NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Faculty of Health and Applied Sciences

Department of Health Sciences

QUALIFICATION: **BACHELOR OF MEDICAL LABORATORY SCIENCES**	
QUALIFICATION CODE: **08BMLS**	LEVEL: **6**
COURSE: **MOLECULAR DIAGNOSTICS**	COURSE CODE: **MOD621S**
DATE: **JANUARY 2019**	SESSION:
DURATION: **3 HOURS**	MARKS: **113**

SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	Ms V Tjijenda
MODERATOR:	Dr A Shiningavamwe

INSTRUCTIONS

1. Answer all questions.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

Permissable material

Non programmable calculator is allowed.

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Excluding this front page)

SECTION A (30 MARKS)

QUESTION 1 **[10]**

Define the following terms:

1.1 Genome (1)
1.2 Multiplex PCR (1)
1.3 Restriction enzymes (1)
1.4 Antiparallel double helix (1)
1.5 Ct value (1)
1.6 Primer (1)
1.7 Nick translation (1)
1.8 DNA chip technology (1)
1.9 RFLP technology (1)
1.10 Hybridization (1)

QUESTION 2 **[20]**

2.0 Consider the following small DNA sequence:

5' GGAACCCGGCCTTGCGTTCC 3'

3' CCTTGGGCCGGAACGCAAGG 5'

2.1 Name the type of enzyme that digests palindromic sequence (1)

2.2 Calculate the Tm of the sense strand. (4)

2.3 What are the two factors that affect melting temperature? (2)

2.4 Digest the palindrome such that it yields a blunt end. (2)

2.5 Digest the palindrome such that it yields a 5' overhang (sticky end). (2)

2.6 Digest the palindrome such that it yields a 3' overhang (sticky end). (2)

2.7 When choosing an enzyme for plasmid cloning, why do molecular biologists prefer to use enzymes which yield a sticky end. (2)

2.8 In 1953, Watson and Crick described the secondary structure of DNA. Explain their discovery. (5)

SECTION B (28 MARKS)

QUESTION 3 **[8]**

3.0 Name the enzyme which:

3.1 Joins the ends of two DNA strands (1)

3.2 Copies mRNA during transcription (1)

3.3 Digest RNA (1)

3.4 Removes the primers in prokaryotes (1)

3.5 Unwinds dsDNA (1)

3.6 Copies DNA during cell division (1)

3.7 Is used by HIV to make a copy of its genetic information (1)

3.8 Relaxes the tension caused by supercoiling of DNA (1)

QUESTION 4 **[20]**

4.1 Define gel electrophoresis. (2)

4.2 List the ingredients used in a qPCR and briefly explain their purposes. (14)

4.3 Identify two advantages of qPCR with regards to its methodology (2)

4.4 Mention any two factors that can negatively affect the migration of DNA in gel electrophoresis. (2)

SECTION C (55 MARKS)

QUESTION 5 **[55]**

5.1 Explain quality assurance in a molecular diagnostic laboratory using relevant examples based on the following headings:

5.1.1 Preanalytical phase (4)

5.1.2 Analytical phase (4)

5.1.3 Post analytical phase (4)

5.2 You are a research student in the Postgraduate Laboratory at the Namibia University of Science and Technology. Your research group is interested in assessing the expression of a certain gene in a mouse. Discuss how you would go about extracting mRNA from the mouse using the manual chloroform/phenol protocol all the way until before amplifying the extracted RNA in conventional PCR. (28)

5.3 The Conventional PCR method can be manipulated to increase specificity. Mention two such techniques that can be used to achieve this and further explain how specificity is achieved in each method. (10)

5.4 Explain the principle of Sanger sequencing method. (5)

END OF EXAMINATION