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Exam

2404/302  
CYTOLOGY, HISTOLOGY  
AND GENETICS  
Oct./Nov. 2018  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN APPLIED BIOLOGY

CYTOLOGY, HISTOLOGY AND GENETICS

3 hours

INSTRUCTIONS TO CANDIDATES

*You should have an answer booklet and scientific calculator for this examination.*

*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.*

*Candidates should answer the questions in English.*

**This paper consists of 5 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. (a) State **one** function of each of the following:
- (i) ribosomes; (1 mark)
  - (ii) microtubules. (1 mark)
- (b) List any **two** differences between the cell wall of a green plant and that of a bacteria. (2 marks)
2. (a) Distinguish between the following:
- (i) hertones and histones; (1 mark)
  - (ii) autosomes and sex chromosomes. (1 mark)
- (b) Give **two** structural differences between DNA and RNA. (2 marks)
3. (a) Name any **four** types of gene mutations. (2 marks)
- (b) Distinguish between gene and chromosome mutation. (2 marks)
4. (a) State the role of each of the following during protein synthesis:
- (i) messenger RNA; (1 mark)
  - (ii) transfer RNA. (1 mark)
- (b) (i) Distinguish between transcription and translation. (1 mark)
- (ii) Identify the organelle where each of the above process occurs within the cell. (1 mark)



5. During cell division a pair of homologous chromosomes appear as shown in figure 1.

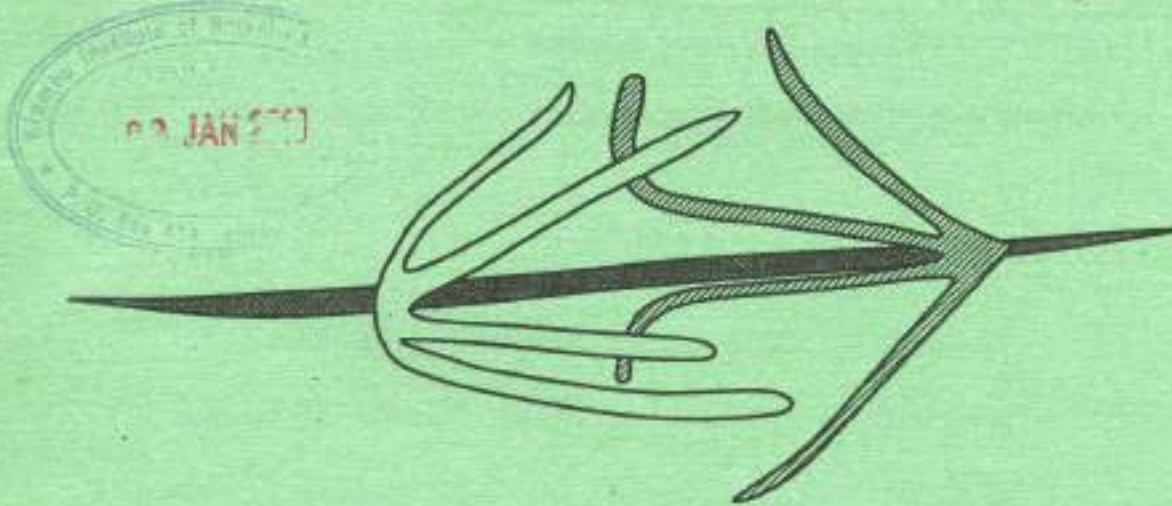


Fig. 1

- (a) Describe the chromosomal behaviour shown in the figure 1. (2 marks)
- (b) (i) Name the type of cell division in which such events occurs. (1 mark)
- (ii) Identify the stage and sub-stage at which such event occurs. (1 mark)
6. When red flowered garden pea was crossed with white flowered garden pea, the  $F_2$  generation produced were as follows:
- 2 Pink, 1 Red and 1 white
- Work out the possible genotypes of the parents using R-red and Z-white. (4 marks)
7. (a) List any **two** qualities of a good fixative. (2 marks)
- (b) Give any **two** disadvantages of using chromium trioxide as a fixative. (2 marks)
8. Describe how the formation of the following can be prevented during tissue processing:
- (a) (i) mercuric chloride crystals; (1 mark)
- (ii) formalin pigment. (1 mark)
- (b) Give **two** reasons for adding sodium chloride to formalin or mercuric chloride during embedding stage. (2 marks)
9. (a) Define impregnation as used in histology. (1 mark)
- (b) Explain the importance of size in impregnation. (3 marks)

10. (a) Define chromatization. (1 mark)
- (b) List any **two** qualities of a good decalcifying agent. (2 marks)
- (c) List any **one** method used in determining the end point of decalcification. (1 mark)

### SECTION B (60 marks)

*Answer any THREE questions from this section.*

11. (a) Describe the events that occur during cell division of prophase I in meiosis. (10 marks)
- (b) Draw a labelled diagram of ultra structures of the following:
- (i) mitochondrion; (5 marks)
- (ii) nucleus. (5 marks)
12. (a) Calculate the volume of fixative required for a spherical muscle tissue with a diameter of 1.8 cm. (6 marks)
- (b) (i) Outline the procedure for fixing a large piece of tissue. (6 marks)
- (ii) Give any **three** reasons for fixing large pieces of tissues. (3 marks)
- (c) (i) List any **two** advantages of using paraffin wax for embedding. (1 mark)
- (ii) Name any **four** other embedding media. (4 marks)
13. (a) Define "sex determination". (1 mark)
- (b) List the **five** mechanism of sex determination. (5 marks)
- (c) Discuss the chromosomal basis of sex determination. (14 marks)
14. (a) Describe the structure and function of Golgi complex. (16 marks)
- (b) Identify any **four** differences between 70s and 80s ribosomes. (4 marks)



15. (a) (i) Define epistatis. (1 mark)
- (ii) Name **two** types of epistatis. (2 marks)
- (b) In epistatic cross between a brown dog and a white dog. The results were 12 white, 3 black and 1 brown in  $F_2$  generation.  
Work out the epistatic crosses given that white epistatic gene is represented by I, its recessive allele i and black hypostatic gene is its allele b. (11 marks)
- (c) Define each of the following terms giving an example in each case:
- (i) collaboration genes; (2 marks)
- (ii) supplementary genes; (2 marks)
- (iii) complementary genes. (2 marks)



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