

BQA NCQF QUALIFICATION TEMPLATE

SECTION A: QUALIFICATION DETAILS																	
QUALIFICATION DEVELOPER (S)			University of Botswana														
TITLE		Doctor of Philosophy in Biological Sciences								NCQF LEVEL		10					
STRANDS (where applicable)		N/A															
FIELD		Natural, Mathematics and Life Sciences								CREDIT VALUE		360					
SUB FIELD		Biological Sciences															
New Qualification			Legacy Qualification			✓			Renewal Qualification								
									Registration Code								
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: The Doctor of Philosophy in Biological Sciences (PhD Biological Sciences) is a four-year research-based graduate qualification. Research in the various disciplines of Biological Sciences (Ecology, Microbiology, Plant Sciences, Zoology, Molecular Biology, and various Applied aspects of these) has an important role to play in generating new knowledge and solving national (as well as regional and global) problems, for development. The national development efforts in agriculture, climate change adaptation, environment, health, industrial production, natural resources utilization and management, tourism and other disciplines have aspects of biological resources – microorganisms, plants and animals and their interactions. In light of this, the qualification will provide training of high-quality personnel and independent thinkers in various fields of Biological Sciences and its applications through this qualification. The qualification is premised on national development goals as set out in the HRDC (2016); NDP11 (2017); Vision 2036: <i>Achieving Prosperity for All</i>, particularly to Pillars 1, 2 and 3 dealing with Sustainable Economic Development, Human & Social Development, and Sustainable Environment respectively (of the Vision), and ETSSP 2015-2020. The Botswana Education & Training Sector Strategic Plan (ETSSP 2015-2020) states, “ETSSP sets out priority programmes and interventions																	

that will strengthen students' acquisition of relevant knowledge and skills" (ETSSP, 2015). This qualification will contribute towards building, sustaining and strengthening the nation's human resource capital for impact-oriented research for development to meet the goal of the country being a knowledge-based economy (as outline in Vision 2036).

The qualification will build capacity in various fields of Biological Sciences to meet the current and future needs of Botswana and the international community in accordance with Botswana's Vision 2036 Pillar 1. There is a need to train, develop and produce skilled graduates who are researchers in the field of biology. Research in Biological Sciences is needed to effectively exploit natural resources such as plants, animals and microorganisms as stated in the National Development Plan 11 Section 7.9 (2017). The Human Resource Development Council (2019) produced a list of "Priority Skills and Employment Trends", and in that list, Life Science Professionals are listed as one of the Top Occupations in demand in Botswana.

The HRDC 'Priority Skills 2023/2024' document further specifically lists 'Scientific Researchers' as one of the occupations needed. Highly trained scientists in Biological Sciences will contribute to several specialist priority areas listed in the HRDC document such as aquaculture, bioinformatics, biotechnology, cytology, entomology, environmental engineering, epidemiology, fish pathology, food science, forensic science, genetics, horticulture, meat inspection, microbiology, molecular biology, nutrition, one health, plant ecology, plant anatomy & physiology, plant pathology, quality assurance, seed technology, toxicology, university and college educators, vaccinology, virology, waste management, weed science, wildlife ecology and management.

The qualification thus aims to produce science researchers who specialise in Biological Sciences. This qualification will also contribute towards the attainment of the African Agenda 2063 Aspiration 1 of a prosperous Africa based on inclusive growth and sustainable development in producing well educated citizens in science, technology, and innovation. Additionally, it will also contribute to the achievement of the United Nations Sustainable Development Goal 4 of ensuring inclusive and equitable education and the promotion of lifelong learning opportunities for all. It will produce graduates who will play a part in helping the actualisation of the UN SDG 9, 13 and 15. It will also ensure that all learners acquire the knowledge and skills needed to promote sustainable development.

