Anatomy

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving
* Digital literacy
* Communication
* Critical thinking
* Interpersonal
* First aid
* Photography
* Report writing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| * + - 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Classified specimen according to binomial nomenclature   2. Classified Kingdom Monera organisms based on taxonomic classification system.   3. Applied Kingdom monera economic importance knowledge as per taxonomy manual.   4. Protists are classified based on taxonomic classification system.   5. Applied Protistseconomic importance knowledge as per taxonomy manual.   6. Classified Fungi based on taxonomic classification system   7. Applied Fungi economic importance knowledge as per taxonomy manual.   8. Collected and classified plant specimens according to taxonomic classification system.   9. Applied plants economic importance knowledge as per botanical procedures   10. Collected, classified and identified Specimens according to taxonomic classification system.   11. Determinedeconomic importance of kingdom Animalia as per their uses   12. Constructed dichotomous key as per laboratory manual procedures |
| * + - 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| * + - 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Project   3. Oral assessment   4. Portfolio of evidence   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## APPLY MATHEMATICS FOR SCIENCE

**UNIT CODE: 0541 551 07A**

**UNIT DESCRIPTION**

This unit describes the competencies required by a Applied Biology Technologist in order to apply mathematics for science. It involves applying: basic arithmetic operation; algebraic equation and expression; linear and non-linear graphs; indices and logarithm; binomial expansion; matrices; vectors; trigonometry; calculus; sequence and series and statistics.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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 basic arithmetic operation | 1.1 Addition and subtraction is performed as per arithmetic operation rules  1.2 Multiplication and division is applied as per arithmetic operation rules  1.3 Rational and irrational numbers are evaluated as per algebraic rules  1.4 Ratios, ***proportions*** and percentages is applied as per algebraic rules |
| 2. Apply algebraic equation and expression | 2.1 Linear equations are solved as per the concept  2.2 Simultaneous equations are solved as per the ***simultaneous method***  2.3 Formulation of a formula is applied as per the concept  2.4 quadratic equation is solved as per the ***quadratic methods*** |
| 3. Apply linear and non-linear graphs | 3.1 Linear and nonlinear graph is plotted as per the graphical methods  3.2 Reduction of non-linear to linear graphs is performed as per the concept  3.3 Graph is interpreted as per the concept formulate Graphical solution |
| 4. Apply indices and logarithms | 4.1 Indices are operated as per the concept  4.2 ***Logarithm*** is defined as per the concept  4.3 Change of base of logarithms is performed as per  logarithmic concept  4.4 Logarithmic and exponential graph is plotted as per logarithmic concept |
| 5. Apply binomial expansions | 5.1. Roots of numbers are determined using binomial theorem  5.2. ***Errors*** of small changes are determined using binomial theorem  5.3. Permutation and combination are applied using binomial theorem |
| 6.Apply matrices | 6.1 Determinant and inverse of 2x2 matrix is determined as per the concept.  6.2 Simultaneous equations are solved as per matrix concept  6.3 Eigenvalues and Eigenvectors are determined as per matrix concepts |
| 7. Apply vectors | 7.1 Vectors and scalar quantities are obtained in two dimensions  7.2 ***Operations*** on vectors are performed as per vector concept  7.3 Position of vectors are obtained as per vector concept  7.4 Vector is resolved as per vector concept |
| 8. Apply trigonometry | 8.1 ***Trigonometric ratios*** are applied as per trigonometric rules.  8.2 Angles of elevation and depression are determined as per trigonometric rules.  8.3 Angles are determined as per compound angle formula  8.4 Sine and cosine waves are interpreted as per trigonometric rules. |
| 9.Apply Calculus | 9.1 Rate of change is determined as per ***differentiation rules.***  9.2 ***Stationary points*** of functions are determined as per differentiation rules.  9.3 Integrals of algebraic functions are determined as per ***integration rules***  9.5 Integrals of logarithmic functions are determined as per integration rules |
| 10. Apply sequences and series | 10.1 Arithmetic means and nth term of an arithmetic sequence is determined as per the concept  10.2 Sum of terms of a given ***arithmetic series*** are determined as per the concept  10.3 A geometric sequence is differentiated according to arithmetic sequence  10.4 A finite geometric sequence is differentiated according to finite geometric sequence  10.5 Geometric means and nth terms of a geometric sequence is determined as per geometric sequence concept  10.6 Sum of finite and infinite geometric sequence is determined as per geometric sequence concept |
| 11.Apply statistics methods | 11.1 ***Raw data*** is collected as per job requirement  11.2 ***processing of raw data*** is carried out as per job requirement  Interpretation of data is performed as per job requirement  11.3 ***Data presentation*** is performed as per job requirement |

