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| Candidate Name | Centre Number | Candidate Number |
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WELSH JOINT EDUCATION COMMITTEE
 General Certificate of Education
 Advanced



CYD-BWYLLGOR ADDYSG CYMRU
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315/01

BIOLOGY BI5

P.M. FRIDAY, 23 June 2006

(2 hours)

For Examiner's Use Only

| | |
|------------------------|--|
| Total Marks | |
|------------------------|--|

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions in sections A and B.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The quality of written communication will affect the awarding of marks.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

SECTION A

Answer all questions.

1. (a) (i) Name **three** endangered species. [1]

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.....
.....

(ii) Give **two** reasons for species being endangered. [1]

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.....

(b) (i) Name the coiled tube divided into three canals in the inner ear. [1]

.....

(ii) Name the fluid in the two outer canals. [1]

.....

(iii) Name the membrane between the middle and lower canal. [1]

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(Total 5 marks)

2. In Africa, Lake Nabugabob separated from Lake Victoria thousands of years ago. There are five species of cichlid fish of the genus *Haplochromis* in Lake Nabugabob, each descended from a different species in the main lake, Lake Victoria.

(a) Name the Phylum and Class to which these cichlid fish belong. [2]

Phylum

Class

(b) Explain why the fish from each lake can be described as different species. [2]

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(c) Suggest how analysis of DNA or proteins might be used to supply additional evidence that the Lake Nabugabob fish have descended from ancestors in Lake Victoria. [2]

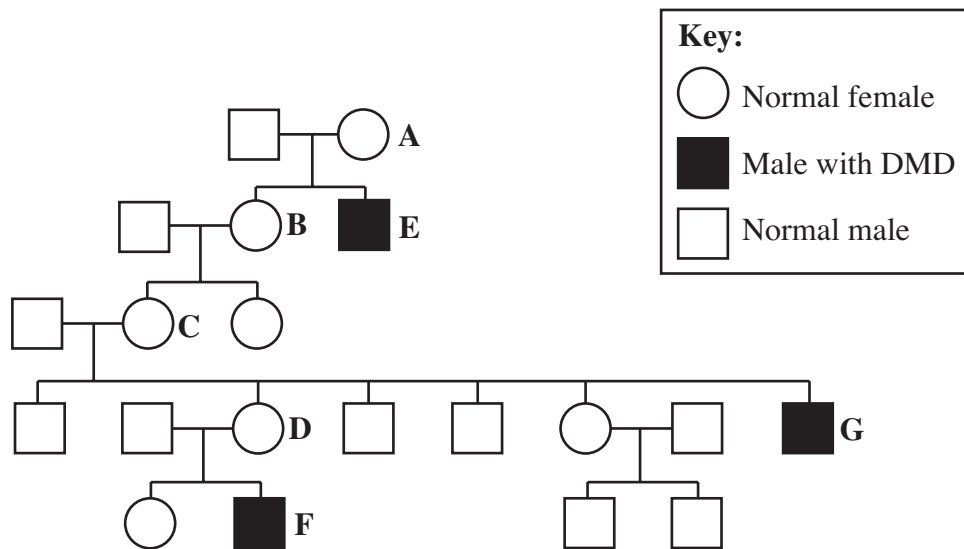
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(d) Explain how the splitting of the fish population into Lake Nabugabob and Lake Victoria populations has led to the formation of the separate species. [4]

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(Total 10 marks)

3. Duchenne muscular dystrophy (DMD) is a degenerative muscular disease. It is caused by a sex-linked recessive allele. A family pedigree showing inheritance is shown below.



- (a) Fully explain the term *sex-linked recessive allele*.

[3]

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- (b) Use the key below to answer the following questions.

KEY: X^N Normal allele
 X^n Muscular dystrophy allele
 Y Male chromosome

- (i) The probable genotype of **A**, **B**, **C** and **D** is

[1]

.....

- (ii) The genotype of **E**, **F** and **G** is

[1]

.....

