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**UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER
MAIN EXAMINATIONS**

FOR THE DEGREE OF BACHELOR OF SCIENCE IN BIOLOGY

COURSE CODE: SZL 312

COURSE TITLE: ANIMAL GENETICS AND EVOLUTION

DATE: 13TH DECEMBER 2023

TIME: 2.00 - 4.00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One (1) and any other two (2) Questions.

Question One is compulsory and carries 30 marks, the other Questions carry 20 marks each.

TIME: 2 Hours

This paper consists of 3 printed pages. Please Turn Over



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Question 1

- a. Which of these DNA fragments will have a higher melting temperature? (3 marks)
- A) GCATTGACCGGAGGGACT
CGTAACTGGCCTCCCTGA
- B) GGATTTC AATTACTTAAAT
CCTAAAGTTAATGAATTA
- b. Which type of mutation does not change an organism's phenotype despite changing its genotype? (1 mark)
- c. Which enzyme is NOT involved in DNA replication? (1 mark)
- A. Lipase
 - B. Helicase
 - C. Gyrase
 - D. DNA polymerase
 - E. Ligase
- d. Which of the following characteristics is NOT seen in both DNA and RNA? (1 mark)
- A. Read in the 5'-to-3' direction
 - B. A double helix
 - C. Adenine
 - D. A pentose sugar
- e. Which of the following statements is correct about the differences between DNA and RNA? (1 mark)
- A. DNA is present as a single-stranded molecule while RNA is double-stranded
 - B. The sugar molecule in RNA has one more hydroxyl group than the sugar molecule in DNA
 - C. RNA is synthesized from DNA during transcription, but DNA can never be synthesized from RNA
 - D. RNA contains the same bases as DNA, except uracil is present instead of guanine
 - E. DNA is not present in prokaryotes, while RNA is
- f. DNA is found as linear chromosomes, tightly coiled and packaged with associated proteins, called histones, in which type of organism? (1 mark)
- A. Eukaryotes
 - B. Prokaryotes
 - C. Both eukaryotes and prokaryotes
- g. Define the following terminologies: (5 marks)
- i. Loci,
 - ii. Exon,
 - iii. Intron,
 - iv. Species,

- v. Nucleoside.
- h. The essence of Darwin's theory is that natural selection will occur if three conditions are met. What are these conditions? (3 marks)
- i. What are the 3 principles of Mendelian genetics? (3 marks)
- j. Is gene flow synonymous with migration? Explain your answer. (4 marks)
- k. What are the requirements for polymerase chain reaction? (5 marks)
- l. What is a gene? (2 marks)

Question Two

- a. What is natural selection? (2 marks)
- b. With the help of examples, differentiate between the various types of natural selection. Use diagrams where need be. (18 marks)

Question Three

Discuss the DNA transcription process. Use relevant diagrams where need be. (20 marks)

Question Four

Marian's father is colorblind, as is her maternal grandfather (her mother's father). Marian herself has normal color vision. Marian and her husband, Martin, who is also colorblind, have just had their first child, a son they have named Michael. Please answer the following questions about this small family. (20 marks)

- a. What is the probability that this child will be colorblind?
- b. Three sources of the colorblindness allele are mentioned in this family. If Michael is colorblind, from which of these three men (Marian's grandfather, Marian's father, or Martin) did he inherit the allele?
- c. Using proper pedigree format, diagram the available information about the four generations of this family described, assuming that Michael is colorblind.
- d. If Martin were not colorblind, how would this affect the prediction about Michael?

Question Five

Using any organism as an example, discuss sex determination. (20 marks)