Health Professions Council of Zambia

CORE COMPETENCIES REFERENCE MANUAL FOR BIOMEDICAL SCIENTISTS TO PRACTISE IN ZAMBIA

CORE COMPETENCIES& MINIMUM STANDARDS

Contents

QUALIFICATION AND RESPONSIBILITIES:

Title of the programme: Bachelor of Science in Biomedical Sciences or its equivalent

Key accountability for the job: Laboratory Screening and Diagnosis of Disease

Primary roles and responsibilities:

- Conduct routine and specialized laboratory screening and diagnosis of disease
- Monitor drug treatment of patients
- Conduct surveillance of infectious diseases
- Manage the laboratory
- Conduct quality assurance activities
- Ensure laboratory commodity security
- Identify abnormal or unexpected results and report back
- Accurately maintain records
- Maintain and run specialized laboratory equipment
- Supervise, mentor and support trainee Biomedical Professions and other staff
- Conduct biomedical research in an ethical manner

1.0. INTRODUCTION

The Health Professions Council of Zambia (HPCZ) is a statutory body that was established by the Health Professions Act No. 24 of 2009. The Act renames and continues the existence of the Medical Council of Zambia established by the Medical and Allied Professions Act of 1977. The Health Professions Act No. 24 provides for the registration of health practitioners and regulation of their professional conduct; provides for the licensing of health facilities and the accreditation of health care services provided by health facilities; and provides for the recognition and approval of training programmes for health practitioners.

Following the issuance of the guidelines for introduction of licensing examinations for health professionals to be registered with the Health Professions Council of Zambia, this bulletin provides an outline of the minimum competency standards for registrants who have successfully completed the Degree in Biomedical Sciences or its equivalent seeking provisional or temporal registration to practice as Biomedical Scientists in Zambia.

2.0. EXIT EXAMINATIONS AND AWARD OF BSC- BIOMEDICAL SCIENCES BY TRAINING INSTITUTIONS

Training institutions, private or public (local or foreign) approved and recognised by the Health Professions Council of Zambia are mandated to examine and graduate their students under their own seal and authority. The BSc-Biomedical Sciences or its equivalent is designated the primary qualification of the practitioner and it is a pre-requisite requirement for eligibility for licensure examinations. Accordingly, a holder of BSc-Biomedical Sciences or its equivalent will be required to take and pass the HPCZ licensure examination to qualify for registration with the Council as a Biomedical Scientist.

3.0. LICENSURE EXAMINATIONS BY THE HEALTH PROFESSIONS COUNCIL OF ZAMBIA

A person shall not practise as a health practitioner, unless that person is registered as a health practitioner in accordance with the Health Professions Act No. 24 of 2009. In the exercise of its functions under this Act, the 2nd and the 3rd Council of the Health Professions Council of Zambia instituted Licensure Examinations to help maintain standards given the emergence of multiple private and public training institutions. This "Bulletin of Information on the Core Competencies and Minimum Standards for Biomedical Scientists to Work in Zambia" binds all parties regulated under this Act. Examination fees for licensure examinations, as prescribed by the Council, are payable to the Health Professions Council of Zambia as part of the eligibility to sit licensing examination.

The HPCZ Licensure Examination assesses a Biomedical Scientist's ability to apply knowledge, concepts, and principles, and to demonstrate fundamental patient-centred skills, that are important in health and disease and that constitute the basis for safe and effective patient care. The HPCZ Licensure Examination includes, but is not limited to, theoretical and practical examinations which complement each other as prescribed in the curriculum for which this programme was approved. No component is a stand-alone in the assessment of readiness for practice in Zambia.

The candidate will be assessed under three domains, namely:-

1. Knowledge
2. Skills
3. Attitude

The above domains will be assessed by means of a theory exam comprising of multiple choice questions followed by a practical examination structured asspot and scenario questions.