**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. Proportions include but not limited to: | * Direct proportion * Inverse proportion |
| 1. Simultaneous method includes but not limited to: | * Elimination method * Substitution * Graphical method |
| 1. Quadratic methods include but not limited to: | * Factorization * Completing Square Method * Quadratic formula |
| 1. Logarithms include but not limited to: | * Operation * Conversions * Graph plotting |
| 1. Errors may include but not limited to: | * Absolute * Relative * Percentage |
| 1. Trigonometric rules include but not limited to: | * Sine rule * Cosine rule * Double angle formula |
| 1. Binomial theorem includes but not limited to: | * Pascal triangle |
| 1. Differentiation include but not limited to: | * First principles * High order functions * Differential equations * Inverse differentiation |
| 1. Differentiation rules include but not limited to: | * Product rule * Chain rule * Quotient rule |
| 1. Stationary points include but not limited to: | * Maxima * Minima * Point of inflection |
| 1. Integration include but not limited to: | * Constant of integration * Integral notation * Indefinite and definite integrals |
| 1. Methods of integration include but not limited to: | * Standard form * Substitution * Integration by parts |
| 1. Currency table include but not limited to: | * Selling price * Buying price |
| 1. Series include but not limited to: | * Arithmetic Progression * Geometric Progression |
| 1. Raw data include but not limited to: | * Grouped data * Ungrouped data |
| 1. Processing of raw data include but not limited to: | * Mean * Mode * Median * Range * Quartile * Standard deviation * Variance |
| 1. Data presentation include but not limited to: | * Pictograms * Histograms * Pie charts * Bar charts * Frequency polygon |
| 1. Order of matrix include but not limited to: | * Singular * Non-singular * Identity * Echelon |
| 1. Matrix operation include but not limited to: | * Compatibility * Addition/subtraction * Multiplication * Multiplication by scalar |

**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 and applying mathematical formulas
* Logical thinking
* Problem solving
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Fundamental operations (addition, subtraction, division, multiplication)
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Rounding techniques
* Types of fractions
* Types of tables and graphs
* Presentation of data in tables and graphs
* Vector operations
* Matrix operations
* Data presentation

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied Ratios, proportions and percentages as per algebraic rules   2. Interpreted graph as per formulated graphical solution   3. Plotted logarithmic and exponential graph as per logarithmic concept   4. Solved Simultaneous equations as per matrix concept   5. Performed operations on vectors as per vector concept   6. Determined angles of elevation and depression as per trigonometric concept   7. Determined rate of change as per differentiation concept   8. Differentiated finite geometric sequence as per finite geometric sequence   9. Determined sum of terms of geometric sequence as per the geometric sequence concept   1.10 Interpreted data as per work requirement  1.11 Presented data as per job requirement |
| 1. Resource Implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant work environment.   3. Resources relevant to the proposed activities or tasks. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical Assessment   2. Project-Based Assessment   3. Portfolio of Evidence   4. Written Assessment |
| 1. Context of Assessment | Competency may be assessed in a workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ANATOMY AND PHYSIOLOGY CONCEPTS

**UNIT CODE: 0511 551 08A**

**UNIT DESCRIPTION**

This unit of competence specifies the competences required to apply animal anatomy and physiology. It involves analyzing communication in plants and animals, applying nutrition in plants and animal’s concepts, applying transport in plants and animal’s concepts, analyzing support and locomotion in animals, analyzing reproduction in plants and animals, applying excretion in plants and animal’s concepts, applying gaseous exchange concepts in plants and animals.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Analyze communication in plants and animals | * 1. Experiments on Structure and function of the ***nervous* system** is performed as per anatomical procedures   2. Experiment to determine Structure and function of the ***sensory organs*** is carried out as per anatomical procedures   3. Experiment on role of ***endocrine glands*** in communication is performed as per Anatomy laboratory procedures   4. Plant growth experiment is performed as per Anatomy laboratory procedures   5. Tropic, tactic and nastic movements experiments are carried out as per physiological procedures.   6. Nervous system diseases and disordersknowledge is applied as per pathological procedures |
| 2.Apply nutrition in plants and animal’s concepts | * 1. Plant nutrition experimentis performed as per physiological procedures   2. Digestive enzymes experiment is carried out as per physiological process   3. Laboratory animal is dissected as per anatomy laboratory procedures   4. Digestive system diseases and disordersknowledge is applied as per pathological procedures |
| 3.Apply transport in plants and animals | * 1. Experiment on internal structures of the root and shoot are performed as per botany laboratory procedures   2. Plants water and mineral salts uptake Experiment is carried out as per botany laboratory procedures   3. Translocation experiments are carried out as per botany laboratory procedures   4. Mammalian circulatory system concepts is applied as per Anatomy laboratory procedures   5. Circulatory system diseases and disordersknowledge is applied as per pathological procedures |
| 4.Analyze support and locomotion in animals | * 1. Muscles experiment is performed as per anatomy laboratory procedures   2. Types and structure of skeletons are identified as per anatomy procedures   3. Structure and function of joints are identified as per anatomy procedures   4. Skeletal system diseases and disordersknowledge is applied as per pathological procedures   5. Muscular system diseases and disordersknowledge is applied as per pathological procedures |
| 5.Analyze reproduction in plants and animals | * 1. Plants meiosis is examined as per botany laboratory procedures   2. Flower is dissected as per botany laboratory procedures.   3. Seeds and fruits are identified as per botany laboratory procedures.   4. Animals’ reproductive system concepts are applied as per Anatomy laboratory procedures.   5. Pollination is carried out as per Mendelian theory   6. Reproductive system diseases and disordersknowledge is applied as per pathological procedures |
| 6.Apply excretion in plants and animals’ concepts | * 1. ***Plants excretory products*** are collected and identified as per botany laboratory procedures   2. Mammalian excretory organs are identified as per Anatomy laboratory procedures   3. ***Animal excretory products*** are analyzed as per Anatomy laboratory procedures   4. Excretory system diseases and disordersknowledge is applied as per pathology procedures |
| 7.Apply gaseous exchange concept in plants and animals | * 1. Gaseous exchange structures are identified according to Anatomy and Botany laboratory procedures   2. Experiment of gaseous exchange in plants are performed as per Botany laboratory procedures   3. Experiment of gaseous exchange in animals are performed as per Anatomy laboratory procedures   4. Respiratory system diseases and disordersknowledge is applied as per pathology procedures |