(iii) Give the genotype of all the normal males. [1]

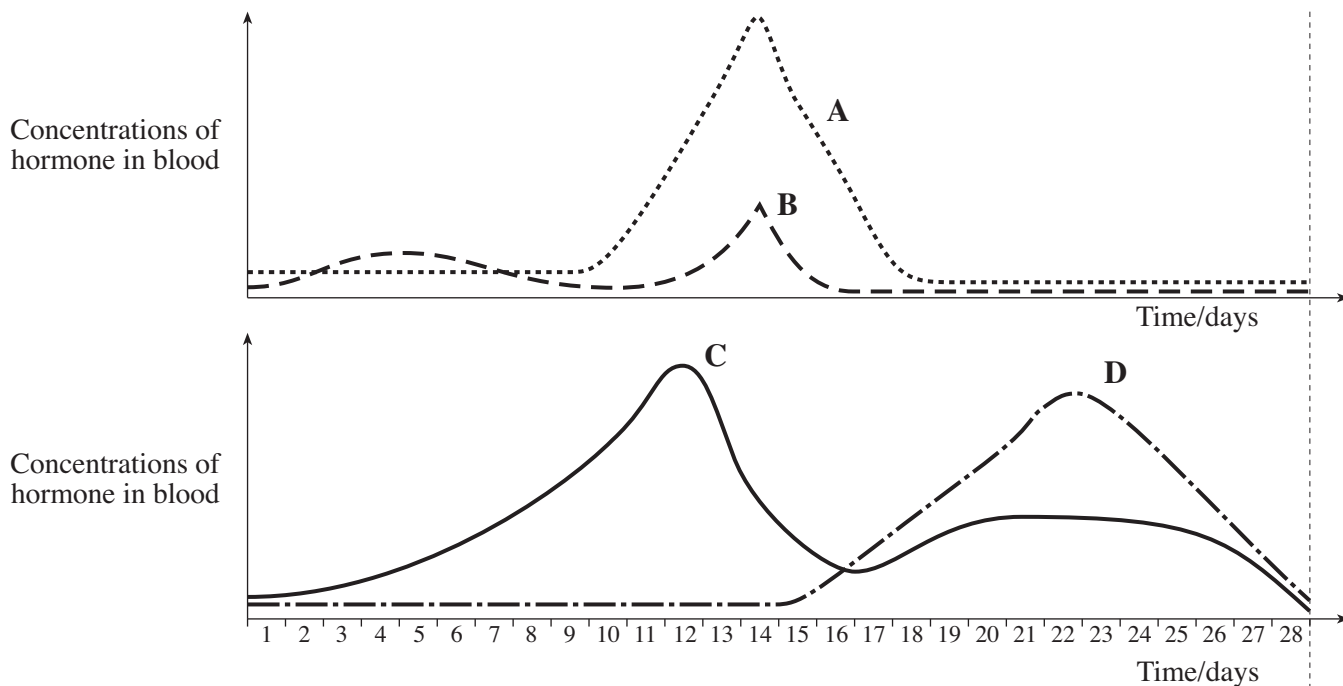
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(c) Complete the genetic diagram to show the mechanism by which **E** inherited the disease. [4]

| | | | |
|---------------------------------------|-------|-------|--------|
| Parents | Male | X | Female |
| Genotype | ..... |  | ..... |
| Gametes | ..... |  | ..... |
| | | | |
| Offspring Genotypes | ..... | ..... | ..... |
| Corresponding Offspring Phenotypes | ..... | ..... | ..... |

(Total 10 marks)

4. The diagrams below show the changes in levels of four hormones in the blood during the human oestrous cycle.



(a) Identify the hormones **A**, **B**, **C** and **D**. [4]

- A**
- B**
- C**
- D**

(b) Describe precisely what would be happening in the **ovary**

(i) during days 1 to 5; [1]

.....

(ii) on day 14; [1]

.....

(iii) during days 14 to 22. [1]

.....

(c) Describe precisely what is happening in the **uterus**

(i) during days 6 to 12; [1]

.....

