NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION: BACHELOR OF SCIENCE	
QUALIFICATION CODE: 07BOSC	**LEVEL:** 6
COURSE NAME: GENETICS	**COURSE CODE:** GEN602S
SESSION: NOVEMBER 2019	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER (S):	**Prof. Edosa Omoregie**
MODERATOR:	**Prof. Sylvester Rodgers Moyo**

INSTRUCTIONS
1. Answer all questions in Sections A 2. Answer any three questions in Section B 3. Write clearly and neatly 4. Number your answers correctly

PERMISSIBLE MATERIAL

Scientific Calculator

THIS QUESTION PAPER CONSISTS OF 5 PAGES
(Including this front page)

SECTION A (MULTIPLE CHOICE QUESTIONS): ANSWER ALL QUESTIONS [40]

1. Which of the following conditions best describe the appearance of the chromosomes after the *S* phase of cell division? (2)
   A. a pair of homologous chromosomes
   B. a pair of sister chromatids each with its own centromere
   C. a pair of homomorphic chromosomes
   D. a pair of sister chromatids that share one centromere

2. Which of the following statements is true during the anaphase phase of mitosis? (2)
   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 opposite poles

3. Which of the following blood genotypes belong to an individual that is regarded as a universal blood donor? (2)
   A. I^AI^A
   B. I^AI^O
   C. I^AI^B
   D. I^OI^O

4. In a cross between two black labrador retriever dogs, the phenotypic ratio of the offspring is 9 black puppies to 3 chocolate puppies to 4 yellow puppies; this is an example of? (2)
   A. partial recessiveness
   B. incomplete penetrance
   C. incomplete dominance
   D. epistasis

5. Which of the following concepts is not attributable to Mendel? (2)
   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

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? (2)
   A. dominant
   B. recessive
   C. pleiotropic
   D. incompletely dominant

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? (2)

A. a hydrogen bond
B. a phosphodiester bridge
C. an amide bond
D. a phosphoanhydride bond

8. Which of the following statements best describes a polygenic genetic disorder? (2)
A. disorders transmitted in the gametes through generations
B. disorders with multifactorial inheritance
C. disorders derived from parents
D. disorders present at birth

9. In RNA, which of the following pairings of nitrogenous bases is true? (2)
A. the [G] = [C]
B. the [A] = [T]
C. the [G+C] = [A+T]
D. none of the above are true

10. Which of the following chromosome conditions is for a Down Syndrome individual? (2)
A. 47 XXY
B. trisomy 21
C. X monosomy
D. Trisomy 15

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? (2)
A. X^hX^h
B. X^HX^h
C. X^HX^H
D. All of the above

12. The Pribnow Box of the sequence TATAAT of six nucleotides that is an essential part of which of the following sites on the RNA? (2)
A. attenuator
B. enhancer
C. promoter
D. operator

13. During DNA replication, the role of the enzyme DNA polymerase is to? (2)
A. remove the RNA primer
B. add nucleotides to the 3' end of the DNA
C. to link okasaki fragments together
D. to unwind the original DNA molecule

14. Removal of introns from RNA in gene expression is by the following molecules? (2)
A. primosomes
B. peptidases
C. galactosidases

D. spliceosomes

15. In the genetic code, the length of a codon is _____. (2)
A. 1 base
B. 2 bases
C. 3 bases
D. 4 bases

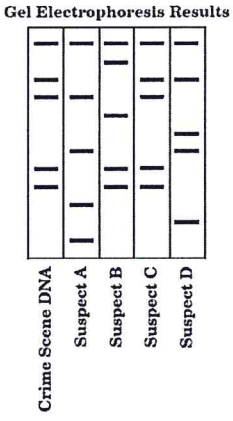
16. Which of the following is the optimum temperature for thermostable DNA polymerase of Taq polymerase during the PCR experimental step of DNA extension? (2)
A. 15 – 20^{O}C
B. 20 – 25^{O}C
C. 45 – 50^{O}C
D. 72 – 74^{O}C

17. Which of the following is an autosomal recessive trait (2)
A. Duchenne muscular dystrophy
B. Lesch-Nyhan syndrome
C. Marfan syndrome
D. Cystic Fibrosis

18. Which of the following sequences will a strand of DNA with the sequence of base AACTTGGTA have a complimentary strand? (2)
A. CCAGGTCAT
B. AACTTGCAT
C. TTCAAGCAT
D. TTGAACCAT

19. In chromosomal mutation, which of the following chromosome numbers is referred to as Tetrasomy. (2)
A. $2n - 1$
B. $2n + 2$
C. $2n + 1$
D. $2n - 2$

20. The diagram below represents DNA fingerprints which are the result of gel electrophoresis done 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): ANSWER ANY THREE QUESTIONS [60]

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

B. With suitable examples, explain polygenic inheritance as a genetic concept that is beyond Mendelian principle? (7)

C. With the aid of schematic illustration, discuss the process of deletion, duplication, inversion and translocation in chromosomal mutation. (8)

22. A. Briefly explain the molecular structure of mRNA and highlight the main structural differences between RNA and DNA molecules. (10)

B. With reference to types and actions of the various enzymes involved, discuss the process of transcription and translation in gene expression. (10)

23. A. 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. (4)

B. Explain the roles of transposons and transposase in genetic recombination (8)

C. Explain the roles of the various enzymes involved in the synthesis of new DNA strands from the parent DNA strand. (8)

24. Discuss how the process of natural selection, genetic drift and gene flow alter the frequencies of alleles in a population. (20)