

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARD**

**FOR**

**INDUSTRIAL CHEMISTRY TECHNICIAN**

**KNQF LEVEL 6**

**OCCUPATIONAL STANADRD ISCED CODE: 0531 554A**

**First published 2024**

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**FOREWORD**

The provision of quality education and training is fundamental to the Government’s overall strategy for social-economic development. Quality education and training will contribute to 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 Industrial Chemistry 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.

**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. TVET has a responsibility of facilitating the process of inculcating knowledge, skills, and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

The TVET Act CAP 210A and sessional paper No.14 of 2012 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by the industry as well as increase the global competitiveness of the Kenyan labour force.

**ACKNOWLEDGMENT**

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

I also thank all the individuals and organizations who participated in the validation of this Occupational Standard.

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# ABBREVIATIONS AND ACRONYMS

ISCED International Standard Classification of Education

KNQF Kenya National Qualification Framework

QAI Qualification Awarding Institutions

TVET Technical and Vocational Education and Training

CBET Competency Based Education and Training

CBETA Competency Based Education and Training Authority

NSSC National Sector Skills Committee

UIPAC International Union of Pure and Applied Chemistry

AC Alternating Current

DC Direct Current

CRO Cathode Ray Oscilloscope

CPR Cardiopulmonary Resuscitation

HPLC High Performance Liquid Chromatography

AAS Atomic Absorption Spectroscopy

TVETA Technical and Vocational Education and Training Authority.

ANOVA Analysis of Variance

FAES Flame Atomic Emission Spectrometer

FT-IR Fourier Transform-Infrared

GC Gas Chromatography

GC-MS Gas Chromatography – Mass Spectroscopy

HPLC High Performance Liquid Chromatography

CPU Central Processing Unit

RAM Random Access Memory

CDs Compact Discs

DVDs Digital Versatile Disc

HDMI High-Definition Multimedia Interface

DVI Digital Visual Interface

VGA Video Graphics Array

USB Universal Serial Bus

TVs Televisions

CV Curriculum Vitae

ICT Information and Communication Technology

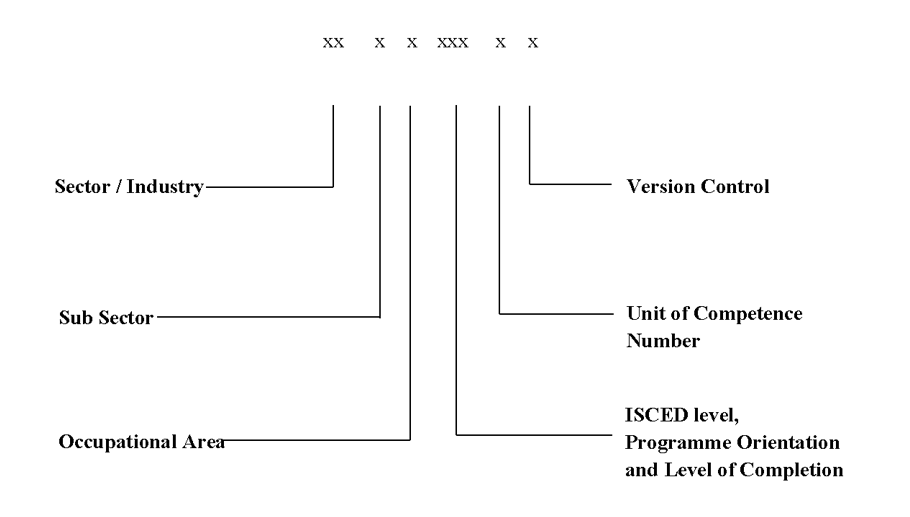
UV-VIS Ultra-Violet Visible spectrophotometer

NEMA National Environment Management Authority

EPRA Energy and Petroleum Regulatory Authority

ASTM American Standard of Testing and Materials

# KEY TO UNIT CODE



# OCCUPATIONA STANDARD OVERVIEW

The industrial chemistry technology level 6 occupational standard consists of competencies that an individual requires to enable him/her to effectively work as an industrial chemistry technician. This occupational standard consists of the following competencies; perform unit operation, operate analytical equipment, perform process control and optimization, perform production quality control, manage industrial wastes, process industrial products and carry out material analysis. Other competencies relevant to the performance of the duties of Industrial Chemist include: chemical, electrical and mechanical sciences concepts, laboratory and safety management practices, mathematical concepts and research projects. In addition, communication skills, digital literacy, entrepreneurial skills and work ethics and practices are applicable.

Thus, the units of competency in this occupational standard comprising Industrial Chemistry Level 6 qualification include the following basic, common and core competencies:

# SUMMARY OF UNITS OF COMPETENCY

|  |  |
| --- | --- |
| **BASIC UNITS OF COMPETENCY** | |
| **UNIT CODE** | **UNIT TITLE** |
| 0611 541 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** | |
| 0531 551 05A | Apply Chemical Science Concepts |
| 0713 551 06A | Apply Electrical Science Concepts |
| 0715 551 07A | Apply Mechanical Science Concepts |
| 0711 551 08A | Apply Laboratory, Safety and Management Practices |
| 0500 551 09A | Conduct Research Project |
| 0541 551 10A | Apply Mathematics for Science |
| **CORE UNITS OF COMPETENCY** | |
| 0711 551 11A | Perform Unit Operations |
| 0711 551 12A | Operate Analytical Equipment |
| 0711 551 13A | Perform Process Control and Optimization |
| 0711 551 14A | Perform Production Quality Control |
| 0712 551 15A | Manage Industrial Wastes |
| 0720 551 16A | Process Industrial Products |
| 0720 551 17A | Carry Out Material Analysis |