The five **main subject areas** (assessed under all three learning domains**)** for Biomedical Scientists in Zambia are:

1. Medical Microbiology and immunology
2. Medical Biochemistry and molecular biology

3. Cellular Pathology and Histopathology
4. Medical Parasitology
5. Haematology and Blood Transfusion Science

Other subject areas prescribed by the curriculum such as Laboratory Management and Entrepreneurship may only be assessed as cognitive domains in the theory paper. The overall expected outcomes of the Licensure examination is to ensure that the candidate will meet the minimum standards for the role as a Biomedical Scientists.

4.0. COMPETENCE OUTCOME GUIDELINES

The curriculum must have identified attributes in each educational domain (knowledge, skills and attitude) and present them to guide student learning and assessment by examiners. HPCZ directs Biomedical Scientists to be compassionate and empathetic in caring for patients and to be trustworthy and truthful in all their professional dealings. Biomedical Scientist have a responsibility to respect and provide care that is up to standard for the lives and health that are entrusted by patients.

The process of licensure seeks to detect the candidate's attainment in each educational domain (knowledge, skills and attitude) and evaluates the minimum competence standards as benchmarks for licensure to practice the profession. It also guides prospective candidate's learning and assessment by examiners. HPCZ, on behalf of the general public and professional stakeholders, expects holders of the BSc- Biomedical Sciences to meet the minimum competency standards outlined in this document. The expectations are largely in three main competence areas as follows:

Overall Outcomes

a) Scientific Knowledge

1.1. Application of biomedical science knowledge in healthcare provision.

1.2. Provision of a good standard of practice by keeping abreast with scientific and professional knowledge in the field.

1.3. Understand scientific process and the role of biomedical research in human health

b) Skills and Performance

2.1. Performing quality and reliable diagnostic procedures and utilizing laboratory equipment appropriately.

2.2. Critically read scientific literature and perform basic statistical data analysis

2.3. Effectively managing the laboratory and ensuring safety in the work place.

c) Attitudes, Values and Professionalism

3.1. Uphold and respect patient's autonomy, dignity and confidentiality.

3.2. Work with colleagues in ways that best serve the patient's interests.

3.3. Adhering to good laboratory practice.

5.0. CORE COMPETENCIES: BSc IN BIOMEDICAL SCIENCES

DOMAIN: KNOWLEDGE		
STATEMENT COMPETENCY	**COMPETENCY**	**SUBCOMPETENCIES**
Demonstrate Understanding and Application of Basic Health Sciences Requisite or Complimentary to the Study of Biomedical Sciences	1. Basic Sciences	1.1. Explains normal human body structure and function 1.2. Explains the biochemical composition and scientific basis of chemical interactions with biological systems of the human body 1.3. Explains the role of genetics in health and disease 1.4. Demonstrates basic knowledge of major drug classes, actions, side effects, and interactions
Demonstrate Understanding and Application of Biomedical Science Principles Requisite to the Practice of the Profession	2. Biomedical Science Principles	2.1. Explains and applies fundamentals of haematology in laboratory practice 2.2. Applies knowledge applicable to understanding of cellular and chemical pathology 2.3. Applies knowledge required to perform blood transfusion science 2.4. Explains and apply principles and practice of parasitology in diagnosis, treatment, prevention /control and research the biology of parasitic organisms, 2.5. Demonstrates knowledge of the diversity of bacteria implicated in disease conditions 2.6. Demonstrates knowledge of the diversity of viruses implicated in disease conditions
Demonstrate Knowledge and Understanding of Disease Processes	3. Disease Process	3.1. Demonstrates and applies knowledge required to understand processes of disease development, diagnosis and the development of novel therapies 3.2. Explains the general principles and effects of toxic agents on mammalian systems 3.3. Demonstrates understanding of the principles and concepts of various haematological processes in health and disease 3.4. Demonstrate understanding of host-pathogen interactions
Demonstrate Knowledge and Understanding of	4. Medical Diagnostic	4.1. Demonstrates knowledge and understanding

