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(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: FUNDERMENTALS 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

1. Which one of the following is a pair of contrasting traits studied by Mendel to devise the laws of inheritance?

    A. Red and yellow pods
    B. Round and wrinkled seeds
    C. Pink and white flowers
    D. Axial and terminal leaves

2. What was the type of pea lines used by Mendel?
    A. True-breeding
    B. False-breeding
    C. Not breeding
    D. Indefinitely breeding

3. A chromosome with a very short arm and a very long arm is referred to as_____
    A. Metacentric
    B. Telocentric
    C. Acrocentric
    D. Sub-metacentric

4. Each of the chromosome at the anaphase stage of a bone marrow cell in our body has---------
    A. One chromatid
    B. Two chromatids
    C. Several chromatids
    D. No chromatids

5. A cross between two pure individuals differing in two sets of characters is called_____
    A. Dihybrid cross
    B. Monohybrid cross
    C. Trihybrid cross
    D. Reciprocal cross

6. Which one of the following statement is true about lethal alleles ?

    A. Lethal alleles can only be recessive.
    B. Recessive lethal allele only appears when the individual is homozygous for the gene
    C. Lethal alleles cannot be dominant
    D. Lethal alleles cannot be maintained in the population if penetrance of the gene is less than 100%

7. Which one of the following sex-linked trait does not follow X-linked recessive inheritance?
    A. Color blindness
    B. Hemophilia
    C. Fragile X syndrome
    D. Hunter syndrome

8. Which one of the following statements is true regarding the "law of segregation"?

    A. Law of segregation is the law of purity of genes
    B. Alleles separate from each other during gametogenesis
    C. Segregation of factors is due to the segregation of chromosomes during meiosis
    D. 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)