



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF (MAIN PAPER)
SCIENCE AND TECHNOLOGY
(MMUST)**

**MAIN CAMPUS
UNIVERSITY EXAMINATIONS**

2023/2024 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DIPLOMA
IN
MEDICAL BIOTECHNOLOGY**

COURSE CODE: BBD 312

COURSE TITLE: FUNDAMENTALS OF GENETICS

DATE: 7TH DECEMBER 2023

TIME: 8.00-10.00AM

INSTRUCTIONS TO CANDIDATES

This paper is divided into three sections, A B and C, carrying respectively: Multiple Choice Questions (MCQs), Short Answer Questions (SAQs) and Long Answer Questions (LAQs). Answer all questions. **DO NOT WRITE ON THE QUESTION PAPER**

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over

SECTION A (MCQs) 20MARKS

- Which one of the following is a pair of contrasting traits studied by Mendel to devise the laws of inheritance?
 - Red and yellow pods
 - Round and wrinkled seeds
 - Pink and white flowers
 - Axial and terminal leaves
- What was the type of pea lines used by Mendel?
 - True-breeding
 - False-breeding
 - Not breeding
 - Indefinitely breeding
- A chromosome with a very short arm and a very long arm is referred to as _____
 - Metacentric
 - Telocentric
 - Acrocentric
 - Sub-metacentric
- Each of the chromosome at the anaphase stage of a bone marrow cell in our body has-----
 - One chromatid
 - Two chromatids
 - Several chromatids
 - No chromatids
- A cross between two pure individuals differing in two sets of characters is called _____
 - Dihybrid cross
 - Monohybrid cross
 - Trihybrid cross
 - Reciprocal cross
- Which one of the following statement is true about lethal alleles ?
 - Lethal alleles can only be recessive.
 - Recessive lethal allele only appears when the individual is homozygous for the gene
 - Lethal alleles cannot be dominant
 - Lethal alleles cannot be maintained in the population if penetrance of the gene is less than 100%
- Which one of the following sex-linked trait does not follow X-linked recessive inheritance?
 - Color blindness
 - Hemophilia
 - Fragile X syndrome
 - Hunter syndrome
- Which one of the following statements is true regarding the "law of segregation"?
 - Law of segregation is the law of purity of genes
 - Alleles separate from each other during gametogenesis
 - Segregation of factors is due to the segregation of chromosomes during meiosis
 - All of the above

9. The incorrect option about penetrance is _____
- A. If penetrance is 100% all recessive genotype shows one phenotype
 - B. If penetrance is 100% the expressivity is 100%
 - C. If penetrance is 100% all the heterozygotes have similar phenotype
 - D. If penetrance is 100% all the dominant genotypes have a different phenotype from recessive
10. Which one of these statements is true about expressivity?
- A. Expressivity depends on penetrance.
 - B. Expressivity explains whether disease shows up
 - C. Expressivity describes the expression of a single gene
 - D. Expressivity is a quantitative measurement
11. Crossing over takes place in the----
- A. Diakinesis stage
 - B. Anaphase stage
 - C. Pachytene stage
 - D. Leptotene stage
12. The map of the chromosome which shows identifiable sites is called _____
- A. Gene expression
 - B. Genome sequencing
 - C. Chromosome walking
 - D. Genome map
13. Genes causing color blindness in man are located on
- A. Y chromosome
 - B. X chromosome
 - C. Both X or Y chromosome
 - D. Either X or Y chromosome
14. In humans, recessive genes on the X chromosome are always expressed as _____
- A. Females are the ones who have it.
 - B. Deadly
 - C. Non-fatal
 - D. Males have this gene.
15. The Phenomenon of two or more than two genes affecting the expression of each other is called _____
- A. Crossing over
 - B. Pairing
 - C. Gene interaction
 - D. Linkage
16. The effect which shows the change in expression of alleles of the gene due to a specific environmental condition is _____
- A. Pleiotropy
 - B. Linkage
 - C. Phenocopy
 - D. Penetrance
17. Which one of the following term represents a pair of contrasting characters?

- A. Heterozygous
- B. Homozygous
- C. Codominant genes
- D. Allelomorphs

18. The geometrical device that helps to find out all the possible combinations of male and female gametes is known as-----

- A. Bateson Square
- B. Mendel Square
- C. Punnett Square
- D. Mendel's Cube

19. How many phenotypes can occur in the human blood group ABO with alleles $I^A I^B i$?

- A. 2
- B. 3
- C. 4
- D. 1

20. A small amount of lethal mutation is always present in the population due to

- A. Positive selection
- B. Negative selection
- C. Frequency-dependent selection
- D. Mutation-selection balance

SECTION B: Short Answer Questions (40 marks)

1. Define the following terms: (5 marks)
 - i. Gene-
 - ii. Heritability –
 - iii. Genetic diversity-
 - iv. Allele -
 - v. Chromosomes-
2. a) Differentiate between heredity and variations (2 marks)
 b) Using an equation, state the factors that influence the phenotypic variation within a population? (3marks)
3. Describe the chemical structure of eukaryotic chromosomes (8 marks)
4. State the key differences between mitosis and meiosis (8 Marks)
5. State the 3 Mendelian laws of inheritance (3 marks)
6. Both DNA and RNA are composed of nucleotides. What molecules combine to form a nucleotide? (3 marks)
7. On the basis of Mendel's observations, predict the results from the following crosses with peas: (4 marks)
 - (a) A tall (dominant and homozygous) variety crossed with a dwarf variety;
 - (b) The progeny of (a) self-fertilized;
 - (c) The progeny from (a) crossed with the original tall parent;
 - (d) The progeny of (a) crossed with the original dwarf parent.
8. Describe sex-linkage (3 marks)

SECTION C: Long Answer Questions (60 Marks)

1. Explain the relevance/value/significance of genetics to the human society (20 marks)
2. Describe the modifier genes and the 5 kinds of lethal genes (20 marks)
3. Describe the procedure for chromosome mapping and the factors affecting chromosome mapping (20 marks)