This qualification will also address regional aspirations as articulated in the African Union Agenda 2063. For example, Aspiration 1 of the AU Agenda 2063 is about 'A Prosperous Africa based on Inclusive Growth and Sustainable Development'. Agenda 2063 states that to attain this aspiration, it will mean that "Africa will have well educated citizens underpinned by a skills revolution deliberately focusing on science, technology and innovation for a knowledge society". Part C of the Popular Version of Agenda 2063 lists 13 Flagship qualification to kick start the implementation of Agenda 2063. This qualification will therefore address the following two flagship programs of Agenda 2063: 'Embark on skills revolution and science, technology and innovation' 'Transform, grow and industrialize our economies through beneficiation of natural resources'

PURPOSE: (itemise exit level outcomes)

The purpose of the PhD in Biological Sciences qualification is to produce graduates with the most advanced knowledge, skills and competencies to:

- Conduct the most advanced independent scholarly research in Biological Sciences field
- Synthesise knowledge in the Biological sciences area to formulate solutions to complex situations advanced research methods.

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- Extend the limits of what is currently known through innovative, collaborative and high-quality research and scholarship, contributing to knowledge creation and provision of practical solutions within the field,
- Apply expertise knowledge and skills in Biological Sciences to resolve national and global industrial, economic, technological, environmental and socio-cultural challenges,
- Comply with standards associated with national and international peer-reviewed publishing and modern communication technologies.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

- Master's Degree (NCQF level 9) in biological sciences or related cognate field of study.

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

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SECTION B QUALIFICATION SPECIFICATION	
GRADUATE PROFILE (LEARNING OUTCOMES)	ASSESSMENT CRITERIA
1. Review biological sciences literature to conceptualize novel solutions and technologies in a specialist field of Biological Sciences	1.1 Assess current knowledge, theories, and discoveries in biological sciences, identifying priority areas and novel methodologies for future research 1.2. Synthesise interdisciplinary knowledge of biological sciences, to formulate hypotheses leading to cutting edge solutions to identified priorities/problems. 1.3. Analyze recent advancements in the biological sciences to identify emerging trends and areas where new research could contribute to scientific development and innovation. 1.4. Formulate clear, research-driven hypotheses, experiments or questions, that contribute to the advancement and development of biological sciences.
2. Evaluate and apply current research to address complex problems in Biological Sciences	2.1 Formulate evidence-based solutions to address the identified biological problems, using synthesized research data to justify recommendations 2.2 Present synthesized research and proposed solutions, ensuring the communication of complex ideas in a structured, logical manner that is accessible to both scientific and non-scientific audiences
3. Collate, analyze and interpret biological information to make	3.1. Collect relevant biological data from a variety of credible sources, including scientific databases, peer-

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sound biological conclusions in specialized areas of Biological Sciences	reviewed journals, field sampling and experimental results. 3.2. Assess the quality, reliability, and validity of the retrieved biological information, demonstrating high competence in data handling, processing and analysis. 3.3. Apply advanced analytical methods and scientific reasoning to interpret biostatistical and biological data, deriving meaningful biological conclusions to explain observed phenomena and trends. 3.4. Formulate scientifically sound, evidence-based and testable hypotheses, that ensure conclusions are logical, informed, and applicable to the real-world.
4. Communicate scientific findings appropriately and effectively in the field of Biological Sciences, using appropriate formats and methods tailored to diverse audiences.	4.1. Select appropriate communication formats and methods based on the audience's background and comprehension level. 4.2. Break down complex biological concepts and findings into accessible and clear information, avoiding jargon where possible. 4.3. Use analogies, examples, or diagrams to enhance understanding without diluting scientific accuracy 4.4. Integrate audio-visual, modern graphics and electronic media to simplify concepts and enhance learning. 4.5. Utilize verbal communication skills, including appropriate tone, pace, and engagement techniques to maintain audience interest and facilitate learning
5. Conduct most advanced research and demonstrate capacity to develop and apply new skills and techniques to identify and solve problems in biological sciences.	5.1. Develop specialized techniques and methodologies tailored to achieve the research objectives. 5.2. Develop competence and innovate new technical skills in cutting-edge areas of specialisation in biological sciences. 5.3. Apply critical thinking to interpret complex data, to understand and solve complex underlying biological phenomena. 5.4. Utilize problem-solving skills to troubleshoot experimental/conceptual issues, optimize protocols and methodologies to overcome complex biological challenges.