(ii) during days 14 to 22; [1]

.....

(iii) during days 1 to 5. [1]

.....

(d) The levels of all four hormones change during pregnancy.
Explain what happens to each of the hormone levels and give **one effect** of each change in level. [4]

| <i>Hormone</i> | <i>Change in hormone level</i> | <i>One effect of change in level</i> |
|----------------|--------------------------------|--------------------------------------|
| A | | |
| B | | |
| C | | |
| D | | |

(e) Human Chorionic Gonadotrophin (HCG) is produced during pregnancy. The presence of this hormone in urine is used as the basis of the home pregnancy test kit. Urine containing HCG is drawn along an absorbant strip and forms a blue line where it comes into contact with HCG antibodies complexed with blue granules.

(i) State the main function of HCG. [1]

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(ii) What is the full term used to describe these types of antibodies? [1]

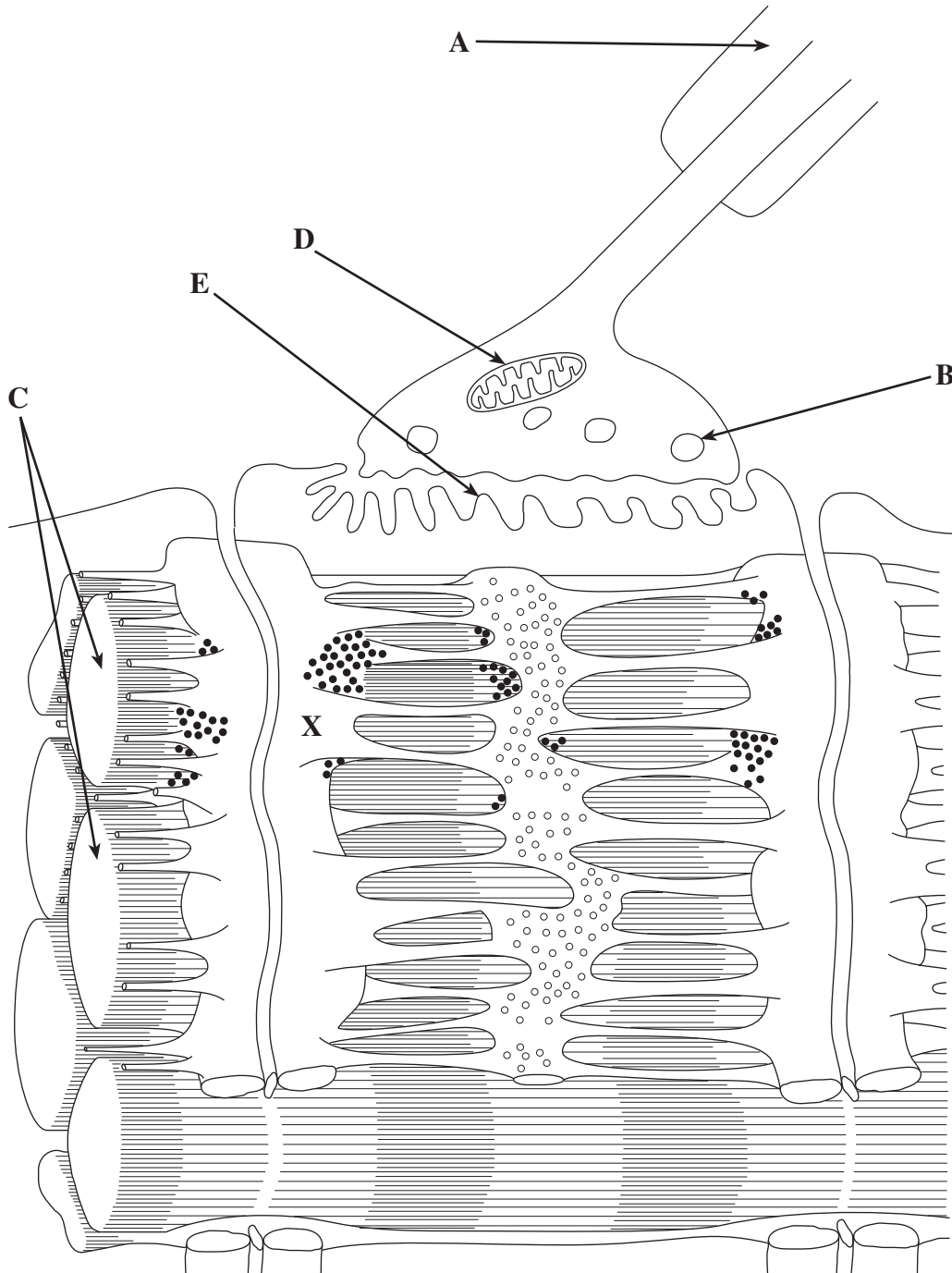
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(iii) Give **one** advantage of using these types of antibodies. [1]

