	BQA NCQF QUALIFICATION TEMPLATE	Document No.	DNCQF.P01.GD02
		Issue No.	01
		Effective Date	01.08.2022


SECTION A: QUALIFICATION DETAILS

QUALIFICATION DEVELOPER (S)		Botswana International University of Science and Technology (BIUST)																																			
TITLE	Master of Science in Chemistry								NCQF LEVEL	9																											
STRANDS (where applicable)	1. 2. N/A 3. 4.																																				
FIELD	Natural, Mathematical and Life Sciences			SUB-FIELD	Physical Sciences			CREDIT VALUE	240																												
<i>New Qualification</i>					<input checked="" type="checkbox"/>	<i>Legacy Qualification</i>																															
SUB-FRAMEWORK		<i>General Education</i>			<i>TVET</i>			<i>Higher Education</i>			<input checked="" type="checkbox"/>																										
QUALIFICATION TYPE	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>Certificate</td> <td>I</td> <td>II</td> <td>III</td> <td>IV</td> <td>V</td> <td>Diploma</td> <td>Bachelor or</td> </tr> <tr> <td colspan="3">Bachelor Honours</td> <td colspan="3">Post Graduate Certificate</td> <td colspan="3">Post Graduate Diploma</td> </tr> <tr> <td colspan="5">Masters</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td colspan="3">Doctorate/ PhD</td> </tr> </table>											Certificate	I	II	III	IV	V	Diploma	Bachelor or	Bachelor Honours			Post Graduate Certificate			Post Graduate Diploma			Masters					<input checked="" type="checkbox"/>	Doctorate/ PhD		
Certificate	I	II	III	IV	V	Diploma	Bachelor or																														
Bachelor Honours			Post Graduate Certificate			Post Graduate Diploma																															
Masters					<input checked="" type="checkbox"/>	Doctorate/ PhD																															

RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE:

The need for Chemists with a qualification in Master of Science in Chemistry in Botswana, the region and internationally has been indicated in various reports, surveys, and documents. The Botswana Human Resources Development Council (Top Occupations in High Demand as of December 2016 and 2019) lists Science and Technology Researchers as being in demand in Botswana. The chemistry profession is also described as of short supply at the medium level (Department of Research, Science and Technology 2009). According to the report, chemistry professionals are required in the mining, energy, agriculture, and health


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sectors. Physical Scientists and Physical Science Technicians are also in short supply in the education sector. Chemists are among the 42 professional categories enjoying scarce skill allowance in the civil service owing to their scarcity in Botswana. Chemists, including chemistry teachers, enjoy the highest scarce skill allowance of 40% of a basic salary and are categorized in the same bracket as medical doctors, dentists, engineers, architects, quantity surveyors, and pharmacists. Laboratory chemists are also categorized as a profession with acute scarcity (Tsa Badiri Consultancy 2015).

Most researchers in Botswana hold bachelor's degrees as opposed to Masters's and Doctorate degrees (DRST 2009). There is, therefore, a need to upgrade Chemistry researchers to Honours masters and PhD levels. During the National Development Plan (NDP) 11 the Botswana Government will continue to grow the economy through beneficiation of minerals, various agricultural, and indigenous products/herbs. The proposed qualification will produce graduates with relevant skills to work in these sectors.

Chemistry is required to support other disciplines such as biology, engineering, pharmacy, and medicine. The proposed qualification will help to diversify the economy as there is potential for growth in the chemical industry. This innovative industry will benefit from the skill set produced by the qualification. Botswana has the potential to develop fine chemicals and drugs. This could replace imported fuels and other chemicals. These activities require Chemistry which a bulk of it will be covered in this qualification.

The high demand for chemistry graduates applies regionally and internationally. The Republic of South Africa has a high demand for Research and Development Managers, Environmental Managers, Safety, Health, Environment and Quality Practitioners, Air Pollution Analyst, Water Quality Analyst, Physical Science Teachers, Natural Science Teachers, Chemistry Technicians, Physical Science Technicians, Forensic Technicians, Food and Beverage Technicians, Manufacturing Technicians and Water Inspectors (South Africa Government Gazette 2014). In the United States of America, the demand for Chemists and Chemical Technicians grew by 3.1% and 4.2%, respectively in 2014 (Rovner, 2014). Chemists are in demand in Australia (<http://www.visabureau.com/australia/anzsco/jobs/chemist-jobs-australia.aspx>). In Europe, shortages of Chemical Technicians are expected (C and E-News, 93 issues 24, pp34-26, 2005). The proposed qualification is in line with Vision 2036 as it will promote the following pillars (i) a knowledge-based economy - the use of science, technology, and innovation to propel economies to high levels of efficiency is key to supporting socio-economic development. (ii) promote human capital development-as the country will have developed an internationally competitive workforce that is productive and has international exposure and (iii) Education and skills development-Botswana society will be knowledgeable with a relevant quality education that is outcome-based, with an emphasis on technical and vocational skills as well as academic competencies and (iv) Ecosystem functions and services-providing research for the identification and development of marketable products. It will also produce chemists (and Chemical Technicians) for the region as well as the international community.