**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** |
| * + - 1. Nervous system includes but not limited to: | * Neuron * Central Nervous System (CNS) * Peripheral Nervous System (PNS) |
| * + - 1. Endocrine glands include but not limited to: | * Pituitary gland * Hypothalamus * Pineal gland * Thyroid gland * Parathyroid gland * Pancreas * Adrenal gland * Testes * Ovaries * Thymus |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy
* Animal pathology
* Genetics

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving
* Digital literacy
* Communication
* Interpersonal
* First aid
* Photography
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | * 1. Determined experiment determine Structure and function of the sensory organs is carried out as per anatomical procedures   2. Performed experiment on role of endocrine glands in communication as per Anatomy laboratory procedures   3. Performed plant growth experiment as per Anatomy laboratory procedures   4. Performed plant nutrition experiment as per physiological procedures   5. Digestive enzymes experiment is carried out as per physiological process   6. Dissected laboratory animal as per anatomy laboratory procedures   7. Applied mammalian circulatory system concepts as per Anatomy laboratory procedures   8. Performed experiment on internal structures of the root and shoot as per botany laboratory procedures   9. Identified Types and structure of skeletons as per anatomy procedures   10. Identified Structure and function of joints as per anatomy procedures   11. Identified Seeds and fruits are as per botany laboratory procedures.   12. Applied Animals reproductive system concepts as per Anatomy laboratory procedures.   13. Identified Mammalian excretory organs as per Anatomy laboratory procedures   14. Identified gaseous exchange structures according to Anatomy and Botany laboratory procedures   15. Performed experiment of gaseous exchange in plants as per Botany laboratory procedures   16. Performed experiment of gaseous exchange in animals as Anatomy laboratory procedures |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Portfolio of evidence   3. Oral assessment   4. Third party report   5. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## CONDUCT SCIENTIFIC RESEARCH

**UNIT CODE: 0542 551 09A**

**UNIT DESCRIPTION**

This unit specifies the competencies required to conduct scientific research**.** It involves preparing scientific research proposal, carrying out laboratory research and analyzing the laboratory research findings.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Prepare scientific research proposal | * 1. Scientific research problem is identified based on existing research gap   2. Research objectives are developed according to research problem   3. Research questions or hypothesis are designed based on research objectives   4. Research concept note is developed as per standard research procedures   5. Scientific research proposal is developed as per standard research procedures |
| 2.Apply scientific research methods | * 1. ***Scientific study design*** is determined in accordance with research procedures.   2. Sample size is determined based on statistical formulae.   3. ***Sampling techniques*** are determined in accordance with scope and research methodology   4. Research materials are identified based on scope and research methodology   5. Data is collected in accordance with research methodology |
| Analyze scientific research findings | * 1. ***Data analysis tools*** are assembled as per research proposal   2. Data analysis is performed based on research proposal   3. Research report is prepared and disseminated as per scientific research procedure. |

**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** |
| * + - 1. Scientific study design includes but not limited to: | * Descriptive * Analytic |
| * + - 1. Sampling techniques include but not limited to: | * Probability * Non-probability |
| 1. Data analysis tools include but not limited to: | * Microsoft excels * Python * Statistical package for social sciences (SPSS) * Statistical analysis System (SAS) |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy
* Animal anatomy and physiology
* Animal pathology

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving
* Digital literacy
* Communication
* Interpersonal
* First aid
* Photography
* Report writing
* Presentation
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Identified scientific research problem based on existing research gap   2. Developed research concept note as per standard research procedures   3. Developed scientific research proposal as per standard research procedures |
| 2. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   2.3 Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Projects   2. Portfolio of evidence   3. Oral assessment   4. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## APPLY LABORATORY PRACTICE PRINCIPLES

**UNIT CODE: 0511 551 10A**

**UNIT DESCRIPTION**

This unit of competency provides competencies required by a science laboratory technologist to apply laboratory and management practices. The practices include maintaining laboratory safety, managing laboratory personnel and material resources, preparing laboratory water and managing laboratory waste.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Maintain laboratory safety | * 1. Laboratory safety rules are applied as per good laboratory practices   2. Laboratory risk assessment is carried out as per Occupational Safety and Health (OSH) guidelines   3. ***Laboratory*** ***hazards*** are handled in line with laboratory safety procedures   4. ***Laboratory Injuries*** are handled according to laboratory first aid procedures   5. First aid procedures are reviewed as per laboratory safety guidelines |
| 2.Process laboratory water | * 1. Water sources are identified as per laboratory requirement   2. ***Water processing*** is carried out in line with organisational laboratory manual   3. Laboratory water is stored according to organisational laboratory manual |
| 3.Manage laboratory personnel and material resource | 3.1 Principles of laboratory management are applied as per laboratory management procedures  3.2 Laboratory manager qualities are applied based on good laboratory practices  3.3 Laboratory inventories are maintained as per laboratory management procedures  3.4 ***Laboratory equipment maintenance*** is carried out as per manufacturer’s instruction |
| 4.Manage laboratory waste | 4.1 ***Laboratory wastes*** are segregated according to laboratory procedures  4.2 Laboratory working areas are decontaminated and cleaned as per laboratory procedures  4.3 Laboratory waste is disposed as per laboratory procedures |

