



MACHAKOS UNIVERSITY

University Examinations 2022/2023 academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (AGRICULTURAL EDUCATION AND EXTENSION).

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF ENVIRONMENTAL SCIENCES

SBC 120: INTRODUCTION TO GENETICS

DATE:

TIME:

INSTRUCTIONS

1. Answer Question ONE (compulsory) and **any two** questions in Section B.
2. Use clean well labelled diagrams wherever appropriate.

SECTION A

QUESTION ONE (30 MARKS).

- a) A culture of animal tissue was being grown in a laboratory to study mitosis. A solution containing radioactively labelled nucleotides was added to the culture in the middle of prophase. Growth was halted at the end of telophase.
- i. At which stage would the scientists see radioactively labelled DNA? (1 mark)
 - ii. Explain your answer. (2 marks)
- b) Using an illustration, show how gametes with new combinations of alleles can arise from **AA BB** and **aa bb** parents. (3 marks)
- c) In the snapdragon flower (*Antirrhinum majus*), a cross between a homozygous parent with white flowers ($C^W C^W$) and a homozygous parent with red flowers ($C^R C^R$) will produce offspring with pink flowers ($C^R C^W$).
- i. Explain this observation (1 mark)
 - ii. Using a punnett square, show the results of the offspring from a cross between two heterozygous individuals (3 marks)

- d) In garden peas, the allele **Y**, for yellow pea pod color is dominant to **y**, the allele for green pea pod color. In a garden with 10,000 pea plants, 1,600 were found to have green pods. Determine the frequency of **homozygous** and **heterozygous** plants (4 marks)
- e) Tomato variety A with **improved fruit size** was developed and selected by plant breeders under a controlled environment.
- What do you think were the observations made when Tomato variety A was cultivated by farmers under field conditions? (1 mark)
 - Account for the observations made (2 marks)
 - Why is this observation/phenomenon a challenge to plant breeders? (2 marks)
- f) Two genes **A** and **B** are linked. The other homologous chromosome contains their **a** and **b** allele. Give combination of alleles in gametes with and without crossing over. (4 marks)
- g) Differentiate between pleiotropy and polygenic inheritance and give an example in each case. (4 marks)
- h) What is the role and economic importance of crop genetic diversity in food security? (3 marks)

SECTION B: ANSWER ANY TWO QUESTION

QUESTION TWO (20 MARKS).

- Using clear illustrations, discuss mitosis. (10 marks)
- Compare and contrast mitosis and meiosis (10 marks)

QUESTION THREE (20 MARKS).

- Using a clear illustration, describe the process of DNA replication. (10 marks)
- Using the principle of DNA replication, describe an experiment for detecting *Babesia bigemina* pathogen in a cattle blood specimen. (10 marks)

QUESTION FOUR (20 MARKS).

- With the aid of illustrations where possible discuss three sources of genetic diversity. (12 marks)
- Discuss ways in which genetic diversity can be lost in a population (8 marks)

QUESTION FIVE (20 MARKS)

- Using a relevant example in each case, illustrate how polygenic inheritance differs from Mendelian inheritance. (10 marks)
- Describe the pattern of rabbit coat color inheritance (10 marks)