SECTION A:	***QUALIFICATION DETAILS***																	
QUALIFICATION DEVELOPER (S)	University of Botswana																	
TITLE	Master of Science (Chemistry)													***NCQF LEVEL***	9			
FIELD	Natural, Mathematical and Life Sciences		***SUB-FIELD***	Chemistry										***CREDIT VALUE***	240			
New Qualification		✓	*Review of Existing Qualification*															
SUB-FRAMEWORK	*General Education*		*TVET*		*Higher Education*	✓												
QUALIFICATION TYPE	*Certificate*	*I*		*II*		*III*		*IV*		*V*		*Diploma*		*Bachelor*				
	Bachelor Honours		*Post Graduate Certificate*		*Post Graduate Diploma*													
	Masters	✓	*Doctorate/ PhD*															

RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE:

Chemistry's broad scope offers exciting employment opportunities in rapidly growing fields, such as biochemistry, biotechnology, forensic science, materials science, polymers, pharmaceutical/medicinal chemistry, chemical education research, and environmental science. Master of Science (Chemistry) graduates are equipped with skills

to enter any of these fields since chemistry is the central science with connections to biology, mathematics, physics, medicine, and environmental sciences.

Botswana's economy drivers include mining, agriculture, and tourism, which require highly qualified graduates who will ascertain quality in the processes and commodities derived from these drivers. The above mentioned are scare skills in Botswana hence the need to produce more skilled people in this particular field of science. Jobs in these fields are mostly filled by expatriates in Botswana.

The qualification will help Botswana to have chemical experts such as geochemists, water chemists, material scientists, food scientists, quality assurance scientists, and medical laboratory scientists as outlined in the HRDC document for the most needed skills in Botswana, thus, helping Botswana to achieve the objectives of Pillar 1 (Sustainable Economic Development) of the vision 2036 specifically the development of knowledge-based economy, strategy priority 5: strengthening skill development of the Botswana Education and Training Sector, Strategic Plan (ETSSP-2015-2020 and achieve higher transition rates from secondary to tertiary education as highlighted in article 5.9 of the National Development Plan 11 2017-2023).

PURPOSE:

The purpose of the qualification is to produce graduate who have most advanced knowledge, skills, and competences to:

- Produce highly skilled labour which will participate in research and development centers.
- Undertake specialized research and analytical techniques necessary for professional chemists.
- Apply new skills and techniques to identify and solve problems in a range of professional contexts.
- Implement a strategy for dissemination of research findings and defend the research work and outputs before a diverse audience.
- Exercise high level of initiative and scholarly integrity in a wide range of context.

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirement:

- Bachelor of Science Degree in Chemistry (NCQF level 7) or equivalent.

- There will be access through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) in accordance with the RPL and CAT National Policies.

SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
LO 1. Demonstrate advanced knowledge at the frontier of chemistry or cross-disciplinary fields capable of contributing towards development of professional practice through research or reviewing existing knowledge.	1.1 Conduct original and scholarly research of international standard to solve problems. 1.2 Formulate a research question. 1.3 Conduct comprehensive literature review and synthesize knowledge. 1.4 Design an appropriate research methodology for the problem at hand.
LO 2. Demonstrate advanced skills and techniques including critical analysis, evaluation and synthesis of new and complex ideas to develop new knowledge.	2.1 Solve a chemistry problem through research. 2.2 Identify the right kind of data required to solve a chemistry problem. 2.3 Collect, analyse data and interpret findings using appropriate statistical analytical tools and techniques. 2.4 Produce a report using scientific academic writing.
LO 3. Implement a strategy for dissemination of research findings and defend the research work and outputs before a diverse audience	3.1 Draft reports using scientific academic writing. 3.2 Present research findings at national, or regional scientific meetings. 3.3 Compose an original research MSc dissertation. 3.4 Publish manuscripts in international-peer reviewed journals with a known impact factor.

LO 4. Demonstrates advanced leadership skills, mastery of professional practice and management with some responsibility and accountability of resources.	4.1 Plan and execute a research project with minimal supervision 4.2 Design steps towards solving the problem 4.3 Adhere to standard operating systems (SOPS) in a chemical environment.
LO 5. Employ scholarly and professional integrity.	5.1 Apply advanced research methodologies to contribute new knowledge in chemistry. 5.2 Adhere to ethical research and academic integrity.

LO 6. Demonstrate strategic leadership, proficiency in professional practice and associated systems design in research.	6.1 Plan and execute a research project independently. 6.2 Analyse a scientific problem. 6.3 Design steps towards solving a problem. 6.4 Analyse and evaluate of existing professional practice. 6.5 Place issues and ideas in perspective in specialized research.
LO 7. Exercise high level of initiative and scholarly integrity in a wide range of context	7.1 Write reports using scientific academic writing. 7.2 Adhere to ethical research and academic integrity. 7.3 Apply advanced research methodologies to contribute significant knowledge in Chemistry

SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total*** ***(Per** Subject/ Course/ Module/ Units)*
		Level [9]			
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	Separation Science and Spectrometry				***15***
	Advanced Inorganic Chemistry				***15***
	Advanced Physical Chemistry				***15***
	Advanced Organic Chemistry				***15***
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Supervised research				***120***
	Analytical Chemistry				
	Electroanalytical Chemistry				***15***

ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	Process instrumentation and sample handling				***15***
	Chemometrics				***15***
	Applications of Analytical Chemistry				***15***
	Organic chemistry				
	Spectroscopic Methods in Organic Chemistry				***15***
	Methods and Design of Organic Synthesis				***15***
	Advanced Laboratory Synthesis				***15***
	Introduction to the Chemistry and Biosynthesis of Natural Products				***15***
	Inorganic chemistry				
	Main Group Chemistry				***15***
	Physical Methods in Inorganic Chemistry				***15***
	Kinetics and Mechanisms of Reactions in Transition				***15***

	Metal, Coordination and Organometallic Chemistry				
	Chemistry of the Solid State, Metals and Semiconductors				***15***
	Organometallic Chemistry in Homogeneous Catalysis and Synthesis				***15***
	Physical Chemistry				
	Advanced Physical Chemistry				***15***
	Quantum Mechanics and Spectroscopy				***15***
	Interfacial Phenomena				***15***
	Polymer Chemistry				***15***
	Advanced Chemical Kinetics				***15***

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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
9	***240***
TOTAL CREDITS	***240***

Rules of Combination:

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

A Candidate must complete a total of 240 credits.

The candidate shall register for 60 credits of the fundamental courses, 120 credits of the core courses (which is a research project in the chosen area of specialisation).

The candidate shall register for at least 60 credits chosen from one of the four elective/optional courses in the specialization area of choice.

ASSESSMENT ARRANGEMENTS
Formative assessment (tests, concept papers, presentations, and assignments) shall contribute 50% and summative assessment comprising a written dissertation/report and an oral defence will be used to assess the candidate's research. This shall contribute 50 %.
MODERATION ARRANGEMENTS
There shall be internal and external moderation arrangements done by BQA registered and accredited moderators.
RECOGNITION OF PRIOR LEARNING
This will be done in line with the National Recognition of Prior Learning (RPL) policy.
CREDIT ACCUMULATION AND TRANSFER
Transfer of credits from another recognized University or equivalent Institution of higher education may be considered on production of satisfactory documentation and references. No more than one-third of the total number of credits required for the programme can be credited from study at another university.
PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)
Horizontal Articulation: • Master of Science (Medicinal Chemistry) • Master of Science (Industrial Chemistry) • Master of Science (Forensic Science) • Master of Science (Environmental Science) • Master of Science (Material Science)

Vertical Articulation:

- Doctor of Philosophy (Chemistry)
- Doctor of Philosophy (Medicinal Chemistry)
- Doctor of Philosophy (Industrial Chemistry)
- Doctor of Philosophy (Forensic Science)
- Doctor of Philosophy (Environmental Science)
- Doctor of Philosophy (Material Science)

Employment pathways:

- Senior Secondary School Teacher
- Lecturer in academic institutions
- Research and development chemist in industry
- Chemist in mining industry
- Chemist in food industry
- Chemist in fuel industry
- Environmental quality control professional.
- Chemist in regulatory agencies dealing with environment, drug quality, consumer protection
- Chemist in energy and utilities (power and water)
- Quality control chemist in water treatment and supply
- Consultant for pharmaceutical manufacturers
- Chemist in consumer goods manufacturing
- Consultant in agricultural enterprises
- Chemist in fertilizer manufacturing.
- Consultant in all enterprises dealing with chemicals.
- Consultant in customs departments
- Chemist in bureaus of standards
- Process Chemists

QUALIFICATION AWARD AND CERTIFICATION

Qualification award:

On successful completion, a candidate will be awarded a Master of Science degree in Chemistry. The candidate should have achieved a minimum of 240 credits according to the rules of combination to be awarded this qualification.

Certification:

The successful candidate will be awarded a Master of Science (Chemistry) and an official transcript.

REGIONAL AND INTERNATIONAL COMPARABILITY

Similarities and differences:

Main Similarities

- All the compared Universities have a similar duration for the MSc (Chemistry) qualification to the University of Botswana (2 years).
- In all the compared Universities, the research project is in area of specialisation of the candidate (i.e., Analytical, Inorganic, Organic, or Physical Chemistry).
- All the compared Universities have similar credits for the dissertation/Thesis module to the University of Botswana (120).
- Both the University of Botswana and the University of Auckland, New Zealand, have 240 credits as the minimum credits for the MSc (Chemistry) degree qualification.

Main Difference(s)

The minimum credits for the MSc (Chemistry) degree qualification are 288 and 390 credits at the University of Namibia and Makerere University, respectively.

REVIEW PERIOD

Every 5 years