**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** |
| * + - 1. Laboratory hazards may include but not limited to: | * + Chemical   + Biological   + Physical   + Electrical   + Fire |
| 2.Laboratory Injuries include but not limited to: | * Cuts * Bleeding * Bites * Burns * Bruises * Fractures |
| 3.Water processing include but not limited to: | * Distillation * Deionization * Filtration * Sedimentation * Reverse osmosis * Adsorption |
| 5.Laboratory equipment maintenance include but not limited to: | * Calibration * Validation * Preventive maintenance |
| 6.Laboratory wastes include but not limited to: | * Organic wastes * Inorganic waste |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Microscopy
* Taxonomy
* Animal anatomy and physiology
* Animal pathology

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving skills
* Digital literacy
* Communication
* Interpersonal
* First aid
* Photography
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Handled laboratory hazards in line with laboratory safety procedures   2. Handled injuries according to laboratory first aid procedures   3. Carried out water treatment in line with organisational laboratory manual   4. Applied principles of laboratory management as per science laboratory standards   5. Maintained laboratory inventories as per science laboratory guidelines |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Portfolio of evidence   3. Oral assessment   4. Third party report   5. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

# CORE UNITS OF COMPETENCY

**CONDUCT CYTOLOGICAL AND HISTOLOGICAL TECHNIQUES**

**UNIT CODE: 0511 551 11A**

**UNIT DESCRIPTION:** This unit describes the competencies required by an applied biology technologist to conduct cytological and histological techniques. It involves carrying out care and maintenance of microscope, performing cytological and Histological techniques

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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. Carry out care and maintenance of microscope | * 1. Ocular parts and surfaces are cleaned as per manufacturer’s specifications   2. Movable parts are lubricated as per manufacturer’s specification   3. Measurement parts are calibrated as per manufacturer’s standards   4. Microscope is positioned and stored as per manufacturer’s specifications |
| 2.Perform cytological technique | 1. Cytological specimens are collected as per cytological laboratory procedures 2. ***Cytological specimen*** isprocessed as per cytology laboratory manual procedures 3. Cytological specimens are examined as per cytology laboratory practical manual. 4. Results are reported as per work requirement |
| 3.Perform Histological technique | 3.1 Histological specimens are collected as per histology laboratory manual.  3.2 Histological specimen is processed as per histology laboratory manual.  3.3 Histological specimens are examined as per histology laboratory manual.  3.4 Results are reported as per work requirement |

**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** |
| * + - 1. Cytological specimen includes but not limited to: | * Blood * Stool * Urine * Milk * Tissues |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy
* Animal anatomy and physiology
* Animal pathology

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving skills
* Digital literacy
* Communication
* Interpersonal
* First aid
* Photography
* Analytical
* Report writing
* Time management

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | * 1. Cleaned ocular parts and surfaces as per manufacturer’s specifications   2. Calibrated measurement parts as per manufacturer’s standards   3. Positioned and stored microscope as per manufacturer’s specifications   4. Collected cytological specimens as per cytology laboratory procedures   5. Processed cytological specimenas per cytology laboratory manual procedures   6. Examined cytological specimens as per cytology laboratory manual.   7. Processed Histological specimen as per histology laboratory manual.   8. Examined Histological specimens as per histology laboratory manual. |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Project   3. Portfolio of evidence   4. Oral assessment   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## PERFORM MICROBIOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 12A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to perform microbiological techniques. It involves collecting microbiological samples, culturing microbiological specimen, carrying out antimicrobial sensitivity testing, testing microbial organisms in food and water and performing industrial microbial processes.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Collect microbiological samples | 1.1 Microbiological Sample collection tools and materials are assembled as per microbiology laboratory manual  1.2 Microbiological samples are collected and labeled as per microbiological procedures  1.3 ***Microbiological sample handling*** is carried out as per microbiological procedures |
| 2.Culture microbiological specimen | 2.1 ***Culture* equipment and materials**are assembled and sterilized as per microbiology laboratory manual.  2.2 ***Culture reagents*** and media are prepared as per manufacturer’s instructions.  2.3 ***Culture media inoculation*** and incubation is carried out as per microbiology laboratory manual.  2.4 Microbial culture is sub-cultured as per microbiology laboratory manual  2.5 Pure Microbial culture examination and ***identification*** is conducted as per microbiology laboratory manual |
| 3.Carry out antimicrobial sensitivity testing | 3.1 Antimicrobial sensitivity testing tools and materials are assembled and sterilized as per microbiology laboratory manual  3.2 Pure microbial culture is isolated as per Standard Microbiological Procedures  3.3 ***Antimicrobial samples*** are introduced into the pure microbial culture and incubated as per drug sensitivity protocols  3.4 Antimicrobial test findings are recorded and reported as per Good Laboratory Practices (GLP) manual |
| 4.Test microbial organisms in food and water | * 1. Water and food are sampled according to microbiological procedures   2. Water and food sample is processedas per microbiology laboratory manual   3. Water and food samples are tested as per work requirement.   4. Water and food sample test findings are recorded and reported as per GLP manual |
| 5.Perform industrial microbial processes | 5.1 Industrial microorganisms are assembled as per good laboratory practices  5.2 Microorganisms are sub-cultured and maintained as per work place procedures.  5.3 Microorganisms are introduced into ***industrial processes*** and monitored as per work place procedures. |