Medical Diagnostic Procedures	Procedures	of a wide range of medical diagnostic and laboratory procedures that are essential to the Biomedical Scientist's role in the healthcare team 4.2. Explains and apply knowledge required in the use of analytical techniques, and interpretation of laboratory results
SKILLS AND PERFORMANCE DOMAIN		
Undertake and Participate in Disease Surveillance aimed at monitoring and controlling diseases	1. Disease Surveillance	1.1. Executes laboratory activities aimed at monitoring and controlling of disease. 1.2. Performs the roles of a biomedical scientist in disease surveillance. 1.3. Communicates surveillance data for decision-making and action.
Perform appropriate and reliable diagnostic procedures in the care of patients	2. Diagnostic procedures	2.1. Operates and use of laboratory equipment and instruments correctly. 2.2. Collects and handle biological samples and clinical specimens. 2.3. Prepares reagents using applicable analytical techniques. 2.4. Applies principles of microscopy. 2.5. Applies diagnostic techniques. 2.6. Utilizes sensitive and specific instruments for the various tests. 2.7. Evaluates and make decisions on the most appropriate procedures, as informed by evidence. 2.8. Develops protocols and standard operating procedures.
Perform appropriate and reliable therapeutic and drug monitoring processes in the care of patients.	3. Therapeutic and drug monitoring	3.1. Operates and use of therapeutic drug monitoring equipment correctly in the laboratory. 3.2. Applies knowledge and understanding of pharmacology and toxicology to perform therapeutic drug monitoring 3.3. Applies appropriate methods and techniques of significance to screening and measuring of drug levels in biological samples (e.g. blood, urine, tissue, etc.) 3.4. Assesses results and identify sources of

		interference and initiate corrective action. 3.5. Generates reports of therapeutic indices and toxicological profiles of drugs and chemicals 3.6. Develops operating procedures for therapeutic drug monitoring process. 3.7. Performs immunological techniques to diagnosis and therapeutic management of disease. 3.8. Organises and interpret immunological data and correlate them with clinical findings. 3.9. Investigates and control parasitic and opportunistic infections related to HIV/AIDS 3.10. Providesbiomedical expertise in clinical care of patients. 3.11. Carries out antimicrobial susceptibility tests and monitor drug resistance. 3.12. Initiate drug and microbial resistance studies.
Conduct basic biomedical research and disseminateresearch findings in form of a dissertation	4. Biomedical Research	4.1. Conceptualizes a research problem in biomedical sciences. 4.2. Carries out critical literature review using relevant data retrieval systems. 4.3. Designs a biomedical study. 4.4. Writes a research proposal. 4.5. Applies principles of scientific enquiry and collect data. 4.6. Utilizes appropriate statistical methods and tools to analyze data. 4.7. Interprets and critically discuss research findings in the context of published work 4.8. Demonstrates academic writing and research presentation skills.
Manage a laboratory in a public or private healthcare setting, including veterinary or research facilities	5. Laboratory Management	5.1. Applies the principles of management to leadership, supervision and quality processes within the laboratory. 5.2. Prepares a budget and other laboratory reports. 5.3. Manages the procurement and supply chain system of laboratory commodities. 5.4. Demonstrates teamwork in the laboratory. 5.5. Demonstrates numeracy, literacy and ICT skills in the laboratory. 5.6. Assesses a laboratory for accreditation and quality standards. 5.7. Demonstrates strict adherence to principles

