1ST SEM. 2006/2007

UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME:	**DIPLOMA IN AGRICULTURE AND DIPLOMA IN AGRICULTURE EDUCATION YEAR II**
COURSE CODE:	**APH 202**
TITLE OF PAPER:	**PRINCIPLES OF GENETICS**
TIME ALLOWED:	**TWO (2) HOURS**
INSTRUCTIONS:	**YOU MUST ANSWER QUESTION 1 AND ANY OTHER 3 QUESTIONS.** **ALL WORKING MUST BE CLEARLY SHOWN**
REQUIREMENTS:	**CALCULATOR AND STATISTICAL TABLES**

THIS PAPER MAY NOT BE OPENED UNTIL THE CHIEF INVIGILATOR HAS GRANTED PERMISSION.

QUESTION 1 (COMPULSORY)

a) Using a table, contrast mitosis and meiosis. **(10 Marks)**

b) A cross between plants true-breeding for axial flowers and plants true-breeding for terminal flowers gave F_1 plants of all of which produced axial flowers. Selfing the F_1 plants gave F_2 plants in which 75% produced axial flowers while the remainder produced terminal flowers.

i. How many traits are segregating? **(2 Marks)**

ii. Which trait(s) is/are dominant? Explain your answer. **(3 Marks)**

iii. Using symbols of your choice to represent each allele. Give the genotypes of parents and show the crosses described in (b). **(5 Marks)**

c) In garden peas, *grey* seed colour is dominant to *white* seed colour. In the following experiments, parents with known phenotypes but unknown genotypes produced the listed progeny:

	Progeny	
Parents	Grey	White
1. grey x white	82	78
2. grey x grey	118	39
3. white x white	0	50
4. grey x white	74	0
5. grey x grey	90	0

Using the letter *G* for *grey* gene and *g* for *white*, give the most probable genotype of each parent. **(15 Marks)**

d) Define the following terms:

i. Dihybrid cross

ii. Phenotype

iii. True breeding

iv. Synaptonemal complex

v. Parthenogenesis **(5 Marks)**

QUESTION 2

a) Consider a tall pea plant:

i. If nothing is known of the breeding history of the plant, what are the possible genotypes? **(2 Marks)**

ii. If the plant were to be test crossed, what would be the phenotype of the other parent? **(2 Marks)**

iii. If all of the progeny from the testcross were tall, what would be the genotype of the tall plant? **(3 Marks)**

iv. If the tall plant were heterozygous, what would be the phenotypic ratio of the testcross progeny? **(3 Marks)**

b) Distinguish between the following:

i. Co-dominance and incomplete dominance

ii. Sex-limited and sex-influenced traits

iii. Dominant and recessive traits

iv. Autosomes and sex chromosomes

v. Metacentric and telocentric centromeres **(10 Marks)**

QUESTION 3

a) In a cross *AaBbCc* X *AaBbCc*, what is the probability of producing the genotype *aabbcc,* assuming independent assortment? **(6 Marks)**

b) In chickens, some birds have uniformly coloured feathers (non-barred) whilst others have stripes of light and dark colouring (barred). A poultry breeder crosses a barred male to a non barred female and finds that all the progeny are barred. However, the reciprocal cross gave barred males and non-barred females.

i. What do the results tell you about the inheritance of this trait? **(2 Marks)**

ii. Using clearly stated symbols of your choice, state the genotypes of the parents and progeny in both the forward and the reciprocal cross. **(6 Marks)**

iii. What are the expected phenotypic proportions in the F_2 of this cross?

(6 Marks)

QUESTION 4

a) Explain why you would expect genetic differences between cells to arise from meiosis and not mitosis. **(6 Marks)**

b) Perform a chi-square test for the hypothesis that the observation of 35 tall and 25 short plants arise from a cross between heterozygotes, Tt x Tt. Use $\alpha = 0.05$.

(8 Marks)

c) What is the significance of mitosis? **(6 Marks)**

QUESTION 5

a) Explain what is meant by the following (provide examples where possible):

i. The blending theory of inheritance
ii. The chromosome theory of inheritance
iii. Incomplete dominance
iv. Graded dominance **(8 Marks)**

b) Haemophilia A is caused by a sex-linked recessive gene in humans and in dogs. If a haemophilic male mate with a homozygous non-haemophilic female:

i. What proportions (and sexes) among their offspring will be haemophiliacs? **(4 Marks)**
ii. If a daughter produced by the mating above is mated to a normal male, what proportions (and sexes) will be haemophilic among their offspring?

(4 Marks)

c) Briefly explain the following gene interactions, which may cause changes in phenotypic ratios:

i. Pleiotropism
ii. Lethality **(4 Marks)**