**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** |
| 1. Microbiological sample handling includes but not limited to: | * Packaging * Transportation * Storage |
| 1. Culture equipment and materials include but not limited to: | * Incubator * Petri dishes * Inoculating loops * Autoclaves * Hot air oven * Bio safety cabinets * Glass wares |
| 1. Culture reagents and media include but not limited to: | * Ethanol * Solid media * Liquid media * Semi-solid media * Stains * Distilled water |
| 1. Culture media inoculation include but not limited to: | * Streaking * Stubbing * Pour plating * Spread plate * Slopes * Deep culture |
| 1. Microbial identification includes but not limited to: | * Morphological identification * Biochemical test * Cultural |
| 1. Antimicrobial samples include but not limited to: | * Crude plant extracts * Commercial antibiotics * Commercial antifungals |
| 1. Industrial processes include but not limited to: | * Brewing * Yoghurt making * Baking * Biogas production |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy
* Industrial processes

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving
* Digital literacy
* Communication
* Interpersonal
* First aid
* Photography
* Report writing
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Carried out microbiological sample handling as per microbiological procedures   2. Carried out culture media inoculation and incubation as per microbiology laboratory manual.   3. Sub-cultured microbial culture as per microbiology laboratory manual   4. Conducted Pure microbial culture examination and identification as per microbiology laboratory manual   5. Introduced antimicrobial samples into the pure microbial culture and incubated as per drug sensitivity protocols   6. Recorded and reported antimicrobial test findings as per Good Laboratory Practices (GLP) manual   7. Processed water and food sample as per microbiology laboratory manual   8. Tested water and food samples as per work requirement.   9. Introduced microorganisms into industrial processes and monitored them as per work place procedures. |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Projects   3. Portfolio of evidence   4. Oral assessment   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a :  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## PERFORM PARASITOLOGICAL AND ENTOMOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 13A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to perform parasitological and entomological techniques. It involves collecting parasitological samples, performing parasitological tests, managing human and animal parasites, performing entomological techniques and managing insect pests and vectors.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Collect parasitological samples | 1.1 Parasitological sample collection tools and materials are assembled as per parasitology laboratory manual  1.2 Parasitological samples are collected and labeled as per parasitology laboratory manual  1.3 ***Parasitological samples handling*** is carried out as per parasitology laboratory manual |
| 2.Perform parasitological tests | 2.1 ***Parasitological sample*** is collected as per parasitological laboratory manual.  2.2 Parasitological sample processing is performed as per test requirements  2.3 Parasitological diagnostic test is carried out as per parasitology laboratory manual.  2.4 Parasitological diagnostic test result is reported as per GLP |
| 3.Manage human and animal parasites | * 1. Parasitological specimen is collected as per parasitology laboratory manual   2. Human and animal ***parasite classification*** is carried out as per taxonomical principles.   3. ***Human and animal parasites*** morphology is determined as per parasitological laboratory manual   4. Animal and human parasite life cycle is determined as per taxonomical principles.   5. Human and animal parasites prevention and control measures are implemented as per work requirement |
| 4.Perform entomological techniques | * 1. Insect collection tools are assembled as per entomological procedures   2. Insect collection is carried out as per entomological procedures.   3. Insects are classified as per taxonomical principles   4. Insect are reared according to entomological procedures |
| 5.Manage insect pests and vectors | 5.1 ***Insect*** ***Pests*** and vectorsare collected and classified as per work procedures  5.2 Insects pests and vectors are controlled as per work procedures.  5.3 Pest and vector control report on findings is written as per GLP |

**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** |
| * + - 1. Parasitological samples handling includes but not limited to: | * Packaging * Transportation * Storage |
| * + - 1. Parasitological sample include but not limited to: | * Faecal * Blood * Urine |
| * + - 1. Human and animal parasite classification include but not limited to: | * Protozoa * Metazoan * Arthropods |
| * + - 1. Insect Pests include but not limited to: | * Field pest * Storage pest |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Anatomy and physiology
* Microscopy
* Taxonomy

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving
* Digital literacy
* Communication
* Interpersonal
* First aid
* Photography
* Report writing
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Carried out Parasitological samples handling as per p parasitology laboratory manual   2. Performed parasitological sample processing performed as per test requirements   3. Carried out parasitological diagnostic test as per parasitology laboratory manual.   4. Carried out Human and animal parasite classification as per taxonomical principles.   5. Implemented human and animal parasites prevention and control measures as per work requirement   6. Carried out Insect collection as per entomological procedures.   7. Classified insects are as per taxonomical principles   8. Reared Insect according to entomological procedures   9. Controlled insect’s pests and vectors as per work procedures. |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Project   3. Portfolio of evidence   4. Oral assessment   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## PERFORM ECOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 14A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to perform ecological techniques. It involves collecting ecological samples**,** determining ecological species distribution, performing soil analysis, measuring ecological abiotic parameters

