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QUALIFICATION : **BACHELOR OF SCIENCE**	
QUALIFICATION CODE: **07BOSC**	LEVEL: **6**
COURSE: **GENETICS**	COURSE CODE: **GEN602S**
DATE: **JANUARY 2024**	SESSION: **1**
DURATION: **3 HOURS**	MARKS: **100**

SECOND OPPORTUNITY / SUPPLEMENTARY: QUESTION PAPER

EXAMINER: *Prof Edosa Omoregie*

MODERATOR: *Dr Jeya Kennedy*

INSTRUCTIONS

1. Answer all questions on the separate answer sheet.
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.

PERMISSIBLE MATERIALS:

1. Non-Programmable Calculator

ATTACHMENTS

None

This paper consists of 6 pages including this front page

SECTION A: MULTIPLE CHOICE [20 MARKS]

QUESTION 1: MULTIPLE CHOICE QUESTIONS [20 MARKS]

Evaluate the statements in each numbered section and select the most appropriate answer or from the given possibilities. Fill in the appropriate letter next to the number of the correct statement/phrase on your ANSWER SHEET. [20]

1.1. Which of the following conditions best describes the appearance of the chromosomes after the *S* phase of cell division?
A. a pair of homologous chromosomes
B. a pair of sister chromatids, each with its centromere
C. a pair of homomorphic chromosomes
D. a pair of sister chromatids that share one centromere

1.2. Which of the following statements is valid during the anaphase phase of mitosis?
A. the sister chromatids separate from each other
B. the centromeres replicate
C. the chromosomes replicate
D. the chromosomes separate and move to the cell's opposite poles

1.3. Which of the following blood genotypes belong to an individual regarded as a universal blood donor?
A. I^AI^A
B. I^AI^O
C. I^AI^B
D. I^OI^O

1.4. In peas, a tall, yellow-seeded plant is crossed with a homozygous short, green-seeded plant and yields 203 tall, green-seeded plants, 199 short, green-seeded plants, 207 tall, yellow-seeded plants, and 192 short, yellow-seeded plants. Which of the following genotypes is the most likely genotype of the tall, yellow-seeded parent?
A. TtYy
B. TTYY
C. ttyy
D. ttYY

1.5. Which of the following concepts is not attributable to Mendel?
A. one allele may be dominant to another allele at the same locus
B. chromosomes are the carriers of the genes
C. genetic traits are particulate in nature
D. the pair of alleles at a locus separate from each other during gamete formation.

1.6. In a species of the Snapdragon flower plant, a cross between a homozygous, red-flowered plant and a homozygous, white-flowered plant yields all pink-flowered plants. This is an example of which of the following?
A. dominant
B. recessive
C. pleiotropic
D. incomplete dominant

1.7. In nucleic acids, the 5' carbon of one sugar is held to the 3' carbon of the adjacent sugar by which of the following bonds?
A. a hydrogen bond
B. a phosphodiester bridge
C. an amide bond
D. a phosphoanhydride bond

1.8. Which of the following statements best describes a polygenic genetic disorder?
A. disorders transmitted in the gametes through generations
B. disorders with multifactorial inheritance
C. disorders derived from parents
D. disorders present at birth

1.9. In RNA, which of the following pairings of nitrogenous bases is true?
A. the [G] = [C]
B. the [A] = [T]
C. the [G+C] = [A+T]
D. the [G] = [A]

1.10. Which of the DNA strands grows continuously towards the replication fork during the process of DNA replication?
A. lagging strand
B. RNA strand
C. leading strand
D. replicating strand

1.11. Haemophilia is a sex-linked recessive trait in humans. If a father is a carrier, and their son is haemophiliac, but the mother is normal, her genotype must be?
A. X^hX^h
B. X^HX^h
C. X^HX^H
D. All of the above

1.12. The Pribnow Box of the sequence TATAAT of six nucleotides is an essential part of which of the following sites on the RNA?
A. attenuator
B. enhancer
C. promoter
D. operator

1.13. During DNA replication, the role of the enzyme DNA polymerase is to?
A. remove the RNA primer
B. add nucleotides to the 3' end of the DNA
C. to link Okazaki fragments together
D. to unwind the original DNA molecule

1.14. Removal of introns from RNA in gene expression is by which of the following molecules?
A. primosomes
B. peptidases
C. galactosidases
D. spliceosomes

1.15. In the genetic code, the length of a codon is?
A. 1 base
B. 2 bases
C. 3 bases
D. 4 bases

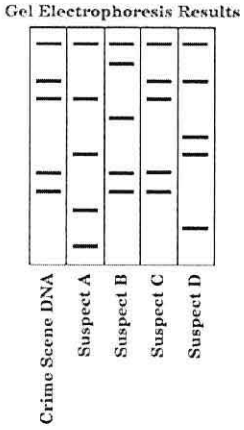
1.16. Which of the following is the optimum temperature for thermostable DNA polymerase of Taq polymerase during the PCR experimental step of DNA extension?
A. 15 – 20^{O}C
B. 20 – 25^{O}C
C. 45 – 50^{O}C
D. 72 – 74^{O}C

1.17. Which of the following is an autosomal recessive trait?
A. Duchenne muscular dystrophy
B. Lesch-Nyhan syndrome
C. Marfan syndrome
D. Cystic Fibrosis

1.18. Which of the following sequences will a DNA strand with the base AACTTGGTA sequence have a complementary strand?
A. CCAGGTCAT
B. AACTTGCAT
C. TTCAAGCAT
D. TTGAACCAT

1.19. In chromosomal mutation, which of the following chromosome numbers is called Tetrasomy.
A. $2n - 1$
B. $2n + 2$
C. $2n + 1$
D. $2n - 2$

1.20. The diagram below represents DNA fingerprints resulting from gel electrophoresis on several DNA samples found at a crime scene. Which suspect is linked to the crime scene by this DNA analysis?



SECTION B: ESSAY QUESTIONS [80 MARKS]

Please answer ANY FOUR of the questions in this section.

QUESTION 2

2.1. In a tabular form, highlight the differences between mutations and polymorphism. (5)

2.2. Explain polygenic inheritance as a genetic concept beyond the Mendelian principle with suitable examples. (7)

2.3. With the aid of illustrations, discuss the process of deletion, duplication, inversion, and translocation in chromosomal mutation. (8)

QUESTION 3

3.1. With reference to chromosomal mutation, number of chromosomes, phenotypic expression, and treatment, discuss Down Syndrome genetic disorder. (8)

3.2. Describe the inheritance of *ABO* blood groups, including an example of the possible outcomes of a homozygous blood group *A* mother having a child with a blood group *O* father. (8)

3.3. Why are transposons referred to as important genetic materials? (4)

QUESTION 4

4.1. List three main functional gene products that control structures and functions in organisms. (3)

4.2. Which of the RNA acts as an adapter in gene expression? (2)

4.3. Using illustrations, types and actions of the various enzymes involved, discuss the process of gene splicing in gene expression. (15)

QUESTION 5

5.1. Briefly explain the potential evolutionary reasons behind the development of sexual dimorphism and its implications for sexual selection and reproductive strategies. (8)

5.2. There are four accepted concepts in the evolution of population. State these four concepts and briefly explain Concept 1. (12)

QUESTION 6

Discuss how natural selection, genetic drift and gene flow alter allele frequencies within a natural population. (20)

END OF QUESTION PAPER