

02
CYTOLOGY, HISTOLOGY AND GENETICS
Oct/Nov. 2011
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN APPLIED BIOLOGY

CYTOLOGY, HISTOLOGY AND GENETICS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

*Answer booklet;
Scientific calculator.*

This paper consists of TWO sections; A and B.

Answer ALL the questions in section A and any THREE questions from section B.

Each question in section A carries 4 marks while each question in section B carries 20 marks.

Maximum marks for each part of a question are indicated.

This paper consists of 4 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A (40 marks)

Answer ALL the questions in this section.

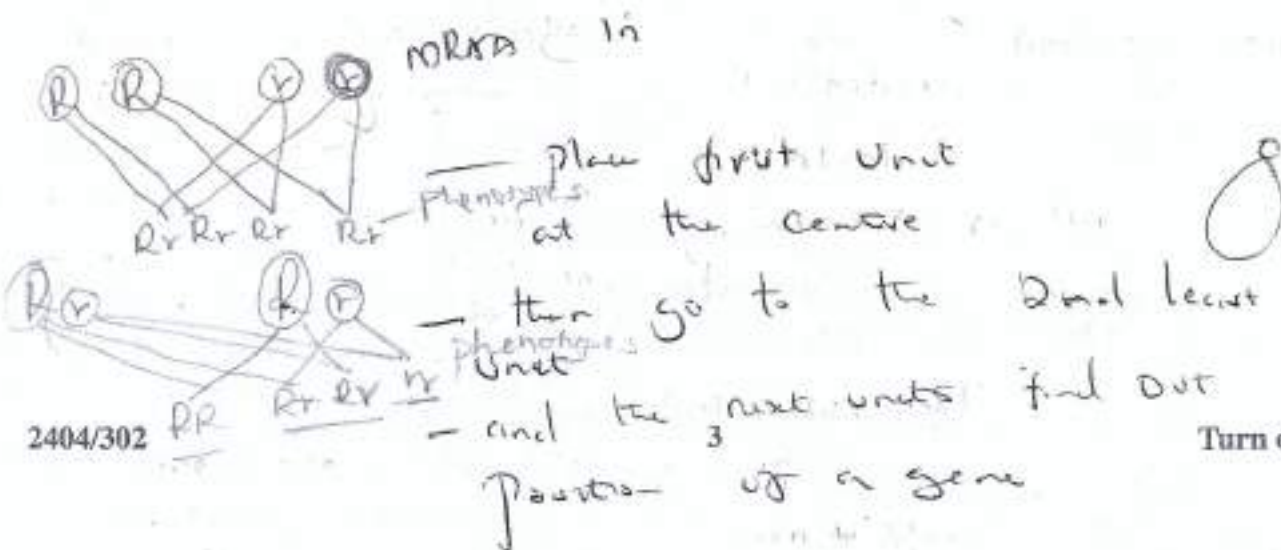
1. Explain the principle of gene mapping. (4 marks)
2. Distinguish between ^{metacentric} metacentric and ^{acrocentric} acrocentric chromosomes. (4 marks)
3. Explain the causes of polyploidy condition in cells. (4 marks)
4. State the role of the following in protein synthesis:
 - (a) r RNA; (2 marks)
 - (b) tRNA. (2 marks)
5. Explain the role of the following cell organelles in interpretation of DNA information: (2 marks)
 - (a) Endoplasmic reticulum; (2 marks)
 - (b) Golgi bodies. (2 marks)
6. (a) Explain why ribboning fails to occur during sectioning. (2 marks)
(b) Explain how ribbons attached to microtome knife can be detached. (2 marks)
7. Outline the mounting of a section on a glass slide. (4 marks)
8. (a) Name any two clearing agents used in histology. (2 marks)
(b) Define epistasis. ^{Epistasis} ^{is a form of gene interaction} ^{where} ^{one} ^{gene} ^{suppresses} ^{the} ^{effect} ^{of} ^{another} ^{gene} ⁱⁿ ^{another} ^{locus}. (2 marks)
9. Explain the importance of crossing over during interphase. (4 marks)
10. State the role of the following cells organelles:
 - (a) cytosol; ^{cytoskeleton} (1 mark)
 - (b) microtubules; ^{microtubule} (1 mark)
 - (c) centrosomes. (2 marks)

11. Picric acid - 2.7
Formaldehyde - 2.7 ml
Acetic 5ml

SECTION B (60 marks)

Answer any **THREE** questions from this section.

11. (a) Describe the events that take place during interphase and prophase of meiotic cell division. (10 marks)
- (b) List the probable gametes that can form from (HGT+) genotype. (2 marks)
- (c) A true breeding red flowered plant was crossed with a true breeding white flowered plant. All F1 were pink. When F1 was selfed, three phenotypes were produced, 1 red, 2 pink and 1 white.
- (i) Using your choice of symbols, suggest the genotype of the parents. (2 marks)
- (ii) Explain the likely type of inheritance. (2 marks)
- (iii) Work out the genotypes of F2. (4 marks)
12. (a) Describe the procedure of dehydrating delicate tissues. (7 marks)
- (b) Describe the preparation of Bouins fixative. (6 marks)
- (c) Explain the role of the following in tissue processing:
- (i) Embedding and infiltration. (4 marks)
- (ii) Clearing. (3 marks)
13. Discuss transcription of mRNA and protein synthesis. (20 marks)
14. (a) Explain the mechanisms of chromosomal mutation. (10 marks)
- (b) Describe the sex determining mechanisms in animals. (6 marks)
- (c) Using specific example, explain how multiple alleles inheritance works. (4 marks)



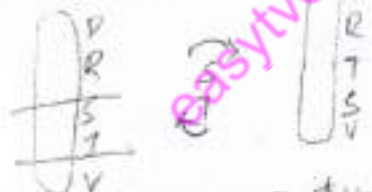
15. (a) (i) Explain the significance of cell division. (5 marks)
- (ii) Explain the role of metaphase and anaphase in meiotic and mitotic cell division. (4 marks)
- (b) (i) Distinguish between mordanting counter staining and progressive staining. (6 marks)
- (ii) Outline the preparation of Carbol Fuchsin stain. (5 marks)



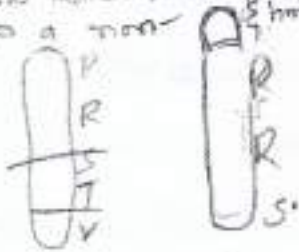
Deletion - part / segment of chromosome is absent / missing.

Duplication - part / segment of chromosome is duplicated / repeated.

Inversion - part / segment of chromosome is reversed / angle of 180°.



Translocation - part / segment of chromosome is transferred to a non-homologous chromosome.



- Two