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Collect ecological samples | 1.1 Ecological sample collection tools are assembled as per work requirement  1.2 Ecological sample is collected as per work requirement  1.3 Ecological sample handling is carried out as per work requirement. |
| 2.Determine ecological species distribution | 2.1 Ecological population estimation tools are assembled as per work procedures  2.2 Population size is estimated as per population estimation protocols  2.3 Ecological species distribution is determined as per work procedures  2.4 Ecological distribution findings are recorded and reported as per work procedures |
| 3.Perform soil analysis | 3.1 Soil collection tools are assembled as per soil laboratory manual  3.2 Soil sample is collected as per work procedures.  3.3 Soil sample is tested according to work procedures.  3.4 Soil sample analysis finding is recorded and reported as per GLP |
| 4.Measure ecological abiotic parameters | * 1. Ecological abiotic parameter measurement tools are assembled as per work requirement   2. ***Abiotic parameters*** are measured as per weather station manual   3. Abiotic parameter results are reported as per weather station manual |

**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** |
| 1. Abiotic parameters include but not limited to: | * Soil * Water * Wind * Temperature * Humidity * Air pressure |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Environmental conservation
* Microscopy
* Taxonomy

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving
* Digital literacy
* Communication
* Interpersonal
* First aid
* Photography
* Report writing
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Collected ecological sample as per work requirement   2. Carried out ecological sample handling as per work requirement.   3. Estimated population size as per population estimation protocols   4. Determined ecological species distribution as per work procedures   5. Collected soil sample as per work procedures.   6. Tested soil sample according to work procedures.   7. Measured abiotic parameters as per weather station manual |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Project   3. Portfolio of evidence   4. Oral assessment   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## PERFORM PHARMACOLOGICAL AND TOXICOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 15A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to perform pharmacological and toxicological techniques. It involves preparing plant crude extracts, testing herbal drugs’ efficacy and carrying out toxicity testing

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Prepare plant crude extracts | * 1. Plant samples are collected as per work requirement   2. Sample extraction tools, equipment, and materials are assembled as per work requirements   3. Crude extract is prepared as per pharmacological procedures   4. Crude extract is processed and stored as per GLP |
| 2.Test herbal drugs’ efficacy | 2.1Herbal drug efficacy test tools, equipment, and materials are assembled as per pharmacological procedures  2.2 Crude extract is prepared as per pharmacological procedures  2.3 Drug active components are determined as per work requirement  2.4 Crude extract is serially diluted as per pharmacological procedures  2.5 ***Drug sensitivity test*** is carried out as per microbiological laboratory manual  2.6 Drug sensitivity test results are reported as per GLP |
| 3.Carry out toxicity testing | 3.1 Toxicity testing tools and materials are assembled as per work requirement  3.2 Drug sample is administered to laboratory animal as per pharmacological procedures  3.3 Drug effective dosage is determined as per pharmacological procedures  3.4 Toxicity test findings are reported as per GLP |

**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** |
| * + - 1. Drug sensitivity test include but not limited to: | * Disc diffusion * Agar well |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving
* Digital literacy
* Communication
* Interpersonal
* First aid
* Photography
* Report writing
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| * + - 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Prepared crude extract as per pharmacological procedures   2. Determined drug active components as per work requirement   3. Carried out drug sensitivity test as per microbiology laboratory manual   4. Administered drug sample into laboratory animal as per pharmacological procedures   5. Determined drug effective dosage as per pharmacological procedures |
| * + - 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Project   3. Portfolio of evidence   4. Oral assessment   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## PERFORM IMMUNOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 16A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to perform immunological techniques. It involves collecting immunological test sample, carrying out immunodiagnostic tests and developing simple vaccines.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Collect immunological test sample | 1.1 Immunological tools, equipment and materials are assembled as per work requirements  1.2 ***Immunological specimen*** is collected as per immunology laboratory manual  1.3 Immunological specimen is processed as per immunology laboratory manual |
| 2. Carry out immunodiagnostic tests | 2.1 ***Immunological tests*** are performed as per immunological laboratory manual  2.2 Immunological test results are analyzed as per immunology laboratory manual  2.3 Immunological diagnostic results are reported as per work requirements |
| 3. Develop simple vaccines | 3.1 Micro-organisms of interest are cultured and isolated as per Good Laboratory Practices  3.2 Microbial by-products are isolated as per microbiology laboratory manual  3.3 Vaccines are processed as per Good clinical laboratory practices (GCLP)  3.4 laboratory animal vaccine trials are performed as per GCLP |

**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** |
| Immunologicalspecimen includes but not limited to: | * Serum * Virology swab * Biopsy and necropsy tissue * Cerebrospinal fluid * Whole blood * Urine * Sputum |
| * + - 1. Immunologicalspecimen includes but not limited to: | * ELISA * Western blot * Agglutination tests * Precipitation tests * Immune electrophoresis * Compliment fixation test |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy
* Plant anatomy and physiology

