RWANDA NATIONAL EXAMINATIONS COUNCIL

B.P. 3817 KIGALI - TEL/FAX : 586871

Biology II

015

08 Oct 2004 8h30 – 11h30

NATIONAL EXAMINATION 2003/2004

SUBJECT : BIOLOGY II

OPTIONS : MATHS – PHYSICS
: NPA

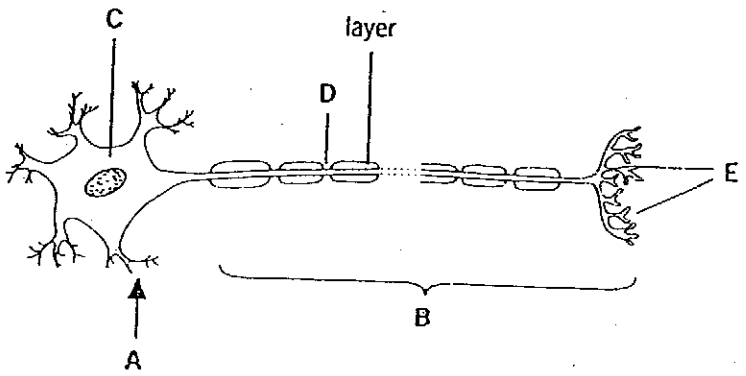
DURATION : 3 HOURS

INSTRUCTIONS :

Answer ALL questions in Section **A**.
THREE questions in section **B** and only ONE in Section **C**.

SECTION A: Answer all questions in this section /55 Marks.

1. The diagram below shows a mammalian neurone.



(a) What type of neurone is shown? **(1mark)**

(b) Name the parts labelled A, B, C and D.

A:
B:
C:
D:

(2marks)

(c) (i) Suggest two reasons why the fibre is surrounded by a fatty layer. **(2maks)**

(ii) Name the fatty layer. **(1mark)**

2. (a) The molecules listed below may be found in eukaryotic cells.

- Glycogen
- Glycoprotein
- Histones
- Cytochrome
- Phospholipids
- RNA
- DNA

Choose two of the molecules listed above that would normally be found in:-

(i) the cell membrane

(ii) a chromosome

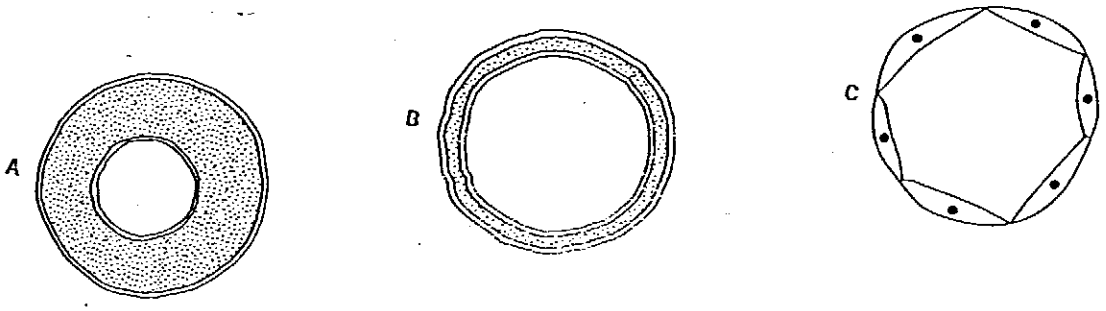
(4marks)

(b) Explain the biological significance of the following.

(i) The nuclear envelope has many pores on its surface.

(ii) The membrane of some cells is folded into microvilli. **(2marks)**

3. The diagrams below show three types of blood vessels in transverse section.



(a) Name the blood vessels.

