



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS**

**2017/2018 ACADEMIC YEAR**

**FOURTH YEAR FIRST SEMESTER EXAMINATIONS**

**FOR THE DEGREE**

**OF**

**BACHELOR OF SCIENCE IN MEDICAL LABORATORY SCIENCES**

**COURSE CODE: BML 411**

**COURSE TITLE: MOLECULAR DIAGNOSTICS**

**EXAM: MAIN**

**DATE:**

**TIME:**

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**INSTRUCTIONS TO CANDIDATES**

This paper is divided into three sections, A, B and C, carrying respectively: carrying respectively: Multiple Choice Questions (MCQ), short answered Questions (SAQs) and Long Answer (LAQs). Answer all Questions.

**TIME: 2 Hours**

MMUST observes ZERO tolerance to examination cheating.

This paper consists of 5 printed pages. Please Turn Over.

**SECTION A: Answer ALL Questions in this Section [20 Marks]**

1. Which of the following statements regarding the polymerase chain reaction is untrue?
  - A. It can increase the amount of DNA in a sample
  - B. It has the potential of diagnosing an infection from a single copy of a gene
  - C. It utilizes DNA polymerases from psychrophilic organisms
  - D. It can amplify DNA of only a few base pairs up to a whole genome
  - E. It essentially mimics DNA replication as it occurs naturally
2. What is the natural function of restriction enzymes?
  - A. Protecting bacteria by cleaving the DNA of infecting viruses
  - B. Protecting bacteria by cleaving their own DNA
  - C. Protecting bacteria by methylating their own DNA
  - D. Protecting bacteria by methylating the DNA of infecting viruses.
3. What is the correct sequence of events in Southern blotting?
  - A. Hybridization of DNA fragments with a labelled probe sequence followed by separation by electrophoresis and then transfer to a membrane
  - B. Separation of DNA fragments by electrophoresis followed by hybridization with a labelled probe sequence and then transfer to a membrane.
  - C. Separation of DNA fragments by electrophoresis followed by transfer to a membrane and then hybridization with a labelled probe sequence.
  - D. Transfer of DNA fragments to a membrane followed by separation by electrophoresis and then hybridization with a labelled probe sequence.
4. Dideoxynucleoside triphosphates (ddNTPs) are used in sequencing DNA because:
  - A. ddNTPs are fluorescent.
  - B. ddNTPs are incorporated very efficiently into DNA by DNA polymerase
  - C. ddNTPs cannot be incorporated into DNA by DNA polymerase
  - D. ddNTPs prevent further DNA synthesis once they are incorporated into the DNA sequence
5. Which of the following is NOT required for a PCR reaction?
  - A. A thermostable DNA polymerase
  - B. Dideoxy-dNTPs (ddNTPs)
  - C. Primers
  - D. Template DNA
6. Which of the following statements about forensic analysis of DNA is correct?
  - A. A DNA profile using short tandem repeats is unique to an individual.
  - B. Forensic analysis makes use of SNPs in coding sequences to distinguish between individuals.
  - C. PCR is used for DNA profiling (DNA fingerprinting).
  - D. DNA fingerprinting cannot be used for paternity testing.
7. The rate of migration of DNA within an agarose gel in the gel electrophoresis technique is primarily based on what factor?