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(Total 17 marks)

5. The diagram below illustrates a muscle cell and motor neurone as seen with an electron microscope.



(a) Identify structures A to E, giving **one** function in each case.

[5]

| | <i>Structure</i> | <i>Function</i> |
|----------|------------------|-----------------|
| A | | |
| B | | |
| C | | |
| D | | |
| E | | |

(b) Briefly describe the sequence of events, in the correct order, which will cause the muscle to contract when an action potential arrives at **X**. [4]

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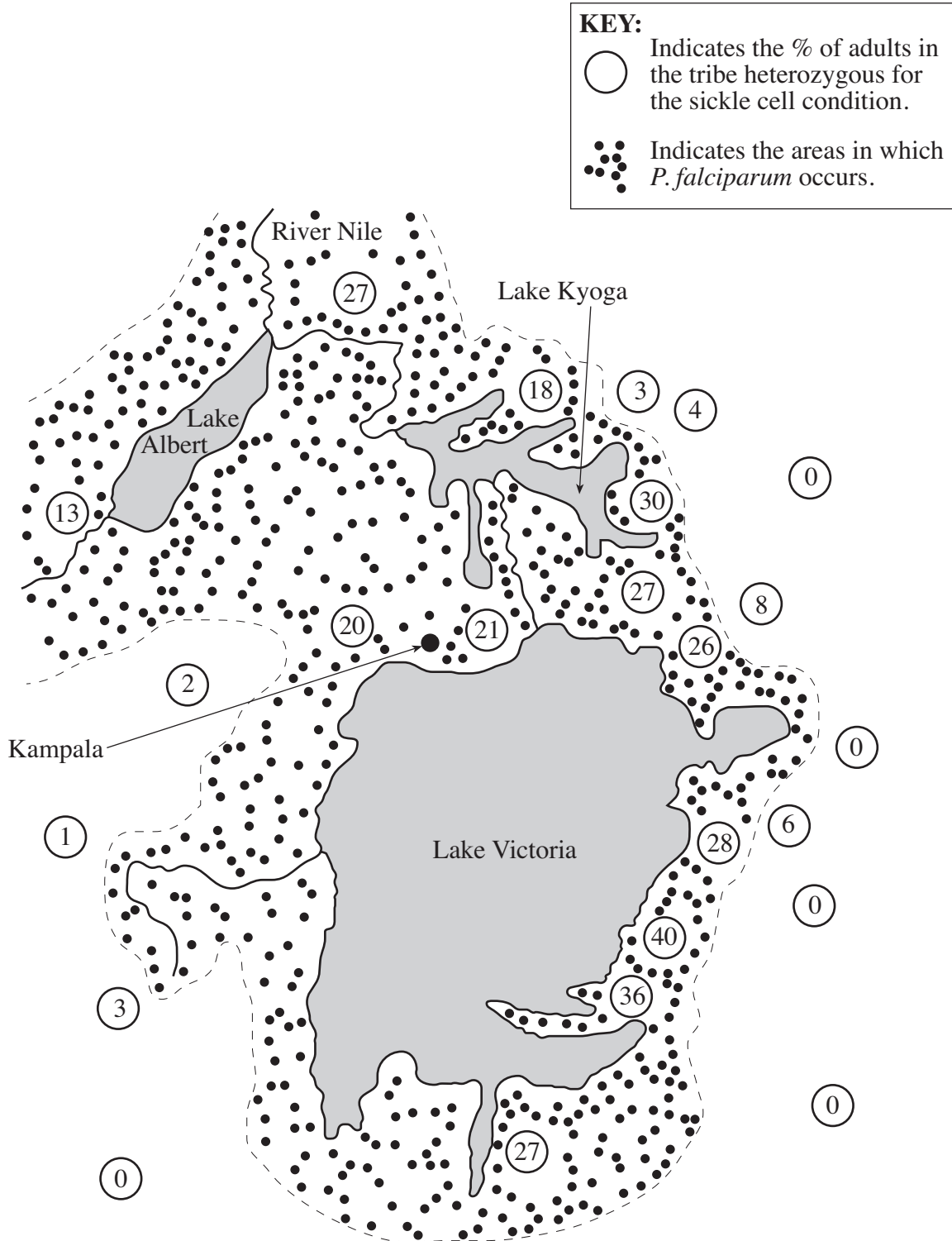
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(Total 9 marks)