A:

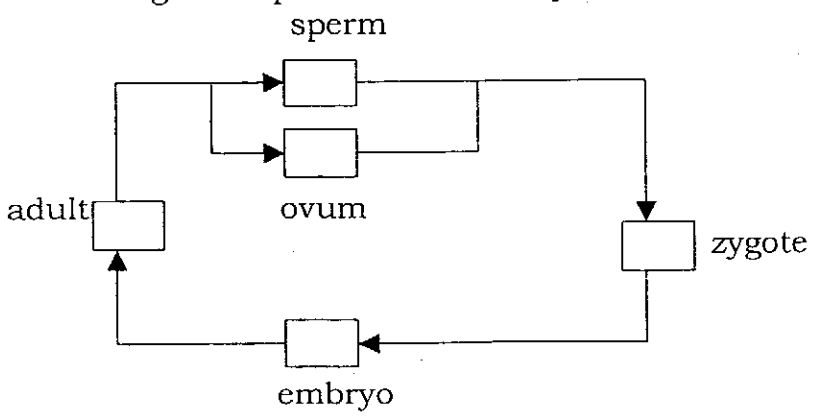
B:

C: **(2marks)**

(b) Describe the roles of vessel C. **(1mark)**

(c) Describe two ways that vessel C is adapted for its function. **(2marks)**

4. The diagram represents the life cycle of the arctic fox (2n = 52)



(a) Complete this diagram by writing in the boxes the number of chromosomes present at each stage. **(2marks)**

(b) The arctic fox is able to breed with the red fox (2n = 34). The offsprings, however, are 2n = 43 which makes them infertile. Suggest why this chromosome number makes the offspring infertile. **(2marks)**

5. (a) Name the region of the kidney in which the renal capsule are found. **(1mark)**

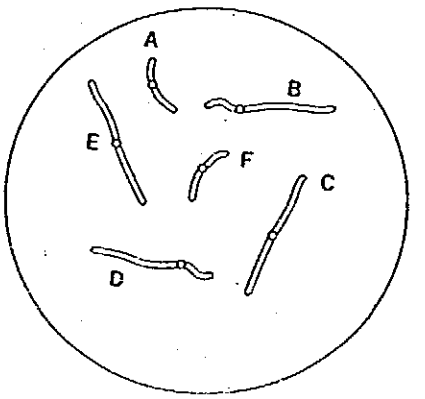
(b) Describe the process of ultrafiltration. **(3marks)**

6. The table below refers to the structure of different types of nucleic acids. If the feature is present place a (✓) in the appropriate box and if the feature is absent place a cross (×) in the appropriate box.

FEATURE.	DNA	m RNA
Cytosine present.		
Uracil present.		
Pentose Sugar present.		
Is single stranded.		

(4marks)

7. The diagram below shows the chromosomes in the nucleus of a cell.



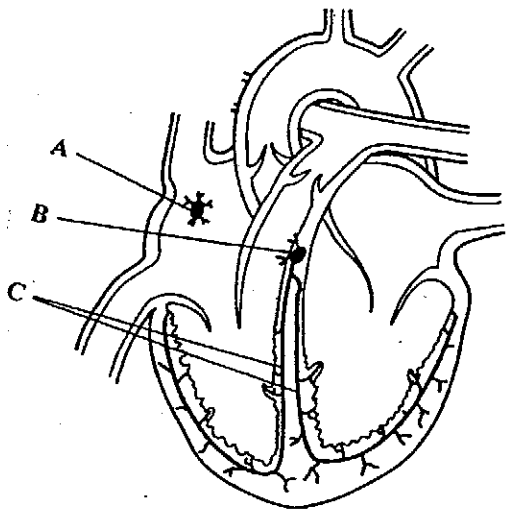
(a) (i) Give the letters of one pair of homologous chromosomes. **(1mark)**

(ii) Draw the diagrams to show the arrangement of chromosomes at Metaphase 1 and Metaphase 2 of the above cell. **(4marks)**

8. Define the following biological terms.
   (a) Pollination
   (b) Protandry **(1mark)** **(2marks)**

9. (a) Cardiac muscle contract myogenically. Explain what is meant by the term Myogenic. **(1mark)**