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PURPOSE: (itemise exit level outcomes)

The purpose of the Master of Science in Chemistry qualification is to equip graduates with advanced knowledge, skills, and competence to:


- Augment the recent developments in the field of green and eco-friendly reactions, pharmaceutical, Bioinorganic Chemistry and relevant fields of research and development.
- Develop and use analytical, modelling, and spectroscopic techniques to solve emerging global problems.
- Communicate scientific information in a clear and concise manner both orally and in Writing.
- Conduct applied research to address various problems involving Chemistry facing the country working in multidisciplinary teams.
- Develop sustainable and eco-friendly technology in Industrial Chemistry.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

- Bachelor's Degree (NCQF level 7) in the same or a cognate field of study.
- Applicants who do not meet the above criteria but possess relevant industry experience may be considered through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) policies for access aligned with BQA/National policies.

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SECTION B		QUALIFICATION SPECIFICATION	
GRADUATE PROFILE (LEARNING OUTCOMES)		ASSESSMENT CRITERIA	
1. Apply advanced problem-solving skills and application of chemistry in real-life situations.	1.1. Evaluate chemistry literature to solve a problem of chemistry encountered in industry. 1.2. Create innovation for the application of chemistry concepts to solve problems. 1.3. Deduce and demonstrate that the chemistry problem has been adequately solved using analytical techniques		
2. Develop advanced digital skills in using library search tools	2.1. Use the library portal to access databases in search of appropriate literature data such as for problem-solving and innovation. 2.2. Gather and interpret data in a research project in a selected specialization of Chemistry. 2.3. Choose appropriate filters to gather specific and credible information		
3. Analyze advanced chemistry knowledge in the characterization of materials and chemicals	3.1. Apply spectroscopic techniques for the determination of material structure. 3.2. Apply analytical tools such as HPLC to purify and determine the purity of materials and chemicals. 3.3. Verify that the structure and purity of materials and compounds are correct. 3.4. Apply specific techniques to determine the suitable application of materials and chemicals. 3.5. Choose appropriate techniques for the characterization of materials and compounds.		
4. Communicate the results of advanced academic field studies using main concepts, constructs, and techniques to an audience	4.1. Use scientific language correctly to produce a clear and coherent written research project document. 4.2. Use appropriate referencing conventions, avoid plagiarism and observe intellectual property laws in written reports. 4.3. Conduct seminar presentations topics in Chemistry to a wider audience 4.4. Formulate non-verbal forms of representation correctly and appropriately when representing structure in Chemistry.		


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<p>5. Apply advanced scientific knowledge with core ethical virtues in resolving societal issues</p>	<p>5.1. Exercise sensitivity and confidentiality when dealing with sensitive information such as intellectual property.</p> <p>5.2. Critic ethically and culturally sensitive decisions when dealing with sensitive data.</p> <p>5.3. Appraise the procedures for obtaining research clearance and a research permit</p>
<p>6. Apply advanced research methods to solve problems in Chemistry.</p>	<p>6.1. Select appropriate chemistry methodologies, collect accurate and relevant data, evaluate recent literature, discuss, and present the results.</p> <p>6.2. Evaluate and critique current research practices and techniques in Chemistry.</p> <p>6.3. Compare the theoretical predictions with published data to evaluate the significance of the results in context.</p> <p>6.4. Generalize the implications of the research project findings on the problem under consideration.</p> <p>6.5. Analyze and draw conclusions on the results of an experiment.</p> <p>6.6. Propose recommendations related to the research problem</p>
<p>7. Apply advanced research knowledge, skills and competence in a practical research project in Chemistry</p>	<p>7.1. Select a Chemistry project and use relevant research methodology to produce meaningful results.</p> <p>7.2. Plan and conduct scientific experiments in the lab to create and refine innovative products in chemistry.</p> <p>7.3. Evaluate the literature review on a selected research topic when writing a research report.</p> <p>7.4. Analyze collected research data using appropriate statistical methods such as SPSS.</p> <p>7.5. Discuss and present results in the form of a written report and oral presentation.</p>

SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	TITLE	Credits Per Relevant NCQF Level			Total Credits
		Level []	Level [8]	Level [9]	
FUNDAMENTAL COMPONENT					
<i>Subjects/ Courses/ Modules/Units</i>					
CORE COMPONENT <i>Subjects/Courses/ Modules/Units</i>	Advanced Research Methods		12		12
	Masters Research Project			228	228
STRANDS/ SPECIALIZATION	<i>Subjects/ Courses/ Modules/Units</i>	Credits Per Relevant NCQF Level			Total Credits
		Level []	Level []	Level []	
1.					

