2404/302
CYTOLOGY, HISTOLOGY AND GENETICS
Oct./Nov. 2008
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** 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.*

This paper consists of 4 printed pages.

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

 Turn over

SECTION A

*Answer **ALL** questions in this section.*

1. List **four** factors that may limit the expression of phenotypic characteristics of the genotype of a plant species. (4 marks)

2. (a) State **two** differences between light and electron microscopes in respect to specimens under observation. (2 marks)

   (b) Differentiate between resolution and magnification of a microscope. (2 marks)

3. (a) Explain the term mordant. (1 mark)

   (b) Name **two** examples of mordants. (2 marks)

   (c) State **one** advantage of using a mordant. (1 mark)

4. (a) Define the term autophagy. (1 mark)

   (b) State the functions of Golgi apparatus. (3 marks)

5. Explain the role of centriole in cell division. (4 marks)

6. Name **four** types of embedding media. (4 marks)

7. State **two** reasons for performing each of the following histological procedures:

   (a) fixing tissues; (2 marks)
   (b) macerating tissues. (2 marks)

8. Name **four** clearing agents in histological procedures. (4 marks)

9. (a) Differentiate between progressive and regressive staining. (2 marks)

   (b) State **two** factors that may affect staining. (2 marks)

10. (a) Name **two** types of microtome knives. (1 mark)

    (b) Explain the process of cutting using a microtome. (3 marks)

SECTION B

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

11. (a) Define the term variation as applied in genetics. (4 marks)

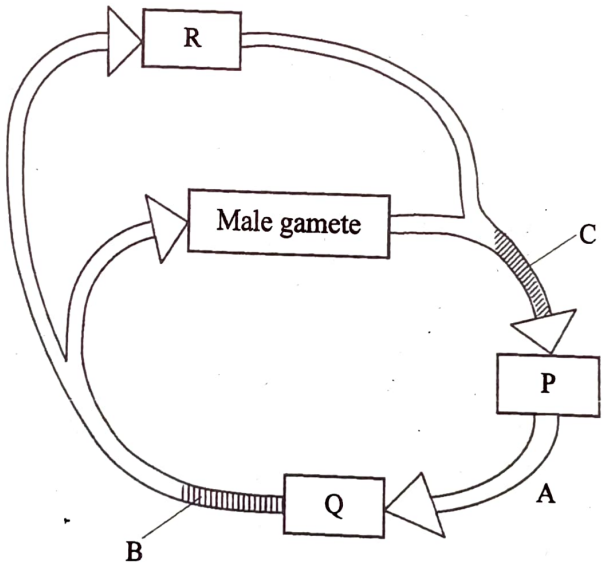
(b) Explain the process that would produce genetic variation in a population of sexually reproducing organisms. (16 marks)

12. (a) Explain how each of the following procedures would be carried out in making a permanent preparation of a tissue:

(i) dehydration; (6 marks)
(ii) clearing; (4 marks)
(iii) infiltration. (4 marks)

(b) State **two** ways in which each of the processes stated in (a) above is important. (6 marks)

13. (a) The diagram below shows a life cycle involving sexual reproduction in animals.



(i) Name the processes labelled A, B, and C. (3 marks)

(ii) In the boxes labelled P, Q, R write the stage in the life cycle and indicate the number of chromosomes. (6 marks)

(b) (i) State the composition of the plasma membrane. (1 mark)

(ii) Name **three** classes of proteins that are embedded in the plasma membrane. (3 marks)

(c) State the function of cell surface markers. (2 marks)

(d) (i) State **three** disadvantages of using natural resin mountants in mounting procedures. (3 marks)

(ii) Name **two** types of pens used in labelling prepared slides. (2 marks)

14. A research scientist carried out work on rearing drosophilas to study their genetics. In this species, the genes for grey body colour and wing length have phenotypic characteristics determined by different alleles: grey and black body; long and short wings. Grey body and long wings are dominant. If pure breeding grey bodied, long winged drosophilas are crossed with black bodied and short winged drosophilas,

(a) determine the:

(i) genotype;
(ii) phenotype of F_1. (6 marks)

(b) (i) Define punnet square (checker board). (2 marks)

(ii) Determine the phenotypic ratio of F_2 obtained by crossing the F_1 individuals. (12 marks)

15. Discuss the main functions of the following:

(a) plant cell wall; (15 marks)

(b) plant cell vacuole. (5 marks)