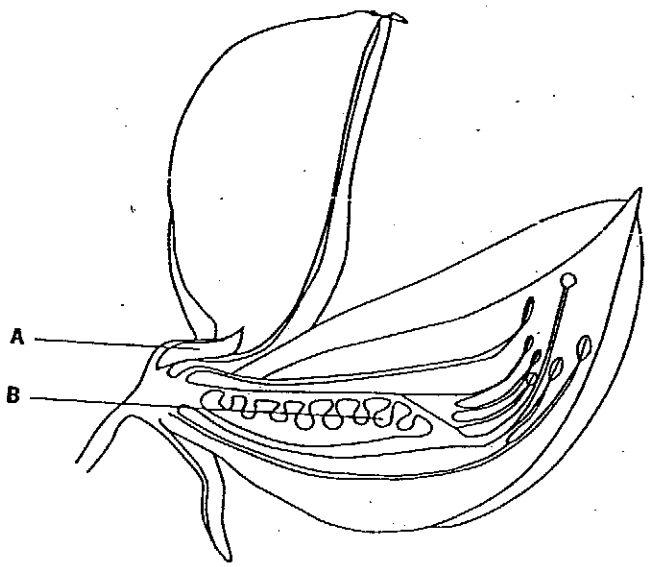
(b) The diagram below shows structures in the heart which are concerned with the coordination of contraction.



(i) Name the parts A, B and C
A----------
B----------
C---------- **(3marks)**

(ii) Explain how the structures shown in the diagram coordinate the contraction of the heart. **(3marks)**

10. The diagram below shows a vertical section of a flower.



(a) State one function for each of the parts labelled A and B. **(2marks)**

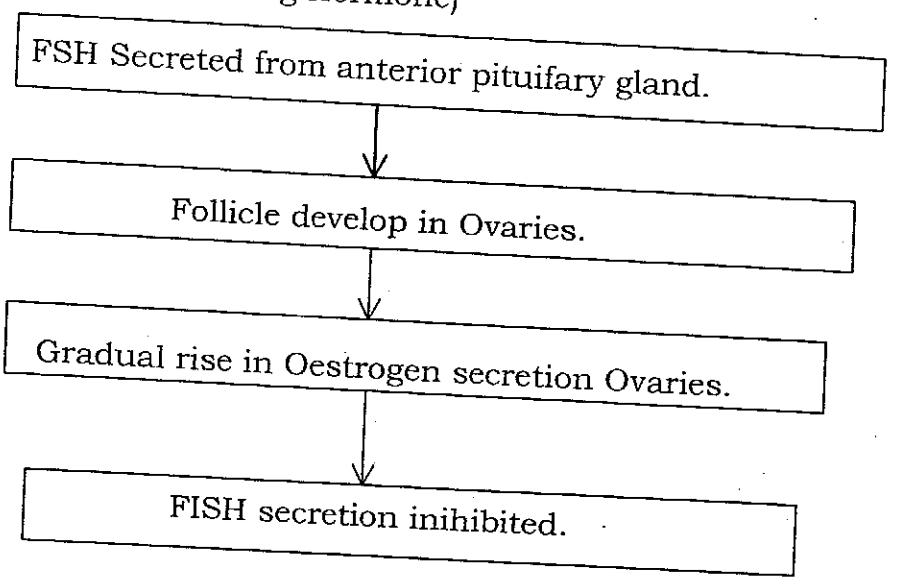
(b) This flower is insect-pollinated. Describe three features visible on the diagram, which are characteristic of insect-pollinated flowers.

(3marks)

(c) State one similarity between a human sperm and a male gamete of a flowering floweer.

(1mark)

11. The diagram below shows some of the effects that follow the secretion of FSH (Follicle Stimulating Hormone)



(a) State the type of mechanism, shown by the diagram, that controls the secretion of FSH and Oestrogen.

(1mark)

(b) Explain why hormones, such as FSH and Oestrogen, only affect the activity of specific target organ.

(2marks)

(c) With reference to the differnces between nervous and hormonal coordination, suggest why the development of the follicle is coordinated by hormones and not by the nervous system.

(2marks)

SECTION B: **/30 Marks**

Answer any THREE questions only.

12. (a) With reference to example explain what is meant by each of the following terms.

(i) Continuous variation. **(2marks)**

(ii) Discontinuous variation. **(2marks)**

(b) Variation can arise by point mutations.