2.					
Electives					



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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL

TOTAL CREDITS PER NCQF LEVEL

<i>NCQF Level</i>	<i>Credit Value</i>
8	12
9	228
TOTAL CREDITS	240

Rules of Combination:
(Please Indicate combinations for the different constituent components of the qualification)


Credit Contribution for Core and Elective Modules

Component	Credit
Core	240
Elective	0
Total	240

All core modules are compulsory.

This qualification will have at least **240 credits** and take at least twenty-four months to complete.

To attain a Master of Science (Research) in Chemistry the learner should pass the credit combination for the qualification of **12** taught module credits and **228** credits from the Master research project module spread over four semesters.

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ASSESSMENT ARRANGEMENTS

There are no written examinations for learners in Masters in Chemistry. However, learners are required to submit a research proposal that will be evaluated by the department. Learners are also required to show satisfactory progress from semester to semester. This is assessed through a progress report at the end of every semester. Learners are required to submit an MSc dissertation which will be examined according to the ETP guidelines.

Assessment	Weightage
Formative (Satisfactory or unsatisfactory)	0 %
Summative (Thesis examination)	100 %

MODERATION ARRANGEMENTS

Moderators must be BQA or equivalent international organisations registered and accredited. Internal and external moderation will be done in line with both institutional and national policies.

RECOGNITION OF PRIOR LEARNING

Candidates may submit evidence of prior learning and current competence and/or undergo appropriate forms of RPL assessment for the award of credits towards the qualification in accordance with applicable RPL policies and relevant national-level policy and legislative framework

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation and Transfer is non-applicable

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

This qualification is designed to facilitate vertical and horizontal progression both locally and internationally.

Horizontal Progression

Graduates may progress horizontally to the following programmes:

- Master of Science in Organic Chemistry
- Master of Science in Materials Chemistry
- Master of Science in Environmental and Analytical Chemistry
- Master of Science in Physical Chemistry
- Master of Science in Inorganic Chemistry

- Master of Science in Medicinal Chemistry
- Master of Science in Pharmaceutical Science
- Master of Business Administration
- Master of Project Management

Vertical Progression

Graduates may progress vertically to level 10 qualifications:

- Doctor of Philosophy in Organic Chemistry
- Doctor of Philosophy in Materials Chemistry
- Doctor of Philosophy in Environmental and Analytical Chemistry
- Doctor of Philosophy in Physical Chemistry
- Doctor of Philosophy in Inorganic Chemistry
- Doctor of Philosophy in Medicinal Chemistry
- Doctor of Philosophy in Pharmaceutical Science

Employment pathways


Graduates of the qualification may find employment in a range of public and private organisations. Typical roles include:

- Site Chemist
- Materials Chemist
- Medicinal Chemist
- Research and Development Chemist
- Development Chemist
- Synthetic Organic Chemistry
- Water Chemists
- Soil Scientists
- Chemical Technicians
- Research Technicians
- Science and Technology Researchers
- Safety, Health, Environment and Quality Practitioners
- Food and Beverage Technicians
- Quality Assurance Technician in Manufacturing Processes
- Water Inspectors

QUALIFICATION AWARD AND CERTIFICATION

A candidate will be awarded a qualification in Master of Science in Chemistry upon meeting the minimum of 240 credits as prescribed in the rules of combination.

Certificate and transcript will be issued to graduates upon successful completion of Master of Science in Chemistry.

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SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

University of South Africa- Master of Science degree in Chemistry “Full research”; subfield

The University of South Africa has a "Full Research" Master of Science degree in Chemistry offered at the National Qualification Framework (NQF) level 9. The degree is worth 180 credits and should be completed within 3 years. The choice of specialization is usually within the four traditional chemistry areas, analytical, inorganic, and organic and physical chemistry.

University of Manchester- MSc in Research Chemistry

The University of Manchester offers a one-year MSc by Research Chemistry. Unlike our proposed MSc, the University of Manchester MSc by Research Chemistry has taught units equivalent to 45 credits and dissertation project equivalent to 135 credits for a total of 180 credits. It is a level 7 degree based on the Frameworks for Higher Education Qualifications (FHEQ) of UK Degree awarding bodies.

Comparability and articulation of the proposed qualification with the ones examined.

The MSc in Chemistry degree offered by the University of South Africa like the proposed degree, in that it's entirely research with research project aligned to departmental research expertise. The successful examination of the research project is a key component to awarding an MSc degree. The MSc from the University of Manchester has 75% credits based on Research with the remaining from course work in the early semesters of study. Thus, the proposed qualification generally compares well with the qualifications studied in terms of content, scope, learning outcomes and hours to be achieved before assessment. The assessment assesses the ability to analyze concepts, synthesize whole ideas and concepts, and to evaluate the value of concepts, prepare and communicate a research project report.

REVIEW PERIOD

Review period is 5 Years and as and when the need arises.