		and guidelines of Good Laboratory Practice (GLP).
Provide Leadership, Manage Health Systems and Engage in Entrepreneurship	6. Leadership and Entrepreneurship	6.1. Applies principles of leadership and management of health systems. 6.2. Effectively manages the laboratory. 6.3. Selects and applies appropriate strategies and tools to plan, control and manages health system resources under their care. 6.4. Develops the necessary capacity and abilities to engage in entrepreneurship opportunities within and outside the field of specialization.
Communicate effectively as a professional with peers, other healthcare professionals and the public in a professional context	**7.** Communication	7.1. Communicates clearly, sensitively and effectively with colleagues, patients and their care-givers by active listening, sharing and responding appropriately. 7.2. Communicates by spoken, written, and electronic methods and be aware of other methods of communication used in the biomedical science field. 7.3. Communicates effectively in various roles, for example: as an educator, mentor, patient counsellor, and health/professional advocate.
Utilize Information Communication Technology (ICT) Appropriate to the Practice of Biomedical Sciences	8. Information Communication Technology (ICT)	8.1 Utilizes ICT to communicate biomedical information effectively. 8.2 Develops, stores, locates, retrieves and utilizes patient biomedical information on a database 8.3 Accesses online data and information retrieval systems (e.g. Web of Science, PubMed, GoogleScholar, Embase, etc.). 8.4 Operates commonly used software such as MS Word, Excel, PowerPoint, Access, etc., including other relevant computer applications.
Practice effective management of laboratory commodities and supplies through utilization of supply chain systems.	9. Laboratory Commodity Security	9.1. Applies elements and principles of Supply Chain Management. 9.2. Undertakes procurement process (i.e. central, local and international procurements) 9.3. Places orders/request for laboratory commodities. 9.4. Receives and store laboratory commodities correctly. 9.5. Manages inventory and keep records of commodities.

		9.6.Reports on laboratory commodity security for the facility/institution
Participate in Public Health Programmes and Teach/Educate Others in Biomedical Sciences	10. Teaching/Education	10.1. Participates in public health intervention and health promotions. 10.2. Participates in teaching others in biomedical science. 10.3. Mentors and provide apprenticeship.
DOMAIN: ATTITUDE		
Adherence to laboratory safety guidelines, professionalism and ethical practice	1. Professional and ethical practice	1.1. Demonstrates awareness of local, regional and international code of ethics 1.2 Ensures confidentiality (with the patient and other healthcare professionals) 1.3 Obtains patient consent (it can be implicit on occasion) 1.4 Do no harm in their practice 1.5 Respects patient's autonomy 1.6 Treats patients with dignity and ensure privacy
	2. Team work and Continuous Professional Development	2.1.Places high value on continuous professional development and career progression. 2.2.Acquires, assesses, applies and integrates new knowledge to keep medical knowledge and skills up to date. 2.3.Be aware of own personal and professional limits and enlist the help of colleagues and supervisors when necessary. 2.4.Pass on the art and practice of biomedical science, by being an effective mentor and teacher to colleagues and others. 2.5.Collaborates and Function Effectively with other Health Professionals 2.6.Support development of others and self in areas of professional practice as a biomedical scientist
	3. Safety and Good Laboratory Practice	3.1.Demonstrate awareness and adherence to local, regional and international standards of laboratory safety, including protocols for management and disposal of laboratory waste. 3.2.Formulate safety rules and regulations for

		laboratory personnel and support staff. 3.3. Promote health and occupational safety at the workplace. 3.4. Behave according to ethical and legal frameworks governing the practice of biomedical scientists. 3.5. Be polite, considerate, trustworthy and honest, and act with integrity, maintain confidentiality, respect patients' dignity and privacy and understand the role of informed consent. 3.6. Respect all patients, colleagues and others irrespective of age, gender, socio-economic status, political affiliation, race, religion or creed. 3.7. Do no harm to patients either by intention or negligence in the course of duty.

6.0. GUIDE TO PREPARATION OF THE LICENSURE EXAMINATION OF BIOMEDICAL SCIENTISTS

The process of developing the blueprint for competency evaluation involves formulating a set of objectives, reflecting the outcomes and critical areas to be assessed in the licentiate examination. Using George E. Miller's model of competence (Table 2), there are **four main levels of competence** that demonstrate professional authenticity *(Miller, 1990)*[1] across the three domains of learning (knowledge, skills and attitudes).

