



*(University of Choice)*

**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)  
(MAIN CAMPUS)  
UNIVERSITY EXAMINATIONS  
2019/2020 ACADEMIC YEAR**

**MAIN EXAM**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE IN MEDICAL BIOTECHNOLOGY**

**COURSE CODE: BMB 314**

**COURSE TITLE: FORENSIC GENETICS & IT'S  
APPLICATION**

**DATE: TIME:**

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**INSTRUCTIONS TO CANDIDATES**

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

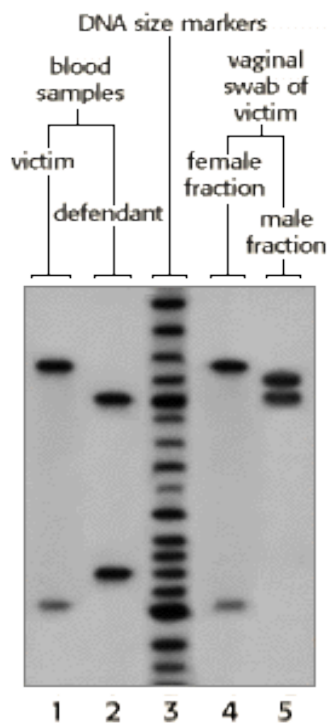
**This Paper Consists of 5 Printed Pages. Please Turn Over**



**SECTION A (20 MARKS): ANSWER ALL QUESTIONS**

1. Restriction enzyme are used in of these techniques\
  - A. Sequencing
  - B. Genotyping
  - C. RFLP
  - D. Polymerization
2. Which of the following statement is false
  - A. Enzymes are differentiated by electrophone method
  - B. While DNA sequencing both forward and reverse process are used
  - C. Amplification is done through PCR
  - D. ABO blood grouping is mainly used for differentiating
3. The presumption test for semen is
  - A. Acid phosphate test
  - B. Sodium alpha naphthyl test
  - C. Naphthalene test
  - D. Barbiturate test
4. The primary duty of a forensic expert in court of law is to:
  - A. Explain scientific procedure
  - B. Explain scientific evidence
  - C. Give testimony
  - D. To tell the truth
5. Facts generated or supported by the use of one or more of the forensic sciences is called:
  - A. Evidence
  - B. Forensic evidence
  - C. Application of forensic sciences
  - D. Generation
6. An appropriate primary container for the collection and preservation of dried blood collected from the surface of an object is:
  - A. Paper bag
  - B. Plastic bag
  - C. Container
  - D. FTA Card
7. Which of the following of forensic fields studies diseases, disease causes, and diagnosis of disease?
  - A. Toxicology
  - B. Entomology
  - C. Pathology
  - D. Biopharmacology

8. What would be the effect on the PCR reaction if any of the following circumstances arose: 1) there are no primers in the reaction, 2) there are no dNTPs in the reaction,
- PCR would proceed normally
  - Non-specific PCR of random templates will occur
  - The reaction will cease after a few cycles
  - The PCR reaction will not commence
9. In the laboratory, DNA molecule can be cut at specific sequences using
- UV light
  - Restriction nucleases
  - Lase tweezers
  - DNA ligase
10. DNA fingerprinting using Variable Number Tandem Repeats (VNTRs) is based on the observation that:
- Every individual has unique alleles at each VNTR locus
  - VNTR sequence show little variability
  - VNTR loci are highly polymorphic
  - The DNA of VNTR loci is more stable than that of loci which code for proteins
11. The key portion of the autoradiograph from a single locus probe analysis of various DNA samples in a rape investigation is shown in the figure below. Samples of DNA were loaded into the following lanes:



- Known blood sample of victim
- Known blood sample from defendant
- DNA size markers
- Female fraction from vaginal swab of victim
- Male fraction from vaginal swab of victim.

**If you are the DNA analyst, what would be your conclusion?**

- The vaginal swab is from the wrong victim.
- The suspect might be guilty, but more probes should be used.
- The suspect is guilty
- The suspect is excluded as a source of DNA in the evidence.

12. Probability calculations are used in forensic applications of DNA fingerprinting to determine if:
- A. DNA from two different sources have matching alleles.
  - B. DNA samples were degraded before analysis
  - C. A match between alleles of different DNA samples might have occurred by chance.
  - D. Alleles in the suspect's DNA are different from alleles of a victim's DNA.
13. What is the correct sequence of events in Northern blotting?
- A. Hybridization of RNA 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 RNA 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.
14. The phenol–chloroform method has been widely used in molecular biology but has been slowly phased out since the mid-1990s, Give reason.
- A. Because of the toxic nature of chloroform
  - B. It yields poor qualities of DNA
  - C. Because of the toxic nature of phenol
  - D. It yields small quantities of DNA
15. The Y-STR's utility in the forensic sciences is that:
- A. Replication of the DNA takes less than one hour.
  - B. It is shorter by six bases on the Y chromosome than the X chromosome.
  - C. The frequency of occurrence in the general population is very small.
  - D. It originates only from a male donor of DNA
16. mtDNA analysis is best suited for:
- A. Samples in which the father or grandfather's DNA is readily available for comparison.
  - B. Samples for which nuclear DNA typing is not possible.
  - C. Analysis in which only a minute quantity of DNA material is available.
  - D. Analysis requiring greater discriminatory power than STR
17. The forensic science community has standardized \_\_\_\_\_ STRs for entry into a national database known as the Combined DNA Index System.
- A. 26
  - B. 128
  - C. 13
  - D. 64
18. mtDNA is considered as one of the best marker tool for population/forensic biologist. What is the reason?
- A. mtDNA undergoes spontaneous mutation

- B. Mitochondrial DNA can be easily isolated  
 C. Mitochondrial gene are specific to mtDNA  
 D. Absence of genetic recombination in mtDNA
19. Allele and genotype frequencies in a population will remain constant from generation to generation in absence of other evolutionary influences state law  
 A) of evolution  
 B) of replication  
 C) of genetic variation  
 D) Hardy-Weinberg  
 None of the above
20. Which of the following correctly shows the Hardy-Weinberg Equation?  
 A)  $p^2 + q = 1$   
 B)  $p^2 + 2pq + q^2 = 1$   
 C)  $p + 2pq + q = 1$   
 A)  $p + q^2 = 1$

### **SECTION B (40 MARKS): ANSWER ALL QUESTIONS**

1. Explain FOUR factors that would affects the efficiency of PCR. (8 Mks)
2. Explain FOUR advantages of mtDNA over nuclear DNA in forensic investigations (8 Mks)
3. Outline FOUR factors that determines the choices of DNA extraction method in DNA typing. (8 Mks)
4. Outline a procedure in extracting DNA from the following challenging samples for forensic cases
  - b) Hair shaft (4 Mks)
  - c) Semen (4 Mks)
5. Briefly describe the following:
  - a) VNTR (3 Mks)
  - b) STR (3 Mks)
  - c) RFLP (2 Mks)

### **SECTION III (60 MARKS) ANSWER ALL QUESTIONS**

1. Describe steps in DNA sample processing procedures for a report case generation in court (20 Mks)
2. Describe stages and requirements of a conventional PCR methodology (20 Mks)
3. Discuss various DNA markers and for each case highlight their importance in forensic analysis (20 Mks)