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	5.5. Synthesize research findings to understand their implications within the field of biological sciences and contribute new knowledge to the field of biological science. 5.6. Develop and communicate solutions or recommendations based on research results that address the original problem, considering potential applications and future research directions
6: Demonstrate independence and teamwork in conducting innovative investigations to address societal challenges in biological and allied sciences, contributing to both knowledge creation and practical solutions within the field	6.1. Set personal and team goals aligned with addressing specific societal challenges, ensuring alignment with the broader investigative aims. 6.2. Utilize regular meetings, progress updates, and open communication channels to facilitate information sharing, troubleshooting, and mutual support within the team. 6.3. Conduct independent research and propose innovative methods or techniques that could enhance the project's effectiveness and relevance. 6.4. Collaborate across biological and allied sciences (e.g., environmental science, public health, bioinformatics) to incorporate a range of perspectives, enriching the investigation's impact on societal challenges 6.5. Draw on complementary skills and knowledge within the team to develop comprehensive, interdisciplinary approaches to complex issues. 6.6. Contribute ideas that bridge theoretical knowledge with practical solutions, addressing societal needs such as healthcare improvements, environmental conservation, or sustainable agriculture. 6.7. Evaluate the project's outcomes, considering both the scientific contributions and their potential impact on societal well-being. 6.8. Document and share findings through publications, presentations, or outreach, emphasizing the relevance of biological science in creating solutions to pressing societal challenges.
7. Manage biological research projects efficiently, including time management, resources allocation	7.1. Outline the research objectives, timelines, and key milestones, ensuring a structured approach to each phase of the project.

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and adherence to international standards and ethical guidelines.

- 7.2. Create a realistic project timeline, allocating sufficient time for data collection, analysis, and reporting, and adjusting as needed for unforeseen challenges.
- 7.3. Identify the necessary materials, equipment, and budgetary requirements for each stage of the project.
- 7.4. Optimize resource use by prioritizing essential components and collaborating with team members or departments to share tools or facilities where possible.
- 7.5. Ensure compliance with ethical guidelines, including obtaining appropriate approvals from ethical review boards, particularly when involving human or animal subjects.
- 7.6. Maintain data integrity, confidentiality, and responsible conduct, adhering to best practices in data collection, storage, and reporting.
- 7.7. Review project progress against established milestones, identifying any delays or issues that may impact project success.
- 7.8. Implement problem-solving strategies and adjust timelines, resource allocations, or methods as necessary to keep the project on track while maintaining ethical standards.

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SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	TITLE	Credits Per Relevant NCQF Level			Total Credits
		Level []	Level []	Level []	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units					
CORE COMPONENT Subjects/Courses/ Modules/Units	Research Proposal	90			90
	PhD Thesis	270			270
STRANDS/ SPECIALIZATION	Subjects/ Courses/ Modules/Units	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

NCQF Level	Credit Value
Level 10	360
TOTAL CREDITS	360

Rules of Combination:

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

To complete this doctoral qualification, a learner shall accumulate a total of 360 credits divided as follows:

- i) Research Proposal worth 90 credits
- ii) PhD Thesis worth 270 credits

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BOTSWANA
Qualifications Authority

ASSESSMENT ARRANGEMENTS

Formative assessment weighting of 25%

Summative assessment with weighting of 75%

Assessment will be carried out by qualified assessors preferably with Doctoral degree in Biological Sciences

MODERATION ARRANGEMENTS

Internal and external moderation shall be carried out by qualified moderators with a minimum Doctorate degree (NCQF level 10) in a relevant field and registered with a recognized regulatory body.

RECOGNITION OF PRIOR LEARNING

Recognition of Prior Learning (RPL) will be applicable for consideration for award in this qualification and will be in line with institutional and National policies.

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation Transfer (CAT) will be applicable for consideration for award in this qualification and will be in line with institutional and National policies.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation

Doctor of Philosophy (Science Education)

Vertical Articulation

PhD in Biological Sciences is the highest qualification and there is no possible articulation. Graduates of the programme can however access post-doctoral studies to expand their knowledge in the area of research.

Employment Pathways

1. Academia
2. Research scholar in biological sciences
3. Science writer
4. Microbiologist
5. Biomedical Scientist
6. Bioinformatician
7. Pharmacologist
8. Ecologist
9. Botanist
10. Zoologist
11. Molecular Biologist
12. Plant/Animal Systematists

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13. Science writer
14. Food technologist
15. Research Associate
16. Resource managers
17. Policy formulation and implementation
18. Negotiators for regional and global bi- and multi-lateral agreements
19. Consultants

QUALIFICATION AWARD AND CERTIFICATION

The Doctor of Philosophy (Biological Sciences) degree shall be awarded to a candidate after accumulating a total of 360 credits and approved by the Senate. The graduate will be issued with a certificate bearing the qualification title and a transcript.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

Benchmarking has been done against other Doctor of Philosophy qualifications offered by the University of Nairobi, Kenya and University of Cape Town, South Africa and Nanyang Technological University, Singapore in relation to graduate profiling, content, assessment criteria and employment pathways. The Doctor of Philosophy degrees in these universities had also been benchmarked against other reputable international universities. The outcomes of this process are highlighted below.

University of Cape Town (South Africa - Regional)

Title of Qualification is the same.

NQF Level & Credit Value or Duration: NQF level (10) and duration of the Doctor of Philosophy Degree is similar to our program. The total credits (360) are also similar at University of Cape Town and University of Botswana.

The duration of the Doctor of Philosophy Biological Sciences differs at University of Cape Town and University of Botswana. The minimum duration at University of Cape Town is 2 years but the maximum duration on full time/part time basis are not stated. For University of Botswana, the duration is 3-4 years (full-time) and 4-8 years (part-time).

Main Exit Outcome(s): Main exit outcomes are similar to the proposed Doctor of Philosophy Biological Sciences.

Domains/Modules/Courses/Subjects covered (Fundamental, core & electives): Are similar to our Doctor of Philosophy Biological Sciences

Assessment strategies and Weightings: The Doctor of Philosophy Biological Sciences at University of Cape town is similar to our qualification by assessment by assessment of oral presentations, and thesis examined by external examiner.

Qualification rules and minimum Standards for the award of the qualification: Are different to our Doctor of Philosophy Biological Sciences. For a student to qualify, the student should pass the PhD thesis examination at University of Cape Town. For University of Botswana, the student should have passed thesis examination and successfully defend the thesis during oral presentation. All or

part of the thesis may be published in accredited journals at University of Cape Town while at least 1 publication is required on the proposed qualification..

Education and Employment Pathways – These are similar to the proposed Doctor of Philosophy Biological Sciences.

University of Nairobi (Kenya- Regional)

Title of Qualification is similar to the proposed Doctor of Philosophy Biological Sciences at University of Botswana but with named areas of specialization e.g. Doctor of Philosophy Biological Sciences (Mycology); Doctor of Philosophy Biological Sciences (Entomology).

NQF Level & Credit Value or Duration: NQF level (10) and duration of the Doctor of Philosophy Degree is similar to our program. The total credits and duration of the Doctor of Philosophy Biological Sciences at University of Nairobi are not stated.

Main Exit Outcome(s): Are similar to our Doctor of Philosophy Degree.

Domains/Modules/Courses/Subjects covered (Fundamental, core & electives): Are similar to our Doctor of Philosophy Biological Sciences.

Assessment strategies and Weightings: The degree at University of Nairobi is similar to our Doctor of Philosophy Biological Sciences in requiring thesis examination by external examiner. The University of Nairobi does not specify oral examination that is on proposed qualification used..

Qualification rules and minimum Standards for the award of the qualification: Are different to our Doctor of Philosophy Biological Sciences. For a student to qualify, the student should pass the PhD thesis examination at University of Nairobi. For University of Botswana, the student should have passed both thesis examination and successfully defend the thesis during oral presentation. Requirements for publication(s) at University of Nairobi are not stated/mentioned while at least 1 publication is required on the proposed qualification..

Education and Employment Pathways – These are similar to the proposed Doctor of Philosophy Biological Sciences. For employment both degrees lead to similar employment opportunities.

Nanyang Technological University (Singapore- International)

Title of Qualification is the same to the proposed Doctor of Philosophy Biological Sciences at University of Botswana.

NQF Level & Credit Value or Duration: NQF level (10) and duration of the Doctor of Philosophy Degree is similar to our program. The total credits of the Doctor of Philosophy Biological Sciences at Nanyang Technological University are not stated.

The duration of the Doctor of Philosophy Biological Sciences at Nanyang Technological University (2-5 years (full time); 3-5 years (part time)) and University of Botswana (3-4 years (full-time); 4-8 years (part-time)) is different.

Main Exit Outcome(s): Are similar to our Doctor of Philosophy Degree.

Domains/Modules/Courses/Subjects covered (Fundamental, core & electives): Are similar to our Doctor of Philosophy Biological Sciences in domains that include molecular biology, microbiology, plant biology; but our Doctor of Philosophy Biological Sciences does not cover neurobiology. Our Doctor of Philosophy Biological Sciences differs with Nanyang Technological University in the coverage of domains such as entomology and Zoology. The Doctor of Philosophy Biological Sciences at Nanyang Technological University also differs with ours in offering core courses in year 1.

Assessment strategies and Weightings: differs with ours by including a PhD qualifying exam (QE) prior to starting the project. The QE panel consist of at least 3 independent members (chaired by senior faculty staff i.e., Associate Professor or above). Lecturers and senior lecturers cannot serve as members of the QE panel. However, the QE exam is comparable to our PhD proposal presentation done before starting the research project. PhD proposal presentation on the proposed qualification does not comprise a QE panel but staff from the relevant area of speciality and other staff members participate.

The thesis advisory committee at Nanyang Technological University meets with the student four times (month 8, 18, 30, 42) while there is no stipulated meetings for our qualification. The degree at Nanyang Technological University is similar to our Doctor of Philosophy Biological Sciences in requiring thesis examination by external examiner and oral examination.

Qualification rules and minimum Standards for the award of the qualification: Are similar to our Doctor of Philosophy Biological Sciences as students should have passed thesis examination and successfully defend the thesis during oral presentation. Requirements for publication(s) at Nanyang Technological University are not stated/mentioned while at least 1 publication is required on the proposed qualification..

Education and Employment Pathways – These are similar to the proposed Doctor of Philosophy Biological Sciences. For employment both degrees lead to similar employment opportunities.

Conclusion:

Overall, the proposed Doctor of Philosophy Biological Sciences shares similarities regionally (Cape Town and University of Nairobi) and internationally (Nanyang Technological University) with proposed Doctor of Philosophy Biological Sciences. The notable differences have been noted across qualifications at all three institutions.

REVIEW PERIOD

Every 5 years.

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For Official Use Only:

CODE (ID)			
REGISTRATION STATUS	BQA DECISION NO.	REGISTRATION START DATE	REGISTRATION END DATE
LAST DATE FOR ENROLMENT		LAST DATE FOR ACHIEVEMENT	



BOTSWANA
Qualifications Authority