(i) Describe two types of point mutation which could result in the change of a GCT codon to a GCA codon. **(2marks)**

(ii) Suggest why such a point mutation might have no effect on the phenotype. **(2marks)**

(c) Variation occurs in humans in their ability to detect sound. Two unlinked genes, each with two alleles (A and a, B and b) affect hearing in humans. A person who is homozygous recessive for either or both of these genes is deaf. A couple have the genotype Aabb and aaBb. Using a genetic diagram determine the probability that a child produced by them will have a normal hearing. **(2marks)**

13. (a) Describe how sex is determined in humans. **(3marks)**

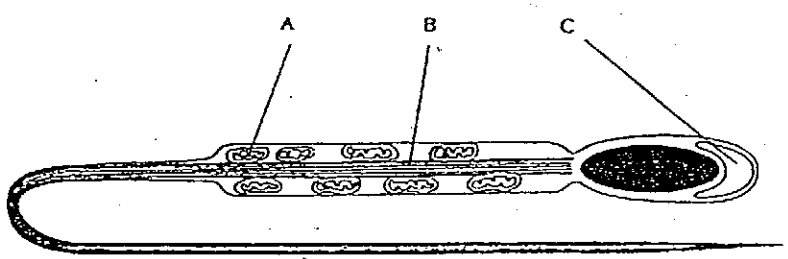
(b) The flow diagram below shows the sequence in spermatogenesis leading to the formation of spermatozoa.

Cell A
↓
Primary spermatocyte
↓
Secondary spermatocyte
↓
Spermatid
↓
Spermatozoan

(i) Name cell A **(1mark**

(ii) Indicate on the flow diagram where the second division of meiosis occurs. **(1mark**

(c) The diagram below shows the structure of a spermotozoon.



Name the parts labelled A, B and C

A:

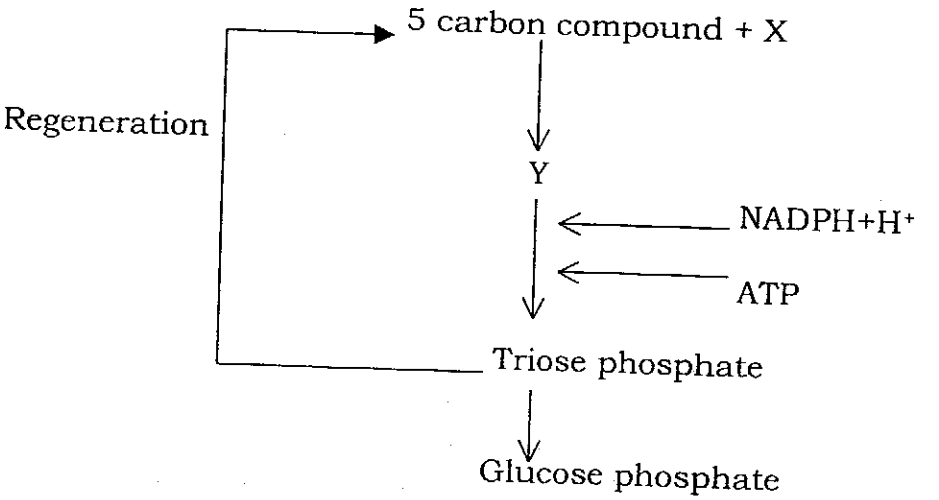
B:

C: **(2marks)**

(d) Describe how the spermatozoa are transfered into the female. **(5marks)**

14. (a) The rate of photosynthesis can be limited by a number of factors. Explain why temperature can be a limiting factor in photosynthesis. **(2marks)**

(b) The flow diagram below shows some of the processes which occur in the light-indipendent reaction of photosynthesis.

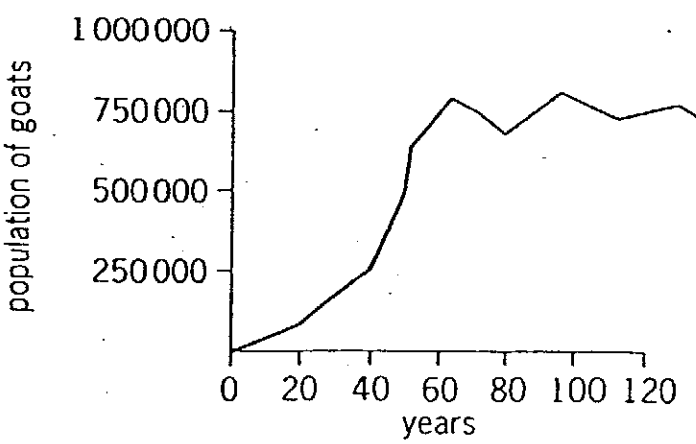


(i) Name the substances represented by X and Y. **(2marks)**

(ii) State the origin of the NADPH+H+ and ATP used in the light-independent reaction. **(1mark**

(c) Describe how the products of photosynthesis are transported in the plant. **(5marks)**

15. A type of wild goat was introduced into an Island and they bred successfully. The following graph shows the number of wild goat population over the period of 120 years after their first introduction to the Island.