**Required skills**

The individual needs to demonstrate the following skills:

* Digital literacy
* Communication
* Critical thinking
* Interpersonal
* First aid
* Photography
* Problem solving
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Processed immunological specimen as per immunology laboratory manual   2. Performed immunological testsas per immunology laboratory manual   3. Analyzed Immunological test results as per immunology laboratory manual   4. Cultured and isolated micro-organisms of interest as per Good Laboratory Practices   5. Processed Vaccines as per Good clinical laboratory practices (GCLP) |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Projects   3. Portfolio of evidence   4. Third party report   5. Written tests   6. Oral presentation |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## CONDUCT BIOCHEMICAL ANALYSIS

**UNIT CODE: 0511 551 17A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to conduct biochemical analysis. It involves carrying out biomolecule tests, performing bio-molecules separation and qualitative analysis and performing enzyme activity tests.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Carry out biomolecule tests | 1.1 Samples are assembled as per biochemistry laboratory procedures  1.2 Biomolecules collection tools are assembled as per biochemistry laboratory procedures  1.3 Biomolecules are tested as per biochemistry laboratory procedures  1.4 Results are recorded as per Good Laboratory Practices |
| 2.perform bio-molecules  separation and qualitative analysis | 2.1 Biomolecules test sample is assembled as per biochemistry laboratory procedures  2.2 Biomolecule collection tools are assembled as per biochemistry laboratory procedures  2.3 ***Biomolecule separation procedures*** are conductedasper biochemistry laboratory procedures  2.3 Biomolecules separation results is reported as per biochemistry laboratory procedures |
| 3. Perform enzyme activity tests | 3.1 Enzyme test sample is collected as per biochemistry laboratory procedures  3.2 ***Enzymatic properties*** are tested as per biochemistry laboratory procedures  3.3 Enzyme activitytest results is reported as per biochemistry laboratory procedures |

**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** |
| * + - 1. Biomolecule separation procedures include but not limited to: | * Chromatography * Electrophoresis |
| 2.Enzymatic properties include but not limited to: | * Temperature * pH * Substrate concentration * Enzyme concentration * Co-factors and co-enzymes |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy

**Required skills**

The individual needs to demonstrate the following skills:

* Digital literacy
* Communication
* Critical thinking
* Interpersonal
* First aid
* Photography
* Problem solving
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Tested biomolecules as per biochemistry laboratory procedures   2. Conducted biomolecule separation proceduresasper biochemistry laboratory procedures   3. Tested enzymatic propertiesas per biochemistry laboratory procedures |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Projects   3. Oral assessment   4. Portfolio of evidence   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## PERFORM MUSEUM, HERBARIUM, AQUARIUM AND VIVARIUM TECHNIQUES

**UNIT CODE: 0511 551 18A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to perform museum, herbarium, aquarium, and vivarium techniques. It involves performing Museum technique, performing herbarium technique, performing Aquarium techniques, performing vivarium techniques and performing aquaculture techniques.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Perform Museum technique | * 1. ***Museum specimen*** is collected as per Museum manuals   2. Museum specimen is processed as per Museum manuals   3. Museum specimen is preserved as per Museum manuals   1.4 Museum specimen is labeled and stored as per Museum manual |
| 2.Perform herbarium technique | 2.1 Herbarium specimen is collected as per Herbarium handbook   * 1. Herbarium specimen is processed as per Herbarium handbook   2. Herbarium specimen is preserved as per Herbarium handbook   2.4 Herbarium specimen is labeled and stored as per Herbarium handbook |
| 3.Perform Aquarium techniques | 3.1 Aquarium tank is designed as per work requirements  3.2 Aquarium tank construction material are assembled as per work requirements  3.3 An aquarium is set up as per aquarium tank design  3.4 Aquarium organisms are introduced as per work requirements  3.5 Aquarium is managed as per work requirements |
| 4.Perform vivarium techniques | 4.1 Vivarium tank design is developed as per work requirement  4.2 Vivarium is set up as per Vivarium tank design  4.3 Vivarium tank construction materials are assembled as per work requirements  4.4 Vivarium is set up as per Vivarium tank design  4.5 Vivarium organisms are introduced as per work requirements  4.6 Vivarium is managed as per work requirements |
| 5. Perform aquaculture techniques | 5.1 ***Fish farming structure*** is constructed based on site location  5.2 Fish farming structure is stocked as per work requirement  5.3 Fish farming structure is managed as per work requirement |

**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** |
| * + - 1. Museum specimen include but not limited to: | * Zoological * Botanical * Pathological |
| 1. Fish farming structure include but not limited to: | * Cages * Hatcheries * Fish ponds |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy
* Anatomy
* Taxidermy

**Required skills**

The individual needs to demonstrate the following skills:

* Digital literacy
* Communication
* Critical thinking
* Interpersonal relationship
* First aid
* Photography
* Problem solving
* Analytical
* Critical thinking
* Writing
* Problem solving
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Collectedmuseum specimen as per Museum manuals   2. Processed museum specimen as per Museum manuals   3. Collected herbarium specimen as per Herbarium handbook   4. Processed herbarium specimen as per Herbarium handbook   5. Set up aquarium as per aquarium tank design   6. Managed aquarium as per work requirements   7. Set up vivarium as per aquarium tank design   8. Managed vivarium as per work requirements   9. Constructed fish farming structure based on site location   10. Managed fish farming structure as per work requirement |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Projects   3. Oral assessment   4. Portfolio of evidence   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## CARRY OUT LABORATORY ANIMAL HUSBANDRY