# BASIC UNITS OF LEARNING

## APPLY DIGITAL LITERACY

**UNIT CODE : 0611 551 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. 4. ***Data manipulation*** on a worksheet is undertaken in accordance with work 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. ***Certificates 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 * News Group * Ecommerce |
| 1. Internet access applications/ software may include but are not limited to: | * Browsers * Email Apps * E-Commerce 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’s 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. Oral assessment   2. Portfolio of evidence   3. Third party report   4. Written assessment   5. Practical assessment   6. Project-Based Assessment |
| 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 | 1. Existing non-verbal communication techniques are identified and applied based on organization policy. 2. Non-verbal communication techniques are articulated and modeled to enhance inclusivity according to workplace requirements. |
| 1. Apply oral communication skills | 1. Types of oral communication are identified and established as per organization policy. 2. Pathways of oral communication are identified and established as per organization policy. 3. Pathways of oral communication are reviewed according to organization procedures. 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. 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. Oral assessment   2. Portfolio of evidence   3. Third party report   4. Written assessment   5. Practical assessment   6. Project-Based Assessment |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | 1. 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 | * 1. ***Teams*** are formed to enhance productivity based on organization’s objectives   2. Duties are assigned to teams under the organization policy.   3. Team activities are managed and coordinated as per set objectives.   4. Team performance is evaluated based on set targets as per workplace policy.   5. ***Conflicts*** are resolved between team members in line with organization policy.   6. Gender and diversity-related issues are identified and mainstreamed in accordance with workplace policy.   7. Healthy ***relationships*** are developed and maintained in line with the workplace.   8. Adaptability and flexibility are applied in dealing with team members as per workplace policies |
| 1. Maintain professional and personal development | 1. ***Personal growth and development*** needs are identified and assessed in line with the requirements of the job. 2. ***Training and career opportunities*** are identified and utilized based on job requirements. 3. ***Resources*** for training are mobilized and allocated based on organizations and individual skills needs. 4. Licenses and certifications relevant to the job and career are obtained and renewed as per policy. 5. Recognitions are sought as proof of career advancement in line with professional requirements. 6. Work priorities and personal commitments are balanced and managed based on the requirements of the job and personal objectives. 7. Dynamism and on-the-job learning are embraced in line with the organization’s goals and objectives. |
| 1. Apply Problem solving skills | 1. ***Creative, innovative*** and practical solutions are developed based on the problem    1. Independence and initiative in identifying and solving problems are demonstrated based on the requirements of the job.    2. Team problems are solved as per the workplace guidelines    3. Problem-solving strategies are applied as per the workplace guidelines    4. Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 1. Promote Customer Care | 1. Customers' needs are identified based on their characteristics 2. Customer ***feedback*** is allowed and facilitated in line with organization policies. 3. Customer concerns and complaints are analyzed and resolved in line with the set organizational culture. 4. Proactive customer outreach programs are implemented as per organizational policies 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. Oral questioning 2. Written test 3. Project-Based Assessment 4. Portfolio of Evidence 5. 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 | * 1. 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 mayinclude but not limited to: | * Salary/Wages * Investments * Savings * Inheritance * Government Benefits. |
| 1. Sources of business finance mayinclude 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. Project Based Assessment 4. Third party report 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 | * 1. Holistic assessment with other units relevant to the   industry sector, workplace and job role is recommended. |

# COMMON UNITS OF LEARNING

## APPLY CHEMICAL SCIENCE CONCEPTS

**UNIT CODE: 0531 541 05A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an industrial chemist to apply chemical science concepts. It includes applying physical chemistry, organic chemistry, inorganic chemistry, biochemistry and industrial microbiology principles.

**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 Physical chemistry principles | * 1. ***Gas law*** knowledge is applied based on work requirement   2. PH and buffer knowledge is applied based on work requirement   3. Chemical kinetics knowledge is applied based on work requirement   4. Surface and colloids chemistry knowledge is applied based on work requirement   5. Electrochemistry principles are applied knowledge based on work requirement   6. Phase equilibrium knowledge is applied based on work requirement   7. Chemical thermodynamics principles are applied as per work requirement |
| 1. Apply organic chemistry principles | * 1. ***Organic compound*** is classified as per the International Union of Pure and Applied Chemistry (IUPAC).   2. Organic compound reaction knowledge is applied based on work requirement   3. Organic compound uses knowledge is applied based on work requirement |
| 1. Apply inorganic chemistry principles | * 1. ***Inorganic element classification*** is carried out based on periodic table   2. Atomic structure and bonding knowledge is demonstrated as per periodic table   3. Chemical reactivity knowledge of inorganic elements and compound is applied based on work requirement   4. Volumetric analysis knowledge is applied based on work requirement. |
| 1. Apply biochemistry principles | * 1. ***Biomolecule classification*** is demonstrated based on molecular composition   2. ***Biomolecules physical properties*** knowledgeis applied based on work requirement   3. ***Biomolecule*** ***chemical properties*** knowledge is applied based on work requirement   4. ***Biomolecule products*** knowledge is applied based on work requirement |
| 1. Apply industrial microbiology principles | * 1. ***Microorganism*** is isolated based on work requirements   2. Microorganisms are introduced in the production process based on work requirements   3. Microbial activity is monitored as per work requirement   4. Microbial activity result is recorded as per work 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. Gas law may include but are not limited to: | * Boyle’s * Charles’ * Avogadro’s * Gay-Lussac’s * Combined |
| 1. Organic compound may include but are not limited: | * Hydrocarbons * Carboxylic acids * Aldehydes * Esters * Ketones * Haloalkanes * Alcohols * Carbonyl compounds |
| 1. Inorganic element classification may include but are not limited: | * S-block * P-block * D-block * Metals * Non-metals * Metalloids |
| 1. Biomolecules classificationmay include but are not limited: | * Carbohydrates * Proteins * Lipids * Vitamins |
| 1. Biomolecule Physical propertiesmay include but are not limited: | * Structure * Color * Shape |
| 1. Biomolecule Chemical propertiesmay include but are not limited: | * Activity * Acidity * Basicity * Hydrophilicity * Hydrophobicity |
| 1. Biomolecule products may include but are not limited: | * Glycerol * Amino acids * Fatty acids * Sugars * Starch * Enzymes |
| 1. Microorganisms may include but are not limited: | * Fungi * Bacteria * Virus * Archaea |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Critical thinking
* Problem solving
* Innovation
* Creativity
* Specimen handling
* Analytical skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Taxonomy
* Chemistry
* Biochemistry
* Microbiology
* Mathematics