SECTION B

Answer all questions.

7. Malaria is a parasitic disease of humans which is endemic in parts of Africa. The map below shows the distribution of the malaria parasite *Plasmodium falciparum*, together with the percentages of heterozygote humans in different areas.



- (a) Suggest an explanation for the distribution of *P. falciparum* as shown on the map. [2]

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- (b) Explain the connection between the percentage of individuals heterozygous for sickle cell anaemia and the distribution of *P. falciparum*. [3]

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- (c) The sickle cell gene has arisen by gene mutation.

(i) Explain precisely what is meant by *gene mutation*. [1]

(ii) Explain the effect of the mutation on the protein for which this gene codes. [2]

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- (d) Prevention of malaria relies on knowledge of the vector's life cycle. Chemical control methods have become almost useless in many areas and increasingly biological control methods of controlling the vector are being used. One method involves releasing sterile males into malaria infected areas.

(i) Explain the difference between biological and chemical control methods. [2]

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(ii) Explain why the chemical methods have become almost useless. [2]

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(iii) Suggest how the release of sterile males may reduce vector numbers. [2]

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(e) There has been extensive research on vaccination against the parasite, but this has had little success.

Give **two** reasons why vaccination is not effective. [2]

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(Total 16 marks)

8. (a) *Erwinia carotovora* is a species of bacterium which causes a soft-rot in many vegetables. The plant tissue is broken down by a number of bacterial enzymes including cellulases and phospholipases. This releases products which the bacteria can use for nutrition. Healthy cells surrounding infected cells often become plasmolysed.

(i) Suggest how cellulases and phospholipases are involved in the nutrition of *Erwinia*. [4]

Cellulases

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Phospholipases

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.....

(ii) Explain why the healthy cells next to infected cells become plasmolysed. [2]

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(b) The effect of *Erwinia* on infected plant tissue can be investigated by measuring changes in electrical conductance of water containing the plant tissue. The conductance increases as ions leak into the water.

In the following investigation a 5g sample of potato tissue was infected with the bacterium, placed in sterile distilled water and the conductance measured daily. This was repeated with uninfected potato.

| <i>Day</i> | <i>Conductance (arbitrary units)</i> | |
|------------|--------------------------------------|-----------------------|
| | <i>Infected potato</i> | <i>Healthy potato</i> |
| 0 | 0 | 0 |
| 1 | 13 | 11 |
| 2 | 80 | 20 |
| 3 | 90 | 22 |
| 4 | 90 | 26 |
| 5 | 90 | 28 |

(i) Explain why the distilled water used for this experiment was sterile. [1]

.....

(ii) Compare the conductance of the two experiments. [2]

.....

(iii) Suggest an explanation for the results in the infected tissue. [2]

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(Total 11 marks)