(a) Describe the pattern of population change shown in the graph. **(3marks)**

(b) (i) Define what is meant by the 'carrying capacity'. **(1mark)**

(ii) What is the carrying capacity for the Island with respect to goats? **(1mark)**

(iii) Name two factors which might limit the size of the Island's carrying capacity for goats. **(2marks)**

(iv) Are factors named in (iii) above density dependent or density independent? **(1mark)**

(v) Explain what is meant by the term density independent factor. **(2marks)**

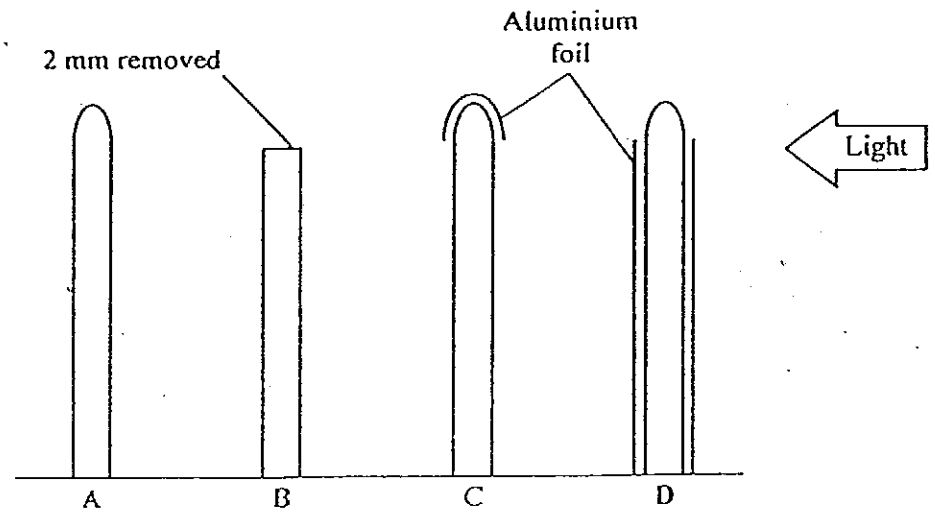
16. (a) Explain how ultrafiltration and reabsorption remove urea from the blood without losing essetial nutrients such as protein and glucose. **(5marks)**

(b) Explain the part played by the loop of Henle and the collecting duct in concentrating Urine in a healthy individual. **(5marks)**

SECTION C: **/15 Marks.**

Answer only ONE question.

17. The diagram shows four Oat seedlings which have been set up to investigate their response to light coming from one side.



(a) How would you arrange for the seedlings to receive light from one side only? **(2marks)**

(b) The seedlings were left for days with light coming from the side as shown in the diagram.

(i) Describe what would happen to the height of each of these seedlings. **(2marks)**

(ii) Describe the direction of the growth movement of each seedling after this time.

Seedling A
Seedling B
Seedling C
Seedling D

(4marks)

(c) Which part of the Oat seedling detects the direction from which the light is shining?

(d) (i) What is the name given to the growth movement of plants in response to light? **(1mark)**

(ii) Explain how this growth response in the shoot is caused. **(5mrks)**

18. There are four alleles of a gene that determine coat colour in rabbits. The alleles are not sex linked.

(a)(i) State the term used to describe these alleles. **(2marks)**

(ii) The alleles for normal colour, R, is dominant to all the other alleles. The allele for albino, r, is recessive to all the other alleles. The allele for Chinchilla, r^{ch} is dominant to himalayan, r^{h}. State the phenotype of the following genotypes.

- Rr^{ch}
- $r^{ch}r^{ch}$
- $r^{ch}r$

(3marks)

(iii) Draw a genetic diagram to show the expected results of a cross between a homozygous chinchilla male and a heterozygous himalayan female. Exaplain your results. **(6marks)**

(b) In the wild, rabbits have a high reproductive rate. Explain why such over production is necessary. **(4marks)**