Table 2: Miller's model of competence

Competence level	**Outcome and attributes demonstrated by the graduate:**
1. 'Knows'	Cognitive facts gathered in scientific knowledge, skill and attitudes
2. 'Knows How'	Interpretation and application of cognitive knowledge, skills and attitudes
3. 'Shows How'	Demonstration of performance, skills and attitudes
4. 'Does'	Performance integrated into professional practice and behaviour

Therefore, the key areas that guide the formulation of the licensure examination are informed by the levels of competence attainment of the learning objectives for Biomedical Scientists. The objectives set for the licensure examination to competence are as follows:

1. To determine the **application of biomedical science knowledge**
2. To ascertain **performance of quality and reliable diagnostic procedures and biomedical science techniques proficiently**
3. To ascertain **proficiency in the use of laboratory technology** and apparatus to monitor patient treatment outcomes
4. To assess **leadership and management skills** to effectively manage the laboratory
5. To ascertain **professionalism** and demonstration of ethical conduct, including adherence to good laboratory practice, safety and health guidelines.

[1] Miller GE (1990). The assessment of clinical skills/performance. Academic Medicine (Supplement), 65: S63 – S67

The blueprint developed for theoretical Licensure Examination questionsfor BSc in Biomedical Science graduates seeking to practice in Zambia is spread among the three domains of learning (i.e. scientific knowledge, skills and attitudes) to cover Level 1 and 2 of the competency framework (Table 2).

Considering the great need for graduates to applyskills and performance attributes, including practice evidence based-biomedical sciences, demonstration of skills and performance is extremely important hence the skills performance domain (Level 3)is given the highest weighting followed by application of scientific knowledge and lastly the professionalism and attitudes. The practical Licensure Examination questions for BSc in Biomedical Science graduates seeking to practice in Zambia is spread to cover the relevant skills, performance, applied scientific knowledge and attitude domains accordingly.

Table 3: Weighting of Competence Areas for Theory and Practical Licensure Examination for Biomedical Scientists

Domain	**Overall**	**Percentage of Total**
Theory Exam (knowledge)	**100%**	
Application of knowledge in biomedical sciences		50
Performance of quality and reliable diagnostic procedures and biomedical science techniques		10
Proficiency in the use of laboratory technology and apparatus		10
leadership and management skills		15
Professionalism, ethical conduct, adherence to good laboratory practice, safety and health guidelines		15
Total		**100**
Practical Exam (Skills and Attitude)	**100%**	
Application of knowledge in biomedical sciences		10
Performance of quality and reliable diagnostic procedures and biomedical science techniques		30
Proficiency in the use of laboratory		30

technology and apparatus		
leadership and management skills		15
Professionalism, ethical conduct, adherence to good laboratory practice, safety and health guidelines		15
Total		100

7.0. CORE PROCEDURES

The following procedures are the minimum standards and a full list could be found in the curriculum.

Medical Parasitology	1	Prepares reagents used for parasite preservation and identification
	2	Collects and process specimens for detection of parasites
	3	Performs macroscopic and microscopic examinations of processed specimens using standardised procedures; wet/direct preparation, concentration techniques and staining
	4	Implement quality assurance in microbiology laboratory
Clinical Biochemistry	1	Collects, process and store specimens
	2	Performs tests involving hydrogen ion and blood gases levels
	3	Uses various techniques to investigate disorders of the heart
	4	Apply appropriate principles to investigate diseases of the liver
	5	Perform kidney function tests
	6	Perform pancreatic function tests
	7	Demonstrates knowledge of porphyria and their investigations
	8	Performs quality assurance and quality control procedures to ensure reliable test laboratory results
Cellular Pathology	1	Accessions and preserves human tissues accurately
	2	Processes tissues in the histopathology laboratory
	3	Carry out tissue sectioning using various microtomes
	4	Performs histopathological staining techniques
	5	Appropriately mounts stained tissue sections
	6	Demonstrates understanding and use the microscope
	7	Performs quality assurance and quality control procedures to ensure reliable test laboratory results
Medical Microbiology	1	Performs basic microbiological and immunological techniques
	2	Identify different types of microorganisms
	3	Carry out antimicrobial susceptibility testing
	4	Interprets susceptibility testing results
	5	Apply safety measures in the microbiology laboratory
	6	Implement quality assurance in microbiology laboratory
	1	Performs aseptic phlebotomy procedure
	2	Carry out laboratory tests for transfusion transmissible infections, compatibility testing and the investigation of transfusion reactions

Haematology and Blood Transfusion Science	3	Prepares blood products
	4	Performs quality assurance procedures
	5	Collects capillary and venous blood
	6	Perform manual and automated full blood counts
	7	Interprethaematological data
	8	Performs quality assurance and quality control procedures to ensure reliable test laboratory results

8.0. SELECTED REFERENCE MATERIALS FOR CORE SUBJECTS

Medical Microbiology:	Greenwood, D., Slack R., Peutherer .J. and Barer M., (2007). Medical Microbiology: A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control (17th Edition). Churchill-Livingstone, Edinburgh. ISBN: 9780443102097
	Goering, R. V., Dockrell H. M, Zuckerman. M, Roitt M. I, Chiodidni P. L (2014) Mims' Medical Microbiology (5th Edition), Elsevier Saunders, China. ISBN 9780808924401
	Ryan, K. J. and Ray, G. C (2014). Sherris Medical Microbiology (6th Edition). Mc Graw Hill Education, New York. ISBN: 9780071818216
	Murphy, K. M, Travers, P, and Walport (2012). Janeway's Immunobiology (8th Edition). Garland Science, New York. ISBN: 0815342438, 9780815342434
Clinical Biochemistry	Ahmed, N and Smith, C (2011). Clinical Biochemistry
	Fundamentals of Biomedical Science. Oxford University Press, Oxford. ISBN: 0199533938
	Berg, J. M, Tymoczko, J. L, and Stryer, L (2011). Biochemistry (7th Edition). W.H. Freeman and Co, New York. ISBN: 1429276355
Haematology and Blood Transfusion Science	Blann, A, Knight, G and Moore, G (2010). Fundamentals of Biomedical Science: Haematology. Oxford University Press, Oxford. ISBN0199568839, 9780199568833
	Lewis, S. M, Bain, B. J, Bates, I and Dacie, J.V (2006). Dacie And Lewis Practical Haematology (10th Edition). Churchill Livingstone-Elsevier, Edinburgh. ISBN: 0443066604, 9780443066603
	Baker, F.J, Silverstone, R.E and Pallister, C.J (1998). Introduction to Medical Laboratory Technology (7th Edition). Butterworth-Heinemann, Oxford
Cellular Pathology	Bancroft, J.D and Gamble, M (2008). Theory and Practice

	of Histological Techniques (6th Edition). Elsevier Health Sciences, Edinburgh. ISBN: 0443102791, 9780443102790
	Cook, D.J (2006). Biomedical Sciences Explained: Cellular Pathology. Butterworth Heinemann, Oxford. ISBN: 10: 1948 42305
	Bancroft, J.D and Cook, H.C (2008). Manual of Histological Techniques. Churchill-Livingstone, Edinburgh. ISBN: 0 44 3028702
Medical Parasitology	Ash, L. R and Orihel, T. C (2007). Ash &Orihel's atlas of Human Parasitology (5rd Edition). American Society of Clinical Pathology Press. ISBN 0891891676, 9780891891673
	Despommier, D. D (2011). Parasitic Diseases (5th Edition). Apple Trees Productions, New York. ISBN: 097000270X, 9780970002709
Laboratory Management	Becan-MacBride, K (1982). Textbook of Clinical Laboratory Supervision. Appelton-Century Crafts, New York. ISBN: 0838588719, 9780838588710 Dent, N and Carson, P (1996). Good Laboratory and Clinical Practices. Butterworths-Heinemann, Oxford. ISBN: 0 7506 1957 0 Kinkus, C. A (2012). Laboratory Management: Quality in Laboratory Diagnosis. Demus Medical Publishers, New York. ISBN: 978 1 936287 45 1
Professionalism	HPCZ (2016). Guidelines for good practice in the Healthcare profession – Maintaining Patient Confidentiality. HPCZ Lusaka HPCZ (2016). Guidelines for good practice in the Healthcare profession – Generation and management of patient records. HPCZ Lusaka HPCZ (2014.) Professional code of ethics and discipline: Fitness to Practice. HPCZ Lusaka