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | * 1. Applied gas law knowledge based on work place requirement   2. pH and buffer knowledge are applied based on workplace requirement   3. Applied chemical kinetics knowledge based on work requirement   4. Applied surface and colloids chemistry knowledge based on workplace requirement   5. Applied electrochemistry principles based on workplace requirement   6. Applied phase equilibrium knowledge based on workplace requirement   7. Applied chemical thermodynamics principles as per workplace requirement   8. Applied organic compound reaction knowledge based on work requirement   9. Applied volumetric analysis knowledge is applied based workplace environment   10. Isolated microorganisms based on work requirements   11. Introduced microorganisms in the production process based on work requirements   12. Monitored microbial activity 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 may be assessed through:   * 1. Practical Assessment   2. Project-Based Assessment   3. Portfolio of Evidence   4. Third Party Reports   5. Written Assessment |
| 1. Context of Assessment | * 1. Competency may be assessed in a workplace or simulated workplace |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ELECTRICAL SCIENCE CONCEPTS

**UNIT CODE: 0713 541 06A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an industrial chemist to apply electrical science concepts. It involves applying electrical principles, electrical quantities principles and using electrical Equipment

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the **key outcomes** which make up workplace function (to be stated in active) | **PERFORMANCE CRITERIA**  These are **assessable statements** which specify the required level of performance for each of the elements (to be stated in passive voice)  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Apply electrical principles | * 1. ***Electrical quantity*** is measured as per work requirement   2. Electrical quantities are calculated based on electrical formulae   3. ***Electrical laws*** are applied based on work requirement |
| 1. Applyelectrical quantities principles | * 1. ***Electrical parameters*** are determined as per work requirement   2. ***Electrical Circuit*** knowledge is applied as per work requirement   3. ***Electrical Current*** knowledge is applied as per work requirement |
| 1. Use electrical Equipment | * 1. PPEs are worn as per work requirement   2. Type of ***electrical equipment*** is selected as per work requirement   3. Electrical equipment safety check is carried out based on manufacturer’s manual   4. Electrical equipment is powered on as per manufacturer’s instruction   5. Electrical equipment parameters are set as per work requirement   6. Electrical equipment is calibrated as per manufactures instruction   7. Electrical equipment is powered off as per manufactures’ manual   8. Electrical equipment is stored and cleaned as per manufactures manual |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Electrical quantity includes but are not limited to: | * Voltage * Current * Charge * Power * Conductivity * Resistivity |
| 1. Electrical laws include but not limited to: | * Ohm’s * Watt’s * Kirchhoff’s * Faraday’s * Coulomb’s * Lenz’ * Henry |
| 1. Electrical parameters include but not limited to: | * Resistance * Capacitance * Conductance * Inductance |
| 1. Electrical circuit include but not limited to: | * Parallel * Series * Wheatstone bridge |
| 1. Electrical current includes but not limited to: | * AC * DC |
| 1. Electrical equipment includes but not limited to: | * Voltmeter * Ammeter * Resistors * Multimeter * Conductivity meter * Rheostat * Cathode Ray Oscilloscope (CRO) |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skill

* Observation
* Communication
* Interpersonal
* Analytical
* Critical thinking
* Trouble shooting
* Innovation
* Creativity
* Interpretation
* Reporting

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Mathematics
* Measurements
* Safety
* Electricity

**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. ***Measured electrical quantity*** per work requirement 2. Calculated electrical quantities based on electrical formulae 3. ***Determined Electrical parameters*** as per work requirement 4. Worn PPEs as per work requirement 5. selected type of ***electrical equipment*** as per work requirement 6. Carried out electrical equipment safety check based on manufacturer’s manual 7. Set electrical equipment parameters per work requirement 8. calibrated electrical equipment as per manufacturer's instruction |
| 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 Assessment. 3. Portfolio of Evidence 4. Third Party Reports 5. Written Assessment |
| 1. Context of Assessment | * 1. Competency may be assessed in a workplace or simulated workplace |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY MECHANICAL SCIENCE CONCEPTS

**UNIT CODE: 0715 541 07A**

**UNIT DESCRIPTION**

This unit of competency provides knowledge required by an industrial chemist to apply mechanical science. It includes applying solid mechanics, applying physics principles, using mechanical systems and applying fluid mechanics principles.

**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 solid mechanics principles | 1. Solid Stability and structures knowledge is applied based on work requirement 2. Hooke’s law is applied as per work requirement 3. ***Solid Dynamics*** principle is applied as per work requirement |
| 1. Apply physics principles | * 1. Mechanical force knowledge is applied as per work requirement   2. Electromagnetic principle knowledge is applied as per work requirement   3. Energy principle knowledge is applied as per work requirement |
| 1. Use mechanical systems | * 1. PPEs are worn as per work requirement   2. ***Mechanical system*** inspection is conducted as per manufacturer’s manual   3. Mechanical systemisoperated as per manufacturer’s manual   4. Mechanical system is powered off as per manufactures’ manual.   5. Mechanical systemis cleaned as per manufactures manual |
| 1. Apply fluid mechanics principles | * 1. Phase equilibrium knowledge is applied as per work requirement   2. Viscosity knowledge is applied as per work requirement   3. Fluid Kinematics knowledge is applied as per work requirement   4. Vacuum systems knowledge is applied 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. Solid dynamics may include but are not limited to: | * Vibrations * Displacement * Plasticity * Stress * Strain * Phase changes |
| 1. Mechanical systems may include but are not limited to: | * Elevators * Plumbing * Heating * Cooling |

**REQUIRED KNOWLEDGE AND SKILLS**

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Mathematics
* Physics
* Measurements
* Material mechanics
* Mechanical systems

**Required skills**

The individual needs to demonstrate the following skills:

* Problem-solving skills
* Analytical skills
* Team work
* Communication
* Creativity
* 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 performance | 1. Applied stability and structures knowledge based on work requirement 2. Applied solid dynamics principle as per work requirement 3. Applied energy principle knowledge as per work requirement 4. Applied phase equilibrium knowledge as per work requirement 5. Applied viscosity knowledge as per work requirement 6. Applied fluid Kinematics knowledge as per work requirement 7. Applied vacuum systems knowledge 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 may be assessed through:   * 1. Practical Assessment   2. Portfolio of Evidence   3. Third Party Reports   4. Written Assessment   5. Project Based Assessment. |
| * + - 1. Context of assessment | * 1. Competency may be assessed in a 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 LABORATORY SAFETY AND MANAGEMENT PRACTICES

**UNIT CODE: 0711 541 08A**

**UNIT DESCRIPTION**

This unit of competency provides knowledge required by an Industrial Chemist to apply laboratory and safety management practices. It involves maintaining safe work environment, managing workplace accidents and incidents, managing laboratory waste products, preparing laboratory reagents and managing laboratory material resources.

**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 safe work environment | * 1. Laboratory safety procedures are developed according to industrial laboratory standards   2. PPEs are worn as per the work requirement   3. Sources of ***laboratory hazards*** and risks are established based on laboratory safety requirements   4. Laboratory chemicals are labelled and stored as per the laboratory safety procedures   5. Laboratory hazards are handled in accordance with safety procedures |
| 1. Manage workplace accidents and incidents | * 1. Incident nature is assessed as per laboratory safety procedures   2. ***Laboratory Injury type*** is established according to first aid procedure   3. ***First aid*** is performed as per first aid procedure   4. Casualty is referred for treatment as per first aid procedure   5. Incident is reported and documented as per the work place guidelines |
| 1. Manage laboratory waste products | * 1. PPEs are worn as per the work requirement   2. ***Laboratory wastes*** are segregated according to laboratory waste management   3. Laboratory ***working area cleaning*** is carried out as per laboratory procedures   4. ***Laboratory waste disposal*** is carried out as per laboratory waste management procedures |
| 1. Maintain science laboratory equipment | * 1. Laboratory equipment is identified based on work requirement   2. laboratory ***equipment maintenance*** is carried out according to manufacturer’s manual   3. laboratory equipment is stored based on manufacturer’s manual |
| 1. Prepare laboratory reagents | * 1. PPEs are worn as per the work requirement   2. ***Laboratory reagent*** ratios are determined based on work requirement   3. Laboratory ***reagent preparation*** is carried out based on laboratory manual   4. Laboratory reagents are labelled and stored a per the workplace procedures |
| 1. Manage laboratory material resources | * 1. Laboratory requisitions are prepared based on organizational guidelines   2. Laboratory inventories are maintained as per science laboratory guidelines   3. Laboratory stock taking is carried as per laboratory guidelines   4. Expired laboratory chemical is dispatched for disposal |

**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 are not limited to: | * Chemical * Mechanical * Biological * Electrical * Flames |
| 1. Laboratory Injury type may include but are not limited to: | * Burns * Bruises * Cuts * Fractures * Sprains * Dislocations * Suffocation |
| 1. First aid may include but are not limited to: | * Cleaning * CPR * Dressing * Ointment application |
| 1. Laboratory wastes may include but are not limited to: | * Broken glassware * Used reagents * Expired chemicals * waste paper * Biohazardous wastes * Polythene bags * Sharp objects * Liquid spillages * Microscopic slides |
| 1. working area cleaning may include but are not limited to: | * Disinfection/sanitization * Stain removal * Removing solid waste * Floor scrubbing |
| 1. Laboratory waste disposal may include but are not limited to: | * Incineration * Recycling * Reusing * Burning * Evaporation * Burying in pit * Land filling * Composting |
| 1. Equipment maintenance may include but not limited to. | * Cleaning * Oiling and greasing * Sterilization * Calibration |
| 1. Laboratory reagent may include but are not limited to: | * Acids * Bases * Indicators\ * Standard solutions * Solvents * Salts |
| 1. reagent preparation may include but are not limited to: | * Weighing * Dissolving * Diluting * Standardization |

**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:

* Communication
* laboratory safety
* Chemistry
* instrumentation knowledge
* Sample collection and storage
* waste management

**Required skills**

The individual needs to demonstrate the following skills:

* Problem-solving skills
* Analytical skills
* Organizational skills
* First aid
* Critical thinking skills
* Waste handling

**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 performance | 1. Developed laboratory safety procedures according to industrial laboratory standards 2. Worn PPEs are per the work requirement 3. Established sources of laboratory hazards and risks based on laboratory safety requirements 4. Handled laboratory hazards in accordance with safety procedures 5. Performed first aid is performed as per first aid procedure 6. Segregated Laboratory wastes according to laboratory waste management 7. Carried out Laboratory waste disposal is carried out as per laboratory waste management procedures 8. carried out laboratory equipment maintenance according to manufacturer’s manual 9. Carried out Laboratory reagent preparationbased on laboratory manual 10. Prepared Laboratory requisitions based on organizational guidelines 11. 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 may be assessed through:   * 1. Practical Assessment   2. Portfolio of Evidence   3. Third Party Reports   4. Written Assessment   5. Project |
| 1. Context of assessment | 1. Competency may be assessed in a 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. |

## CONDUCT SCIENTIFIC RESEARCH

**UNIT CODE: 0500 541 09A**

**UNIT DESCRIPTION**

This unit specifies the competencies required by an Industrial Chemist to conduct scientific research**.** It involves preparing scientific research proposal, carrying out laboratory research, analyzing the laboratory research findings and documenting and disseminating laboratory research findings.

**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 |
| 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 are designed based on research objectives   4. Scientific research proposal is developed as per standard research procedures |
| 1. Apply scientific research methods | * 1. ***Scientific study design*** is determined in accordance with research problem and research data   2. Sample size is determined based on the research methodology   3. ***Sampling techniques*** are determined in accordance with scope and research methodology   4. Ethical considerations are determined based on research methods utilized   5. Research materials are identified based on scope and research methodology   6. Data is collected in accordance with research methodology |
| 1. Analyze scientific research finding | * 1. ***Data analysis methods*** are identified as per job requirement.   2. Data analysis is performed as per work procedure   3. Research report is prepared as per work procedure. |

**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. Scientific study design includes but not limited to: | * Qualitative designs * Quantitative designs |
| 1. Sampling techniques include but not limited to: | * Probability * Non-probability |
| 1. Data analytical methods include but not limited to: | * ANOVA * Measures of central tendency * Measures of dispersal |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical
* Communication
* Computer
* Creativity
* Interpersonal
* Critical thinking
* Data collection
* Decision making
* Dissemination
* Observation
* Problem solving
* Report writing
* Statistical

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified scientific research problem based on existing research gap   2. Developed scientific research proposal as per work requirement.   3. DeterminedScientific study design in accordance with research problem and research data   4. Collected data in accordance with research methodology   5. Applied data analysis techniques as per work requirement Compiled Research report as per work requirement |
| 1. Resource Implications | The following resources should be provided:   * 1. Workstation   2. Reporting tools   3. Data collection tools   4. Stationery   5. Data analysis tools   6. PPEs |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical Assessment   2. Project-Based Assessment   3. Portfolio of Evidence   4. Third Party Reports   5. Written Assessment |
| 1. Context of Assessment | 1. Competency may be assessed in a workplace or simulated workplace |
| 1. Guidance information for assessment | 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY MATHEMATICS FOR SCIENCE

**UNIT CODE: 0541 541 10A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an industrial chemist 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. Addition and subtraction is performed as per arithmetic operation rules   2. Multiplication and division is applied as per arithmetic operation rules   3. Rational and irrational numbers are evaluated as per algebraic rules   4. Ratios, ***proportions*** and percentages is applied as per algebraic rules |
| 1. Apply algebraic equation and expression | * 1. Linear equations are solved as per the concept   2. Simultaneous equations are solved as per the ***simultaneous method***   3. Formulation of a formula is applied as per the concept   4. Quadratic equation is solved as per the ***quadratic methods*** |
| 1. Apply linear and non-linear graphs | * 1. Linear and nonlinear graph is plotted as per the graphical methods   2. Reduction of non-linear to linear graphs is performed as per the concept   3. Graph is interpreted as per the concept formulate Graphical solution |
| 1. Apply indices and logarithms | * 1. Indices are operated as per the concept   2. ***Logarithm*** is defined as per the concept   3. Change of base of logarithms is performed as per logarithmic concept   4. Logarithmic and exponential graph is plotted as per logarithmic concept |
| 1. Apply binomial expansions | * 1. Roots of numbers are determined using binomial theorem   2. ***Errors*** of small changes are determined using binomial theorem   3. Permutation and combination are applied using binomial theorem |
| 1. Apply matrices | * 1. Determinant and inverse of 2x2 matrix is determined as per the concept.   2. Simultaneous equations are solved as per matrix concept   3. Eigenvalues and Eigenvectors are determined as per matrix concepts |
| 1. Apply vectors | * 1. Vectors and scalar quantities are obtained in two dimensions   2. ***Operations*** on vectors are performed as per vector concept   3. Position of vectors are obtained as per vector concept   4. Vector is resolved as per vector concept |
| 1. Apply trigonometry | * 1. ***Trigonometric ratios*** are applied as per trigonometric rules.   2. Angles of elevation and depression are determined as per trigonometric rules.   3. Angles are determined as per compound angle formula   4. Sine and cosine waves are interpreted as per trigonometric rules. |
| 1. Apply Calculus | * 1. Rate of change is determined as per ***differentiation rules.***   2. ***Stationary points*** of functions are determined as per differentiation rules.   3. Integrals of algebraic functions are determined as per ***integration rules***   4. Integrals of logarithmic functions are determined as per integration rules |
| 1. Apply sequences and series | * 1. Arithmetic means and nth term of an arithmetic sequence is determined as per the concept   2. Sum of terms of a given ***arithmetic series*** are determined as per the concept   3. A geometric sequence is differentiated according to arithmetic sequence   4. A finite geometric sequence is differentiated according to finite geometric sequence   5. Geometric means and nth terms of a geometric sequence is determined as per geometric sequence concept   6. Sum of finite and infinite geometric sequence is determined as per geometric sequence concept |
| 1. Apply statistics methods | 1. ***Raw data*** is collected as per job requirement 2. ***processing of raw data*** is carried out as per job requirement 3. Interpretation of data is performed as per job requirement 4. ***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 may include but not limited to: | * Direct proportion * Inverse proportion |
| 1. Simultaneous method may include but not limited to: | * Elimination method * Substitution * Graphical method |
| 1. Quadratic methods May include but not limited to: | * Factorization * Completing Square Method * Quadratic formula |
| 1. Logarithms may include but not limited to: | * Operation * Conversions * Graph plotting |
| 1. Errors may include but not limited to: | * Absolute * Relative * Percentage |
| 1. Trigonometric rules May include but not limited to: | * Sine rule * Cosine rule * Double angle formula |
| 1. Binomial theorem May include but not limited to: | * Pascal triangle |
| 1. Differentiation May include but not limited to: | * First principles * High order functions * Differential equations * Inverse differentiation |
| 1. Differentiation rules May include but not limited to: | * Product rule * Chain rule * Quotient rule |
| 1. Stationary points May include but not limited to: | * Maxima * Minima * Point of inflection |
| 1. Integration May include but not limited to: | * Constant of integration * Integral notation * Indefinite and definite integrals |
| 1. Methods of integration May include but not limited to: | * Standard form * Substitution * Integration by parts |
| 1. Currency table May include but not limited to: | * Selling price * Buying price |
| 1. Series May include but not limited to: | * Arithmetic Progression * Geometric Progression |
| 1. Raw data may include but not limited to: | * Grouped data * Ungrouped data |
| 1. Processing of raw data may include but not limited to: | * Mean * Mode * Median * Range * Quartile * Standard deviation * Variance |
| 1. Data presentation May include but not limited to: | * Pictograms * Histograms * Pie charts * Bar charts * Frequency polygon |
| 1. Order of matrix May include but not limited to: | * Singular * Non-singular * Identity * Echelon |
| 1. Matrix operation May 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
* Calculus

**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   10. Interpreted data as per work requirement   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 | 1. Competency may be assessed in a workplace or simulated workplace |
| 1. Guidance information for assessment | 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CORE UNITS OF LEARNING

## PERFORM UNIT OPERATIONS

**UNIT CODE: 0711 551 11A**

**UNIT DESCRIPTION**

This unit of competency covers the ability of an industrial chemist to perform unit operations. It involves separating, purifying and mixing production materials

**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. Separate production materials | * 1. ***Production material*** is identified as per the work requirement   2. Production material is sampled as per industrial procedures   3. Production materials are testedas per work requirement   4. ***Production material separation*** is carried out as per industrial procedures |
| 1. Purify production materials | * 1. Production material is identified as per the work requirement   2. Production material is sampled as per as industrial procedures   3. Production material is testedas per industrial procedures   4. Purification of production material is industrial procedures |
| 1. Mix production materials | 1. Production material ratio is determined as per work requirement 2. Production material is weighed as per determined ratios 3. Production materials are blended as per the determined ratios |

**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. Production material may include but not limited to: | * Raw materials * Intermediate products |
| 1. Production material separation may include not limited to: | * Sorting * Evaporation * Filtration * Distillation * Chromatography |

**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:

* Separation techniques
* Purification techniques
* Sampling techniques

**Required skills**

The individual needs to demonstrate the following skills:

* Analytical skills
* Observation
* Problem solving
* Critical thinking
* Reporting
* Interpretation
* Communication

**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. Sampled production material as per industrial procedures 2. Tested production materials as per work requirement 3. Carried out production material separation as per industrial procedures 4. Carried out purification of production material industrial procedures 5. Determined production material ratio per work requirement 6. Blended production materials per the determined ratios |
| 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. Third Party Reports 5. Written Assessment |
| 4. Context of assessment | 1. Competency may be assessed in a 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. |

## OPERATE ANALYTICAL EQUIPMENT

**UNIT CODE: 0711 551 12A**

**UNIT DESCRIPTION**

This unit of competency covers the ability of an industrial chemist operate analytical equipment. It includes setting up analytical equipment, calibrating analytical equipment and analyzing material parameters.

**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. Set up analytical equipment | 1. ***Analytical equipment*** is identified as per work requirement 2. Analytical equipment start up is carried out as per Manufacturer’s Operating Manual 3. ***Analytical equipment parameters*** are set as per work requirement |
| 1. Calibrate analytical equipment | * 1. Calibration standards are prepared as per work requirement   2. Blank sample is run in line with work requirement   3. Calibration Standards are run in line with manufacturer’s manual |
| 1. Analyze material parameters | * 1. Samples are prepared according to work requirements   2. Samples are run as per Chemistry laboratory procedures   3. Data is interpreted as per Standard Reference material   4. Data is documented as per organizational guidelines |

**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. Analytical equipment may include but not limited to | * AAS * FAES * UV -visible spectrophotometer * Analytical balance * HPLC * GC-MS * FT-IR * Colorimeter |
| 1. Analytical equipment parameters may include but not limited to: | * Absorbance * Transmittance * PH * Temperature * Wavelength |

**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:

* Instrumental methods of analysis
* Electromagnetic spectrum
* Units of measurement
* safety procedure
* calibration and standards
* data interpretation

**Required skills**

The individual needs to demonstrate the following skills:

* Communication
* Analytical skills
* problem solving
* Data analysis

**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 analytical equipment is as per work requirement 2. set analytical equipment parameters are per work requirement 3. Prepared calibration standards are as per work requirement 4. Run blank sample line with work requirement 5. run calibration standards in line with manufacturer’s manual 6. Prepared samples according to work requirements 7. Run samples are as per chemistry laboratory procedures 8. Interpreted data is as per standard reference material |
| 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. Third Party Reports   5. Written Tests |
| 4. Context of assessment | 1. Competency may be assessed in a 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. |

## PERFORM PROCESS CONTROL AND OPTIMIZATION

**UNIT CODE: 0711 551 13A**

**UNIT DESCRIPTION**

This unit of competency covers the ability of an industrial chemist to perform process control and optimization. It involves conducting manufacturing process and product audit, carrying out process statistical control, carrying out manufacturing process validation and monitoring manufacturing production control system.

**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. Conduct manufacturing process and product audit | * 1. ***Manufacturing process*** inspection is carried out as per work procedure   2. Manufacturing product inspection is carried out as per the work procedure   3. Manufacturing process ***parameters*** are validated based on work requirement   4. Audit report is prepared as per organization audit manual |
| 1. Carry out process statistical control | * 1. Manufacturing process ***control units*** are established as per work requirement   2. Manufacturing Process variation review is carried out in line with manufacturers manual   3. Manufacturing process performance is measured in line with production output   4. Manufacturing process ***Control charts*** are prepared based on control limits |
| 1. Carry out manufacturing process validation | * 1. Manufacturing process design is established based on product requirement   2. Manufacturing process qualification is performed as per the product requirement   3. Manufacturing process verification protocols are developed based on industrial procedure   4. Manufacturing process uncertainty assessment is conducted based on process capability index |
| 1. Monitor manufacturing production control system | * 1. Manufacturing production performance is monitored as per process requirement   2. Corrective adjustments are initiated based on process requirement   3. Manufacturing ***operations control*** are conducted as per process requirement |

**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. Manufacturing process may include but not limited to | * Calcining * Casting * Molding * Labeling * Packaging * Assembling |
| 1. Parameters may include but not limited to | * Temperature * pH * Machine speed * Viscosity * Pressure * Feed low * Voltage time * Chemical concentrations * Torque |
| 1. Control units may include but not limited to | * Assembly lines * Quality inspection stations * Packaging and labelling * Mixing and blending * Storage |
| 1. Control charts may include but not limited to | * Variable control charts * Attributes control charts |
| 1. Operations control may include but not limited to | * Planning and scheduling * Quality control and assurance * Inventory management |

**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:

* Variables
* Data interpretation
* Instrumentation
* Safety
* manufacturing

**Required skills**

* communication
* audit
* 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 | * 1. Inspected manufacturing process as per work procedure   2. Established manufacturing process control units as per work requirement   3. Established manufacturing process design based on product requirement   4. Initiated corrective adjustments based on process requirement   5. Conducted manufacturing operations control are as per process 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. Third Party Reports   5. Written Assessment |
| 4. Context of assessment | 1. Competency may be assessed in a 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. |

## PERFORM PRODUCTION QUALITY CONTROL

**UNIT CODE: 0711 551 14A**

**UNIT DESCRIPTION**

This unit of competency covers the ability of an industrial chemist to perform production quality control. It involves sampling production materials, inspecting production materials, controlling nonconforming products and sorting and packaging production materials.

**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. Sample production materials | 1. Production material sample is collected based on production manual 2. Production materials sample is labeled as per work procedure 3. Production material ***sample treatment*** is carried out as per production manual 4. Production material ***sample storage*** is carried out as per production manual |
| 1. Inspect production materials | * 1. V   2. ***Quality control Inspection tools*** are assembled as per the work requirement   3. ***Production material inspection*** is conducted as per organizational quality control checklist   4. Quality deviations are recorded as per the organizational quality control procedures |
| 1. Control nonconforming products | Tt   * 1. Production nonconforming product is segregated and labeled as per quality control procedure   2. Production Nonconformity root cause analysis is carried out as per quality control procedure   3. Production nonconformity ***corrective measures*** are initiated as per quality control procedure |
| 1. Sorting and packaging of production materials | * 1. Production material grading is carried out based on work requirements   2. Production materials are sorted according to ***grading criteria***   3. Production materials are packed as per the organizational guidelines |

**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. Sample treatment may include but not limited to: | * Drying * grinding and milling * weighing * decomposition * dissolution * digestion * storage |
| 1. Sample storage may include but not limited to: | * cold storage * dark storage * open air storage * air tight containers |
| 1. Quality control Inspection tools may include but not limited to: | * safety gear * score cards * checklist * testing meters * gauges * laboratory testing tools |
| 1. Production material inspection may include but not limited to: | * Visual * destructive testing * nondestructive testing * mechanical testing * chemical testing |
| 1. corrective measures may include but not limited to: | * Replacing the product * Scrapping * Adjustments * Recycling * Reworking * Root cause analysis |
| 1. grading criteria may include but not limited to | * Purity * physical and chemical properties * stability and shelf life |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

* Sampling techniques
* Statistical analysis
* Experimental design
* Measurement units
* Data interpretation

**Required skills**

* Critical thinking
* Problem solving
* Analytical
* Communication

**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. Labeled sample production materials sample is labeled as per work procedure 2. Carried out sample production material treatment is as per production manual 3. Conducted sample production material inspection as per organizational quality control checklist 4. Recorded quality deviations as per the organizational quality control procedures 5. Sorted production materials according to grading criteria |
| * + - 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. Third Party Reports   5. Written Assessment |
| * + - 1. Context of assessment | 1. Competency may be assessed in a 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. |

## MANAGE INDUSTRIAL WASTES

**UNIT CODE: 0712 551 15A**

**UNIT DESCRIPTION**

This unit of competency covers the ability of an Industrial Chemist to manage industrial waste. It includes sorting industrial waste, carrying out industrial waste, treating industrial waste and disposal of industrial 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. Sort industrial waste | * 1. ***Industrial waste*** is collected as per industrial waste management procedure   2. ***Industrial waste test*** is carried out as per industrial waste management procedure   3. Industrial waste is segregated as per industrial manufacturing process |
| 1. Carry out industrial waste management 4Rs | 1. Industrial waste is reduced as per industrial waste management procedure 2. Industrial waste is reused as per industrial waste management procedure 3. Industrial waste is recovered as per industrial waste management procedure 4. Industrial waste is recycled as per industrial waste management procedure |
| 1. Treat industrial waste | * 1. Industrial waste treatment tools are assembled as per of industrial waste generated   2. Industrial waste treatment is carried out as per industrial waste management procedure   3. Treated industrial waste is separated as per industrial management procedure   4. Treated Industrial waste is tested as per industrial waste management procedure |
| 1. Dispose industrial waste | 1. Treated Industrial waste is segregated as per industrial waste management procedure 2. Industrial waste is dispatched to the waste disposal site as per National Environmental Authority (NEMA) regulations 3. Industrial waste disposal is carried out as per industrial waste management procedure |

**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. Industrial waste may include but not limited to: | * Syringes * liquid waste * Hazardous * Solid * Organic * Biological |
| 1. Industrial waste test may include but not limited to: | * chemical analysis * toxicity levels * physical properties analysis * leachability * environmental impact assessment 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:

* Safety
* Analytical techniques
* Types of waste
* Environmental impacts and litigations
* Disposal methods

**Required skills**

The individual needs to demonstrate the following skills:

* Sampling skills
* Critical thinking
* Analytical skills
* Waste handling skills
* problem solving

**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 industrial waste testingas per industrial waste management procedure   2. Segregated industrial waste as per industrial manufacturing process   3. reused industrial waste as per industrial waste management procedure   4. Recycled Industrial waste as per industrial waste management procedure   5. Treated industrial waste as per industrial waste management procedure   6. Separated treated industrial waste as per industrial management procedure   7. Tested treated industrial wastes as per industrial waste management procedure   8. Segregated treated Industrial waste as per industrial waste management procedure   9. Dispatched industrial waste to the waste disposal site as per NEMA regulations |
| 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. Third Party Reports   5. Written Assessment |
| 1. Context of assessment | 1. Competency may be assessed in a 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. |

## PROCESS INDUSTRIAL PRODUCTS

**UNIT CODE: 0720 551 16A**

**UNIT DESCRIPTION**

This unit specifies the competencies required by an Industrial Chemist to process various industrial products which will include processing food, agrochemical, petroleum, pharmaceutical, coating, cosmetic and chemical products.

**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. Process food products | 1. ***Personal Protective Equipment (PPEs***) are worn as per work requirement 2. Food ***Raw materials inspection*** is carried out as per work requirement 3. ***Raw materials preparation*** *is* conducted as per work requirement 4. Raw materials are mixed as per the work requirement 5. Food ***value addition*** is conducted as per the work requirement 6. Production quality control is conducted as per food quality control procedure 7. Sorting and grading are carried out as per the organizational guidelines 8. Production waste is dispatched for disposal as per industrial waste management procedure |
| 1. Process agrochemical products | 1. ***PPEs*** are worn as per work requirement 2. ***Raw materials inspection*** is carried out as per work requirement 3. ***Raw materials preparation*** *is* conducted  as per work requirement 4. Agrochemical products ***compounding*** is carried out as per the product requirement 5. Production quality control is conducted as per quality control procedure 6. Production waste is dispatched for disposal as per industrial waste management procedure. |
| 1. Process petroleum products | * 1. ***PPEs*** are worn as per work requirement   2. *Raw materials inspection* is carried out as per work requirement   3. ***Crude oil refining*** Is carried out as per the American Petroleum Institute (API) standards   4. Incorporation of chemical treatments and additives is carried out as per the product requirement   5. Production quality control is conducted as per quality control procedure   6. Storage is carried out as per the Energy and Petroleum Regulatory Authority (EPRA) standards   7. Production waste is dispatched for disposal as per industrial waste management procedure |
| 1. Process pharmaceutical products | * 1. PPEs are worn as per work requirement   2. Raw materials inspection is carried out as per work requirement   3. Raw materials preparation*is* conducted  as per work requirement   4. ***Pharmaceutical products compounding*** is carried out as per product requirement   5. Production quality control is conducted as per quality control procedure   6. Pharmaceutical products packaging and storage is carried out as per the product requirement   7. Production waste is dispatched for disposal as per industrial waste management procedure. |
| 1. Process coating products | * 1. PPEs are worn as per work requirement   2. ***Coating product*** raw materials are assembled based on the work requirement   3. Coating product Raw materials inspection is carried out as per work requirement   4. Coating product raw materials are mixed as per manufacturing manual   5. Coating product raw materials are milled as per manufacturing manual   6. Coating products are blended as per work requirement   7. Coating products quality control is conducted as per quality control procedure   8. Coating product is packaged as per customer requirements   9. Coating production waste is dispatched for disposal as per industrial waste management procedure |
| 1. Process cosmetic products | * 1. PPEs are worn as per work requirement   2. ***Cosmetic product*** raw materials are assembled based on the work requirement   3. Cosmetic product raw materials inspection is carried out as per work requirement   4. Cosmetic product raw materials are mixed as per manufacturing manual   5. Cosmetic products quality control is conducted as per quality control procedure   6. Cosmetic product is packaged as per work requirement   7. Cosmetic production waste is dispatched for disposal as per industrial waste management procedure |
| 1. Process chemical products. | * 1. PPEs are worn as per work requirement   2. ***Chemical product*** raw materials are assembled as per work requirement   3. Chemical product raw material inspection is carried out as per work requirement   4. Chemical product raw materials preparation*is* conducted  as per work requirement   5. Chemical product processing is carried out as per manufacturing manual   6. Chemical product quality control is conducted as per quality control procedure   7. Chemical product is packaged as per work requirement   8. Chemical production waste is dispatched for disposal as per industrial waste management procedure |

**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. Personal protective equipment (PPEs) may include but are not limited to: | * Eye protection * Head protection * Face protection * Body protection * Foot protection |
| 1. Raw materials inspection may include but are not limited to: | * Setting stage * Documentation review * Inspection criteria * Onsite inspection |
| 1. Raw materials preparation may include but are not limited to: | * Washing * Mixing * Chopping * Refining * Separation * Refrigeration * Thawing |
| 1. Value addition may include but are not limited to: | * Fortification * Enriching * Flavoring * Preservation * Coloring |
| 1. Pharmaceutical compounding may include but are not limited to: | * Granulation * Capsulation |
| 1. Crude oil refining may include but are not limited to: | * Distillation * Cracking * Reforming * Hydro processing * Isomerization * Alkylation * Desalination * Fractionation |
| 1. Coating product may include but are not limited to: | * Paint * Dyes * Inks * Vanishes * Lacquers |
| 1. Cosmetic product may include but are not limited to: | * Perfume * Soap * Creams * Ointments * Sunscreen * Nail polish |
| 1. Chemical product may include but are not limited to: | * Cement * Ceramics * Polymers * Salts * Acids |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skill

* Communication
* Analytical
* Critical thinking
* Problem solving
* First aid
* Innovation
* Creativity
* House keeping

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* separation methods
* raw materials handling
* analytical techniques
* health and environmental safety
* manufacturing process

**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. Wore Personal Protective Equipment (PPEs) as per work requirement   2. Carried raw materials inspection out as per work requirement   3. Conducted raw materials preparation as per work requirement   4. mixed and blended Raw materials are as per the work requirement   5. conducted production quality control as per food quality control procedure   6. Dispatched production waste for disposal as per industrial waste management procedure |
| 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. Third Party Reports   5. Written Assessment |
| 1. Context of Assessment | 1. Competency may be assessed in a workplace or simulated workplace |
| 1. Guidance information for assessment | 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## CARRY OUT MATERIAL ANALYSIS

**UNIT CODE: 0720 551 17A**

**UNIT DESCRIPTION**

This unit specifies the competencies required by an Industrial Chemist to carry out material analysis. It involves analyzing material structure, analyzing material properties, assessing material chemical composition and synthesizing industrial materials.

**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 material structure concepts | 1. ***Material Crystal structure*** is determined as per American Standard of Testing and Materials (ASTM) 2. Material grain structure is determined as per ASTM 3. ***Material defect*** is examined based on work requirement 4. Material property -structure relationship is established based on work requirement |
| 1. Analyze material Properties | * 1. Analysis materialis sampled as per work requirement   2. ***Material property*** is analyzed as per the product requirement   3. Material is characterized based on the material property |
| 1. Assess material chemical composition | * 1. Material Elemental analysis is carried out is based on work requirement   2. Spectroscopic analysis is carried out based on work requirement   3. Mass spectrometry analysis is carried out based on work requirement   4. Chromatographic analysis is carried out based on work requirement   5. Microscopic analysis is carried out based on work requirement |
| 1. Synthesize industrial material | * 1. Industrial raw material is selected as per work requirement   2. Industrial raw materials preparation*is* conducted  as per work requirement   3. Industrial raw materials are mixed as per work requirement   4. Industrial raw materials are blended as per work requirement   5. Industrial materials heat treatment is carried out as per the product requirement   6. Industrial product quality control is conducted as per quality control procedure   7. Industrial products storage is carried out as per the product requirement   8. Industrial production waste is dispatched for disposal as per industrial waste management procedure |

**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. Material Crystal structure may include but are not limited to | * Monoclinic * Cubic * Tetragonal * Rhombic * Triclinic * Orthorhombic * Hexagonal * Octahedron |
| 1. Material defect may include but are not limited to: | * Dislocation * Voids * Inclusions * Impurities * Distortion * Grain boundary |
| 1. Material property may include but are not limited to | * Thermal * Mechanical * Optical * Magnetic * X-ray diffraction * Electrical |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* analytical skills
* IT skills
* research and report writing
* critical thinking
* problem solving

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* physics techniques
* mechanical techniques
* chemical techniques

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | 1. Determined Material Crystal structure as per American Standard of Testing and Materials (ASTM) 2. Determined Material grain structure as per ASTM 3. Examined material defect based on work requirement. 4. Analyzed Material property as per the product requirement 5. Conducted Industrial raw materials preparation as per work requirement 6. Mixed and blended Industrial raw materials as per work requirement 7. Conducted industrial product quality control is as per quality control procedure 8. Carried out industrial products storage is carried out as per the product requirement 9. Dispatched industrial production waste for disposal as per industrial waste management procedure |
| 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. Third Party Reports   5. Written Assessment |
| 1. Context of Assessment | 1. Competency may be assessed in a workplace or simulated workplace |
| 1. Guidance information for assessment | 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |