



“Investing in Africa’s future”

COLLEGE OF HEALTH, AGRICULTURE & NATURAL SCIENCES

NACP 217: GENETICS AND BIOTECHNOLOGY

END OF SECOND SEMESTER FINAL EXAMINATIONS

APRIL 2023

LECTURER: MR. TABARIRA J.

DURATION: 3 HOURS

INSTRUCTIONS

Answer any **four** questions

All questions carry equal marks (25).

DO NOT repeat material.

Write legibly.

Question One

Give explanatory notes on the following:

- a. Importance of mitosis in agriculture. [8]
- b. Difference between RNA and DNA. [4]
- c. Effects of temperature on gene expression. [5]
- d. Sex limited characteristics. [4]
- e. Epistasis gene interaction. [4]

Question Two

a. Provide possible gametes from organisms with the following genotypes:

- a. AaBb [2]
- b. AabbCC [3]
- c. AaBbCc [3]
- d. AaBbCCDd [5]

b. In cats, there is a coat color gene located on the X chromosome. This gene has two alleles—orange and black. A heterozygous cat has tortoiseshell color (mixture of orange and black).

Predict the genotypic and phenotypic proportions among the offspring of the following crosses. Pay careful attention to the **genders** of the offspring.

- i. Black female X Orange male [3]
- ii. Orange female X Black male [3]
- iii. Tortoiseshell female X Black male [3]
- iv. Tortoiseshell female X Orange male [3]

Question Three

- a. Justify why agriculture students study Genetics. [5]

- b. Write brief notes on maternal effects. [4]
- c. Differentiate between co-dominance and complete dominance [5]
- d. Colour blindness is a recessive X-linked gene in humans. A husband and wife both are normal eyed although their respective fathers were colour blind.
 - i. Give the genotypes of this couple and justify. [3]
 - ii. What is the probability that, among the boys from this couple will be colour blind? [2]
 - iii. What percentage of males among the children will have normal vision? [2]
 - iv. What percentage of girls among the children will be colour blind? [2]
 - v. What is the expected percentage of children with normal vision (sex unspecified) from this couple? [2]

Question Four

- a. Discuss the perceived crop production and food security benefits of adopting GMO technology in Zimbabwe. [14]
- b. In flowers of the snapdragon plants, RR = red, Rr = pink, and rr = white. What are the expected **phenotypes** and their **frequencies** from crosses between plants with?
 - i. red and white flowers [2]
 - ii. red and pink flowers [2]
 - iii. pink and pink flowers [2]
 - iv. pink and white flowers [2]
- c. Explain with justification the nature of dominance relations in flower colour in the snapdragon plant. [3]

Question Five

- a. Give genetic explanations, giving supporting evidence for the following observations:
- i. A cross between a tall and dwarf maize plant always produces tall F_1 progeny. [3]
 - ii. A cross between two pink flowered plants produced a mixture of red, pink and white flowered plants. [3]
 - iii. A cross between tall maize plants produced a mixture of tall and dwarf progenies. [3]
 - iv. A cross between yellow mice gave a 2 yellow : 1 white [4]
 - v. A normal man married a colour blind woman produced all colour blind boys and normal girls. [4]
 - vi. A cross between pure red bull and pure white cow produces roan coloured calves. [3]
- b. Demonstrate your understanding of the importance of meiosis. [5]

Question six

Provide a detailed explanation on the possible reasons why the adoption of GMO technology should be encouraged globally. [25]

End of Examination Paper