**UNIT CODE: 0511 551 19A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to carry out laboratory animal husbandry. It involves constructing laboratory animal cages, managing laboratory animals, and carrying out euthanasia.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Construct laboratory animal cages | * 1. Animal laboratory cages are designed as per the work requirement   2. Laboratory cage construction materials are assembled as per work requirement   3. Laboratory cage is constructed as per work requirement |
| 2. Manage laboratory animals | 2.1 ***Laboratory animals*** are sourced as per needs of laboratory  2.2 Laboratory animals are bred as per World Organization for Animal Health (WOAH) Standards  2.3 Laboratory animal diseases are identified as per World Organization for Animal Health (WOAH) Standards  2.4 Laboratory animal diseases are managed as per World Organization for Animal Health (WOAH) Standards  2.5 Laboratory animals are cared as per World Organization for Animal Health (WOAH) Standards |
| 3. Carry out euthanasia | 3.1 Laboratory animals are selected as per work requirements  3.2 ***Animal humane killing*** is carried out as per World Organization for Animal Health (WOAH) Standards  3.3 Laboratory animals are dissected as per World Organization for Animal Health (WOAH) Standards  3.4 Animal carcasses are disposed as per World Organization for Animal Health (WOAH) Standards |

**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** |
| 1. Laboratory animals include but not limited to: | * Laboratory rats * Rabbits * Mice * Guinea pig * Hamster |
| 1. Animal humane killing include but not limited to | * Physical * Chemical |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Microscopy
* Taxonomy
* Anatomy
* Taxidermy

**Required skills**

The individual needs to demonstrate the following skills:

* Digital literacy
* Communication
* Critical thinking
* Interpersonal
* First aid
* Photography
* Problem solving
* Analytical
* Critical thinking

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Constructed laboratory cage as per work requirement   2. Bred laboratory animals as per World Organization for Animal Health (WOAH) Standards   3. Cared for laboratory animals as per World Organization for Animal Health (WOAH) Standards   4. Carried out animal humane killingas per World Organization for Animal Health (WOAH) Standards   5. Dissected laboratory animals as per World Organization for Animal Health (WOAH) Standards |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Projects   3. Oral assessment   4. Portfolio of evidence   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## CARRY OUT PLANT HUSBANDRY

**UNIT CODE: 0511 551 20A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to carry out plant husbandry. It involves performing plant propagation techniques, managing greenhouse facility, managing plant diseases and performing hydroponic techniques.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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.Perform plant propagation technique | * 1. ***Plant propagation material*** is assembled as per work requirement   2. Plant propagation materialis screened as per plant husbandry procedure   3. Planting materials are propagated as per plant husbandry procedure   4. ***Field management practices*** are carried out as per work requirement |
| 2.Manage greenhouse facility | 2.1 Greenhouse design is developed as per greenhouse procedures  2.2 Greenhouse construction material is identified as per greenhouse procedures  2.3 Greenhouse is constructed as per greenhouse procedures  2.4 Maintenance practices are carried out as per greenhouse procedures |
| 3. Manage plant diseases | 3.1 Infected plant samples are collected as per plant pathology laboratory procedures  3.2 Plant samples are tested as per plant pathology laboratory procedures  3.3 ***Plant diseases*** are controlled as per plant pathology laboratory procedures |
| 4. Perform hydroponic technique | 4.1 Plant materials and nutrients are assembled as per hydroponic farming procedures  4.2 Hydroponic plants are cultured as per hydroponic farming procedures  4.3 Hydroponic plants are maintained as per hydroponic farming procedures |

**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** |
| 1. Plant propagation material include but not limited to: | * Seeds * Cuttings * Suckers * Buds * Tubers * Bulbs * Splits |
| 1. Field management practices include but not limited to: | * Weeding * Soil managements * Water management * Pruning * Pest and diseases control * Thinning * Fertilizer application * Harvesting * Gapping |
| 1. Plant diseases include but not limited to: | * Bacterial diseases * Fungal diseases * Viral Diseases * Nematode infections |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Scientific report writing
* Occupational safety and health
* Basic mathematics
* Computer application
* Soil conservation
* Microscopy
* Taxonomy
* Plant Genetics
* Plant anatomy and physiology
* Plant pathology

**Required skills**

The individual needs to demonstrate the following skills:

* Problem solving skills
* Digital literacy
* Communication
* Critical thinking
* Interpersonal
* First aid
* Photography
* Analytical

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Propagated planting materials as per plant husbandry procedure   2. Carried out field management practices as per work requirement   3. Carried out maintenance practices as per greenhouse procedures   4. Tested plant samples as per plant pathology laboratory procedures   5. Controlled plant diseases are per plant pathology laboratory procedures   6. Maintained hydroponic plants as per hydroponic farming procedures |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Project   3. Portfolio of evidence   4. Oral assessment   5. Third party report   6. Written tests |
| 1. Context of assessment | Competency may be assessed in a:  Workplace or simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |