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**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Standards Generating Body (SGB) for

**Mining and Minerals**

registered by Organising Field 06 – Manufacturing, Engineering and Technology, publishes the following qualification for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the qualification. The full qualification can be accessed via the SAQA web-site at [www.saq.org.za](http://www.saq.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the qualification should reach SAQA at the address below and **no later than 13 April 2007**. All correspondence should be marked **Standards Setting – Mining and Minerals** and addressed to

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## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**QUALIFICATION:****National certificate: Laboratory Practice**

| SAQA QUAL ID            | QUALIFICATION TITLE                       |                            |                     |
|-------------------------|---|----------------------------|---------------------|
| 58248                   | National Certificate: Laboratory Practice |                            |                     |
| SGB                     | PROVIDER                                  |                            |                     |
| SGB Minina and Minerals |   |                            |                     |
| ETQA                    |   |                            |                     |
| QUALIFICATION TYPE      | FIELD                                     | SUBFIELD                   |                     |
| National Certificate    | 6 - Manufacturing,                        | Fabrication and Extraction |                     |
|                         | Technology                                |                            |                     |
| ABET BAND               | MINIMUM CREDITS                           | NQF LEVEL                  | QUALCLASS           |
|                         |   |                            | Based               |
| <b>STATUS</b>           |   | <b>N</b>                   | <b>REGISTRATION</b> |
| Draft - Prep for P      |   |                            |                     |
| Comment                 |   |                            |                     |

**PURPOSE AND RATIONALE OF THE QUALIFICATION**

## Purpose:

Laboratory Practices deals with the processes of evaluating materials and products so that plant processing, manufacturing or mining activities can be optimised. Laboratory personnel receive samples and are required to perform either quantitative or qualitative tests on them to establish the content and/or quantities of the content within the sample. These evaluations will inform the processing/manufacturing plants or the mine about possible errors so that the necessary parameter optimisation can occur.

In addition, the laboratories are required to conduct tests to ensure that environmental considerations are taken care of.

This qualification enables laboratory personnel to perform such activities mentioned above by giving them the foundational knowledge and skills for the:

- o Preparation of laboratory samples prior to analysing them.
- Processing of laboratory samples for the testing procedures.
- o Performing basic laboratory analyses.

In addition it provides an opportunity for learners to learn and apply skills in relation to the workplace. This qualification is aimed at persons who work or intend to work within a laboratory and who seek recognition for essential skills in this area.

The key skills, knowledge and understanding reflected in this qualification are that of conducting the essential operations associated with sample preparation prior to analysis, sample processing and basic analyses. This qualification is designed to be flexible and accessible and empowers the learner to acquire and demonstrate knowledge, skills, attitudes and values required to work safely and effectively in a laboratory.

It is intended that qualifying learners are able to:

- o Communicate effectively in the workplace in a variety of ways.
- o Apply mathematical principles in practical applications.
- o Perform basic laboratory skills.
- Perform primary sample preparation.
- Sustain Occupational Health and Safety in the Workplace.
- o Explain the nature of the specific environment.

The qualification is designed to be flexible and accessible **so** that people are able to demonstrate the competencies in laboratories across various sectors where the competencies in the unit standards in the core and elective lists apply.

The unit standards are intended as building blocks for the further development of skills that will make the learner a more fulfilled, informed, efficient and cost effective worker in industry. This should result in more efficient service to the customer and make industry more competitive in the global market.

The possible career pathing for individuals wishing to study in this area is as follows:

- Foundational knowledge of an industrial sector can be learnt from an appropriate General and Further Education and Training Certificate.
- The learner may wish to proceed in the field of laboratory work, then the National Certificate: Laboratory Practice NQF Level 2 would afford him/her foundational knowledge to perform basic tests. The learner may choose to exit at this point in which case he may obtain jobs such as laboratory attendants or operators.
- Should the learner/candidate wish to advance his career within the laboratory environment he/she should then access Certificate: Laboratory Practice NQF Level 3 that would allow one to be able to perform more technical testing. Jobs available to these candidates include assistant analysts' positions.
- The learner can then proceed to The FETC Laboratory Analysis where one would be able to perform advanced technical evaluations and the learner could then become an analyst.
- Higher education and training such as Chemical Engineering or analytical chemistry could then be accessed as long as the prerequisites of the institutions are maintained.
- Should the candidate desire to leave this field, s/he may exit to other occupationally-based qualifications at that level with the fundamental learning that has been achieved.

Rationale:

The National Certificate: Laboratory Practice Level 2 is designed to benefit both the learner and employers in such sectors **as** mining and minerals, chemicals and **food** and beverage and thus contribute to an improved economy by ensuring learner competence and enhanced productivity.

Through its design this qualification will meet the needs of learners in the various mentioned sectors (or those wishing to enter the sectors) and who require technical expertise and essential knowledge in laboratory practices. The qualification will give them the opportunity to balance their practical skills with the essential knowledge needed to earn a formal qualification in laboratory practice relevant to a testing laboratory. The qualification facilitates access to learners from previously disadvantaged groups and other learners to acquire the technical knowledge and skills that are required for laboratory testing operations.

Persons working in testing laboratories require a sound knowledge of the contextual environment and the capacity to understand the relevant laboratory operations.

There **is also** a critical **need** in industry to identify people who are able to conduct the essential operations associated with the:

- **Preparation of laboratory samples prior to analysis.**

- o Processing of laboratory samples.

Source: National Learners' Records Database

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o Basic laboratory analysis.

The National Certificate in Laboratory Practice: Level 2 will produce competent learners who are able to contribute to improved productivity and efficiency within industry. The qualification will have an impact and benefit on the learner and industry as follows: those processes reliant on information determined by the laboratory analyses, which will be conducted with knowledge gained from this qualification, will receive prompt notification of errors. This prompt notification of errors increases productivity and efficiency of operative processes and thus the organisation itself.

Another benefit that will result from learning obtained through this qualification is the understanding that the learner will have about the impact of the processes on the environment. The learner will be able to determine whether processes are polluting the environment and communicate this to those conducting the processes for improvement.

The qualification will allow the learner to gain an understanding of the implication that the laboratory test results have on the specific operation.

It will provide the means for current workers to receive recognition of prior learning, to upgrade their skills and achieve a nationally recognised qualification. It should also assist new entrants to the various industries. The qualification is structured in such a way that it exposes the learner to different aspects of laboratory practice.

#### **RECOGNIZE PREVIOUS LEARNING?**

Y

#### **LEARNING ASSUMED TO BE IN PLACE**

It is assumed that learners are already competent in:

- Communication and Mathematical Literacy at **NQF** Level 1.

Recognition of Prior Learning:

This qualification can be achieved wholly or in part through recognition of prior learning in terms of the criteria laid out.

Evidence can be presented in a variety of forms, including international or previous local qualifications, reports, testimonials mentioning functions performed, work records, portfolios, videos of practice and performance records.

All such evidence should be judged according to the general principles of assessment described in the note to assessors.

Access to the qualification:

There is open access to the qualification.

#### **QUALIFICATION RULES**

Level, credits and learning components assigned to the qualification:

There are three specialisation areas possible for this qualification:

- **National Certificate:** Laboratory Practice: General, **NQF** Level 2.
- **National Certificate:** Laboratory Practice: Precious Metals, **NQF** Level 2.
- **National Certificate:** Laboratory Practice: Coal, **NQF** Level 2.

Fundamental:

Source: National Learners' Records Database

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- o All 36 credits for the Fundamental unit standards must be achieved.
- 20 Communication credits from the list specified.
- 16 Mathematical credits from the list specified.

Core:

- o All 46 credits must be achieved.

Stream specialisations:

General Laboratory Practice:

- The following unit standards totalling 18 credits must be achieved:
  - o 9636: "Determine the pH of a liquid by means of a pH meter", NQF Level 3, 2 Credits.
  - o 9626: "Perform measurements using volumetric equipment", NQF Level 2, 2 Credits.
  - o 9742: "Dissolve solid samples for analysis", NQF Level 3, 5 Credits.
  - o 110169: "Separate solids from a liquid by means of filtration", NQF Level 2, 3 Credits.
  - o 12769: "Perform elementary acid-base titrations and interpret the results", NQF Level 3, 6 Credits.

- o The additional 20 credits are to be obtained from the list of Elective standards.

Precious Metal Laboratory Practice:

- o The following unit standards totalling 19 credits must be achieved:
  - o 9744: "Flux samples in preparation for the fire assay fusion", NQF Level 2, 6 Credits.
  - o 9745: "Collect precious metals from a fluxed sample into a metal button by means of the fire assay fusion process", NQF Level 2, 6 Credits.
  - o 9746: "Recover precious metals from a lead button by means of the cupellation process", NQF Level 2, 7 Credits.

- o The additional 19 credits are to be obtained from the list of Elective standards.

Coal Laboratory Practice:

- The following unit standards totalling 17 credits must be achieved:
  - o 9741: "Perform a sink-float analysis", NQF Level 3, 5 Credits.
  - o 110193: "Determine the physical characteristics of coal related to hardness", NQF Level 3, 5 Credits.
  - o 11037: "Determine the particle size distribution of a sample by means of the sieving technique", NQF Level 2, 3 Credits.
  - o 9634: "Prepare analytical samples from a slurry", NQF Level 2, 4 Credits.

- The additional 21 credits are to be obtained from the list of Elective standards.

### **EXIT LEVEL OUTCOMES**

Qualifying learners will be able to:

1. Communicate effectively in the workplace in a variety of ways.
2. Apply mathematical principles in practical applications.
3. Perform basic laboratory skills.
4. Perform primary sample preparation.

5. Sustain Occupational Health and Safety in the Workplace.

6. Explain the nature of the specific work environment.

Critical Cross-Field Outcomes:

o Identifying and solving problems in which responses display that responsible decisions using critical thinking have been made.

o Evident in Exit Level Outcomes: 2, 5.

o Working effectively with others as a member of a team, group, organization and community.

o Evident in Exit Level Outcomes: 1, 5, 6.

● Organising and managing oneself and one's activities responsibly and effectively.

o Evident in Exit Level Outcomes: 2, 3, 4.

● Collecting, analysing, organizing and critically evaluating information.

o Evident in Exit Level Outcomes: 2, 3, 4.

● Communicating effectively using visual, mathematical and/or language skills.

o Evident in Exit Level Outcomes: 1, 2, 5.

o Using science and technology effectively and critically, showing responsibility toward the environment and health of others.

o Evident in Exit Level Outcomes: 2, 5.

● Demonstrating an understanding of the world as a set of related systems by recognizing that problem contexts do not exist in isolation.

o Evident in Exit Level Outcomes: 2, 6.

#### **ASSOCIATED ASSESSMENT CRITERIA**

1.

o Reading, writing and listening skills are utilized in order for effective communication to occur in the workplace.

o Effective verbal and written communications is performed while performing tasks related to laboratory practice in line with contextual specified requirements.

2.

● Mathematical principles and techniques are applied while performing the tasks related to laboratory practice and in other related contexts.

o Mathematical literacy skills are also used to conduct basic calculations within a laboratory context.

3.

● Samples are received and registered accurately in terms of the process within the Laboratory.

● Basic mass measurements are performed in accordance with the specified Laboratory needs and requirements.

4.

o Samples are dried as per specified requirements within the laboratory.

● Bulk and particle **size** of **solid** samples are reduced in accordance with specified requirements.

● Primary sample preparation techniques are conducted according to set quality control principles.

5.

- o Occupational health, safety, hygiene and environmental requirements are met in accordance with the relevant legislation while conducting laboratory tasks and procedures and other related activities.

- The impact of health and safety requirements on the organisation is explained in accordance with specified requirements.

6.

- The products of the organisation are listed.

- o The processes involved in the generation of the product are explained in accordance with specified requirements.

- o The procedures involved in the evaluation of the product are explained in accordance with laboratory procedures.

Integrated assessment:

Integrated assessment at the level of the qualification provides an opportunity for learners to show they are able to integrate concepts, actions and ideas achieved across a range of unit standards and contexts.

Integrated assessment must evaluate the quality of observable performance as well as the thinking behind the performance, and must be based on a summative assessment guide. The guide will spell out how the assessor will assess different aspects of the performance and will include:

- o Observing the learner at work (both in the primary activity as well as other interactions).
- o Asking questions and initiating short discussions to test understanding.
- o Looking at records and reports in the portfolio and reviewing previous assessments.

In some cases inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It is necessary to ensure that the fundamental part of the qualification is also targeted to ensure that while the competence may have been achieved in a particular context, learners are able to apply it in a range of other contexts and for further learning. The assessment should also ensure that all the critical cross-field outcomes have been achieved.

The learner may choose in which language/s he wants to be assessed. This should be established as part of a process of preparing the learner for assessment and familiarising the learner with the approach being taken.

While this is primarily a workplace-based qualification, evidence from other areas of endeavour may be introduced if pertinent to any of the exit-level outcomes. The assessment process should cover both the explicit tasks required for the qualification as well as the understanding of the concepts and principles that underpin the activities associated with the laboratory practices.

### **INTERNATIONAL COMPARABILITY**

An intensive search was conducted via the Internet utilising key words such as qualification, laboratory practice, and analysis. National qualification sites on the Internet were also explored to determine whether qualifications on Laboratory Practices existed and if so whether the content would be useful for the development of this qualification. The following sites were looked at:

- USA: National Laboratory Training Network - <http://www.phppo.cdc.gov/n/th/default>
- USIDNET: 216.181.117.19/index.aspx - The USA is considered a world leader in practices related to evaluation/testing of products through the manufacturing/processing plants.
- o Washington: <http://www.ehs.wustl.edu/new/trainingpreswusm.htm>
- o United Kingdom: [www.ram.org.uk/training/training\\_competency.asp](http://www.ram.org.uk/training/training_competency.asp)

- Belgium: [www.be.sgs.com/environmentalandlaboratorytraining](http://www.be.sgs.com/environmentalandlaboratorytraining)
- Canada: [www.ccohs.ca/resources/training](http://www.ccohs.ca/resources/training)
- New Zealand Qualifications Authority.
- Centre for Skills Co-ordination Africa \* presented by CMETSA.

The qualification was not comparable to a single qualification but similar components were found in the United Kingdom Level 2 Laboratory Assistant and a Level 1 qualification was found for fire assay (gold and silver) and basic analysis.

From the New Zealand Qualifications Authority the following was found:

- A course called Laboratory Training Experience was found during the USIDNET search. The programme however is for learning in the field of Primary Immune Deficiency Diseases, thus no analysis was conducted.

The search on the Washington site found that there were Laboratory Training Safety manuals. In the National Certificate Laboratory Practice: Level 2 the technical unit standards in the core and elective sections deal with:

- Security and disaster control in the laboratory.
- Safety procedures in the laboratory.
- General safety.
- Lab waste management.

These were found in the modules for the above course, but the scope, content and levels of complexity could not be compared as the details for the modules were not available.

The United Kingdom search also revealed the following *two* relevant training courses:

- National Measurements Systems Valid Analytical measurement programme.
- Quality Systems in testing laboratories.

The first course offered more soft type elements i.e. general aspects of working within a laboratory, weighing, pipetting, pH measurements etc. The second one covered the understanding of the benefits of a quality system and preparing for the implementation of a quality system.

Deduction:

- A combination of learning programmes within both courses would possibly deal with outcomes within the NC Level 2.
- A study of the Centre for Skills Co-ordination Africa a training course presented CMETSA was found to be relevant.

Courses included:

- Introduction to measurement -with amongst others the following content; categories of measurement; industrial and scientific measurement, traceability and calibration and writing of **S** unit names and **symbols**.
- Uncertainty of measurement course run in South Africa.

Deduction:

The contents listed above form the basis for the learning towards the unit standards for the Level 2 qualification in laboratory practice namely:

- 9625 - Determine the mass of a substance.
- Source: National Learners' Records Database

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- 9626 - Perform measurements using volumetric equipment.
- 110186 - Reduce bulk and particle size of a solid sample.

The search on Canada's site revealed:

- Advanced Chemical Safety.
- Occupational health and Safety Resources.

The laboratory safety aspect of the course included:

- Safety rules for supervisors.
- General chemical safety rules.
- Flammable safety rules.
- Corrosive safety rules.
- Toxic safety rules.
- Environmental safety rules.
- Reactive safety rules.
- Compressed gas safety.
- Lab safety.
- Hand tool.
- Glassware.

Deduction:

The contents above are all present within the unit standards in the Level 2 qualification particularly:

- 11039 - Handle gas cylinders in a laboratory environment.
- 110174 - Store chemicals in a laboratory.

A search of the Australian qualification framework revealed there is no vocational outcome at Level 2 for their laboratory personnel.

It can thus be deduced that this qualification being submitted for registration on the South African Qualifications Framework, would be in line with needs discovered in various countries around the world.

### **ARTICULATION OPTIONS**

The qualification allows for horizontal and vertical articulation.

Horizontal articulation can occur with:

- 49045: National Certificate: Lump Ore Beneficiation, NQF Level 2.
- 49043: National Certificate: Mineral Processing, NQF Level 2.

Vertical articulation can occur with:

- 50305: National Certificate: Food Laboratory Analysis, NQF Level 3.

### **MODERATION OPTIONS**

- Anyone assessing a learner or moderating the assessment of a learner against qualification must be registered as an assessor with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

- Any institution offering learning that will enable the achievement of this qualification must be accredited as a provider with the relevant Education, Training, Quality, Assurance (ETQA) Body, or with an ETQA that has a Memorandum of Understanding with the relevant ETQA.

- Assessment and moderation of assessment will be overseen by the relevant Education, Training, Quality, Assurance (ETQA) Body, or by an ETQA that has a Memorandum of Understanding with the relevant ETQA, according to the ETQA's policies and guidelines for assessment and moderation.

- Moderation must include both internal and external moderation of assessments, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described in the associated Unit Standards.

o Anyone wishing to be assessed against this qualification may apply to be assessed by any assessment agency, assessor or provider institution that **is** accredited by the relevant **ETQA**.

### CRITERIA FOR THE REGISTRATION OF ASSESSORS

Assessors should be in possession of:

- An appropriate qualification at or above the level of this qualification and preferably relevant workplace practical experience.
- Registration as an assessor with the relevant ETQA.

### NOTES

N/A

### UNIT STANDARDS

|          | ID     | UNIT STANDARD TITLE  | LEVEL   | CREDITS |
|----------|--------|--|---------|---------|
| Core     | 115501 | Receive and register samples in a laboratory   | Level 2 | 3       |
| Core     | 9625   | Determine the mass of a substance  | Level 2 | 2       |
| Core     | 116520 | Apply safety, health and environmental principles and procedures in a workplace  | Level 2 | 2       |
| Core     | 110205 | Demonstrate knowledge of the Mine Health and Safety Act, regulations and definitions   | Level 2 | 5       |
| Core     | 13912  | Apply knowledge of self and team in order to develop a plan to enhance team performance  | Level 3 | 5       |
| Core     | 110178 | Dry material for analytical purposes   | Level 2 | 2       |
| Core     | 110174 | Store chemicals in the laboratory  | Level 2 | 2       |
| Core     | 110139 | Demonstrate basic understanding of different activities related to extraction of minerals  | Level 1 | 6       |
| Core     | 110186 | Reduce bulk and particle size of a dry solid sample  | Level 3 | 10      |
| Core     | 119915 | Manage personal expenditure  | Level 3 | 3       |
| Core     | 119968 | Demonstrate understanding of the role and the processes of a laboratory involved in a mining operation   | Level 2 | 3       |
| Core     | 110075 | Apply basic fire fighting techniques   | Level 1 | 3       |
| Elective | 9638   | Determine the pH of a liquid by means of a pH meter  | Level 3 | 2       |
| Elective | 9744   | Flux samples in preparation for the fire assay fusion the cupellation process  | Level 2 | 6       |
| Elective | 9634   | Prepare analytical samples from a slurry metallurgical process   | Level 2 | 4       |
| Elective | 117877 | Perform one-to-one training on the job   | Level 3 | 4       |
| Elective | 115505 | Handle cyanide safely in a laboratory  | Level 2 | 4       |
| Elective | 14339  | Identify and maintain the types of records required in own industry and understand why it is necessary to create evidence and maintain confidentiality | Level 2 | 5       |
| Elective | 116511 | Carry out basic first aid treatment in the workplace   | Level 1 | 1       |
| Elective | 116670 | Describe the basic environmental factors of ventilating an underground working place to ensure a safe and healthy working environment                  | Level 2 | 3       |
| Elective | 9627   | Perform titrimetric analysis   | Level 4 | 3       |

|             | ID     | UNIT STANDARD TITLE   | LEVEL   | CREDITS |
|-------------|--------|---|---------|---------|
| Elective    | 9637   | Determine the conductance of a liquid by means of a   | Level 3 | 2       |
|             |        | metalurgical process  |         |         |
| Elective    | 9599   | Lift and move material and equipment by means of a forklift   | Level 2 | 3       |
| Elective    | 110182 | Sample a water source for analytical purposes   | Level 3 | 6       |
| Elective    | 110181 | Determine the redox potential of a liquid by means of a potentiometer   | Level 3 | 2       |
| Elective    | 11031  | Sample material from rail or road trucks  | Level 2 | 6       |
| Elective    | 11035  | Dissolve a sample by means of pressure dissolution  | Level 2 | 5       |
| Elective    | 11034  | Prepare samples for analysis by means of microwave digestion  | Level 3 | 4       |
| Elective    | 11039  | Handle gas cylinders in a laboratory environment  | Level 3 | 2       |
| Elective    | 11037  | Determine the particle size distribution of a sample by means of the sieving technique  | Level 2 | 3       |
| Elective    | 110193 | Determine the physical characteristics of coal related to hardness  | Level 3 | 5       |
| Elective    | 110169 | Separate solids from a liquid by means of filtration  | Level 2 | 3       |
| Elective    | 9747   | Determine the precious metal content of an assayed sample by high temperature cupellation and weighing  | Level 3 | 7       |
| Elective    | 9741   | Perform a sink-float analysis   | Level 3 | 5       |
| Elective    | 9745   | Collect precious metals from a fluxed sample into a metal button by means of the fire assay fusion process                                    | Level 2 | 6       |
| Elective    | 12769  | Perform elementary acid-base titrations and interpret the results   | Level 3 | 6       |
| Elective    | 9626   | Perform measurements using volumetric equipment   | Level 2 | 2       |
| Elective    | 9742   | Dissolve solid samples for analysis   | Level 3 | 5       |
| Fundamental | 119454 | Maintain and adapt oral/sign communication  | Level 2 | 5       |
| Fundamental | 119463 | Access and use information from texts   | Level 2 | 5       |
| Fundamental | 119456 | Write/present for a defined context   | Level 2 | 5       |
| Fundamental | 119460 | Use language and communication in occupational learning programmes  | Level 2 | 5       |
| Fundamental | 7480   | Demonstrate understanding of rational and irrational numbers and number systems   | Level 2 | 3       |
| Fundamental | 7469   | Use mathematics to investigate and monitor the financial aspects of personal and community life   | Level 2 | 2       |
| Fundamental | 9007   | Work with a range of patterns and functions and solve problems  | Level 2 | 5       |
| Fundamental | 9008   | Identify, describe, compare, classify, explore shape and motion in 2- and 3-dimensional shapes in different contexts                          | Level 2 | 3       |
| Fundamental | 9009   | Apply basic knowledge of statistics and probability to influence the use of data and procedures in order to investigate life related problems | Level 2 | 3       |