- A. The size of the DNA fragments
  - B. The number of DNA fragments
  - C. The size of the wells of the gel
  - D. The negative charge of the DNA
  - E. The volume of the DNA sample loaded
8. Oligonucleotide gene probes are defined as what?
- A. Enzymes that recognize and subsequently degrade foreign DNA
  - B. The pieces of DNA produced by restriction endonucleases
  - C. An enzyme important in splicing genes into plasmids and chromosomes
  - D. A short stretch of DNA of a known sequence that will base-pair with a complementary sequence
  - E. A piece of DNA to which new nucleotides are added during DNA sequencing
9. The technique that utilizes probes to detect specific DNA sequences is known as what?
- A. Southern blot
  - B. Northern blot
  - C. Western blot
  - D. Eastern blot
  - E. Northwestern blot
10. Genomic libraries are useful for obtaining what product?
- A. Periodicals on genomics research
  - B. Collections of isolated genes
  - C. Instructional information on how to locate the exact site of the gene of interest
  - D. Information relating to primers and PCR
  - E. The structure and function of an isolated protein
11. The analysis and storage of the massive amount of data generated from sequence maps has led to the growth of what new disciplines?
- A. Immunology and virology
  - B. Bioinformatics and medical microbiology
  - C. Genomics and genetic engineering
  - D. Genomics and bioinformatics
  - E. Proteomics and environmental microbiology
12. Which of the following statements regarding the findings of the Human Genome Project is incorrect?
- A. Humans share approximately 80% of their DNA sequences with mice
  - B. Genetic screening of families for inheritable diseases may become possible.
  - C. A large amount of the human genome contains DNA sequences that do not code for cell protein
  - D. 97% of the human genome is made up of support DNA that functions in chromosome stabilizing and division, gene regulation, and ribosome assembly
  - E. Human chromosomes are capable of "walking."

13. The creation of a DNA fingerprint involves all but which of the following techniques?
- A. Southern blotting
  - B. Western blotting
  - C. Polymerase chain reaction
  - D. The use of restriction endonucleases
  - E. Gel electrophoresis
14. Microarray analysis has allowed scientists to view what phenomenon?
- A. The genome sequence in a cell
  - B. The cDNA of a cell
  - C. The RFLPs of a cell
  - D. The expression of specific genes in a cell
  - E. The number of genes in a cell
15. Which of the following reagent is used for quantifying DNA?
- A. Chloroform
  - B. CTAB
  - C. Diphenylamine
  - D. Dansyl chloride
16. cDNA, a term used in recombinant DNA technology means
- A. Competitive DNA
  - B. Chemical DNA
  - C. Complex DNA
  - D. Complementary DNA
17. Nucleic acids are made up of monomers called;
- A. nucleotides
  - B. nucleosides
  - C. DNA
  - D. RNA
18. Which of the following statements are true?
- A. The two DNA strands are anti- parallel and complementary
  - B. The two DNA strands are anti- parallel and non-complementary
  - C. The two DNA strands are parallel and anti-complementary
  - D. None of the above
19. What term is used to describe the process by which a segment of DNA is copied to produce a molecule of messenger RNA?
- A. Reproduction
  - B. Replication
  - C. Translation
  - D. Transcription

20. What type of enzyme is used in recombinant DNA technology to split a specific sugar phosphate bond in each strand of a DNA double helix?
- A. Esterase
  - B. Restriction enzyme
  - C. Lipase
  - D. Ligase

**Section B: Answer ALL Questions in this Section [40 Marks]**

21. Briefly describe the historical developments of molecular diagnostics [5 Marks]
22. State the advantages and disadvantages of DNA amplification using the PCR method [6 Marks]
23. Differentiate between a primer and a probe [4 Marks]
24. Compare and contrast the nucleic acids DNA and RNA? [6 Marks]
25. Outline the different patterns produced by restriction enzymes [5 Marks]
26. List and describe two different methods for labeling of nucleic acid probes (5 Marks)
27. Name 2 of the methods used to isolate DNA from the excised agarose band and explain the principles behind their ability to recover the DNA from the agarose. [5 Marks]
28. Describe DNA probes, giving examples of their use [4 Marks]

**Section C: Answer Any Two Questions from this Section [40 Marks]**

29. Discuss the methods for bacterial DNA extraction process [20 Marks]
30. List and explain the ethical issues in Molecular Diagnostics [20 Marks]
31. Discuss the applications of recombinant DNA Technology [rDNA technology] in Molecular Diagnostics [20 Marks]