

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

HUMAN BIOLOGY

Genetics, Homeostasis and Ageing

2867

Friday

23 JUNE 2006

Afternoon

2 hours

Candidates answer on the question paper.

Additional materials:

Electronic calculator

Ruler (cm/mm)

| | | | | | | | | | | | | | | |
|----------------|---|------------------|--|--|--|--|--|---|--|--|--|--|--|--|
| Candidate Name | Centre Number | Candidate Number | | | | | | | | | | | | |
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TIME 2 hours

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read each question carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

| FOR EXAMINER'S USE | | |
|--------------------|------------|------|
| Qu. | Max. | Mark |
| 1 | 16 | |
| 2 | 21 | |
| 3 | 12 | |
| 4 | 16 | |
| 5 | 18 | |
| 6 | 19 | |
| 7 | 18 | |
| TOTAL | 120 | |

This question paper consists of 18 printed pages and 2 blank pages.

Answer all the questions.

1 As the prevalence of diabetes mellitus increases, patients are encouraged to manage their condition themselves.

(a) Fig. 1.1 is a diagram of the islets of Langerhans, surrounded by the cells of the pancreas that secrete digestive enzymes.

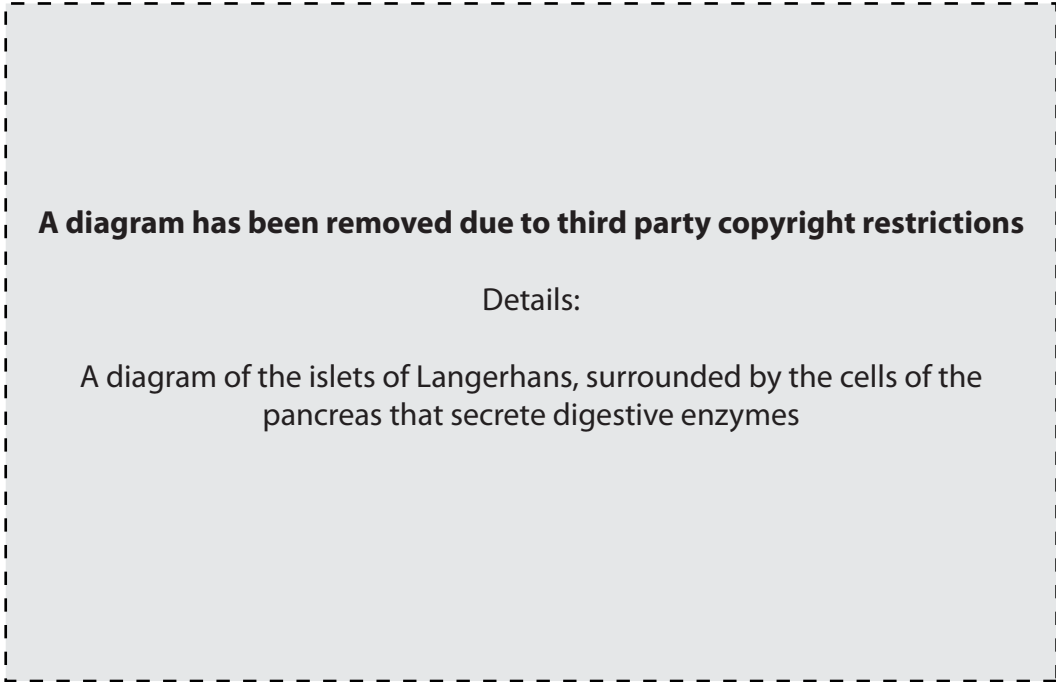


Fig. 1.1

(i) Calculate the magnification of Fig. 1.1.
Show your working. Give your answer to the nearest whole number.

Answer = [2]

(ii) State two features of the islets of Langerhans, which are characteristic of an endocrine gland.

1

.....

2

.....[2]

- (iii) Explain how the islets of Langerhans prevent the blood glucose concentration from **falling too low**.

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.....

.....[3]

- (b) Glucose is the main respiratory substrate in cells. Fig. 1.2 shows the molecular structure of alpha glucose.

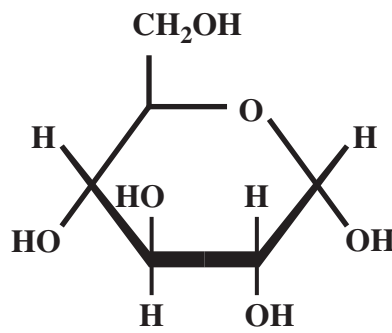


Fig. 1.2

Explain why the structure of the glucose molecule makes it suitable to convert into a source of **stored** energy.

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.....

.....

.....

.....

.....

.....

.....[3]

(ii) Explain how HRT helps to relieve the symptoms of the menopause.

.....
.....
.....
.....[2]

(iii) Explain how the hormones used in HRT cross cell membranes.

.....
.....
.....[2]

(iv) Describe the cyclic **and** the continuous methods of taking HRT.

cyclic

.....
.....
.....

continuous

.....
.....
.....[4]

[Total: 21]

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3 All known species have a latin name.
The name given to modern humans is *Homo sapiens sapiens*.

(a) (i) Explain the meaning of the term **species**.

.....
.....
.....
.....
.....
.....[3]

(ii) State the complete taxonomic grouping of *Homo sapiens sapiens*.

Kingdom

Phylum

Class

Order

Family

Genus

Species sapiens sapiens

[3]

(b) A number of biochemical techniques are used to determine how closely related humans are to other primates such as gorillas, orangutans and gibbons.

(i) Albumin is found in the blood plasma of all primates including humans.

Explain why differences in the albumin of primates are useful in working out how closely related primates are.

.....
.....
.....
.....
.....[2]

(ii) **Antibodies** for human albumin will precipitate human albumin from blood plasma and also the albumin of closely related primates.

Table 3.1 shows the results of mixing antibodies for human albumin with albumin from the blood plasma of humans and three other primates.

Table 3.1

| | human | gorilla | orangutan | gibbon |
|----------------------------|-------|---------|-----------|--------|
| % precipitation of albumin | 100 | 95 | 85 | 82 |

Explain the results shown in Table 3.1.

.....
.....
.....
.....
.....
.....
.....
.....[4]

[Total: 12]

- 4 Nail patella syndrome is a rare genetic disease, which causes deformity or absence of some or all of the nails and the absence of the patella (knee-cap).

Fig. 4.1 shows a pedigree from an affected family. The ABO blood groups of the members of the family are also shown.

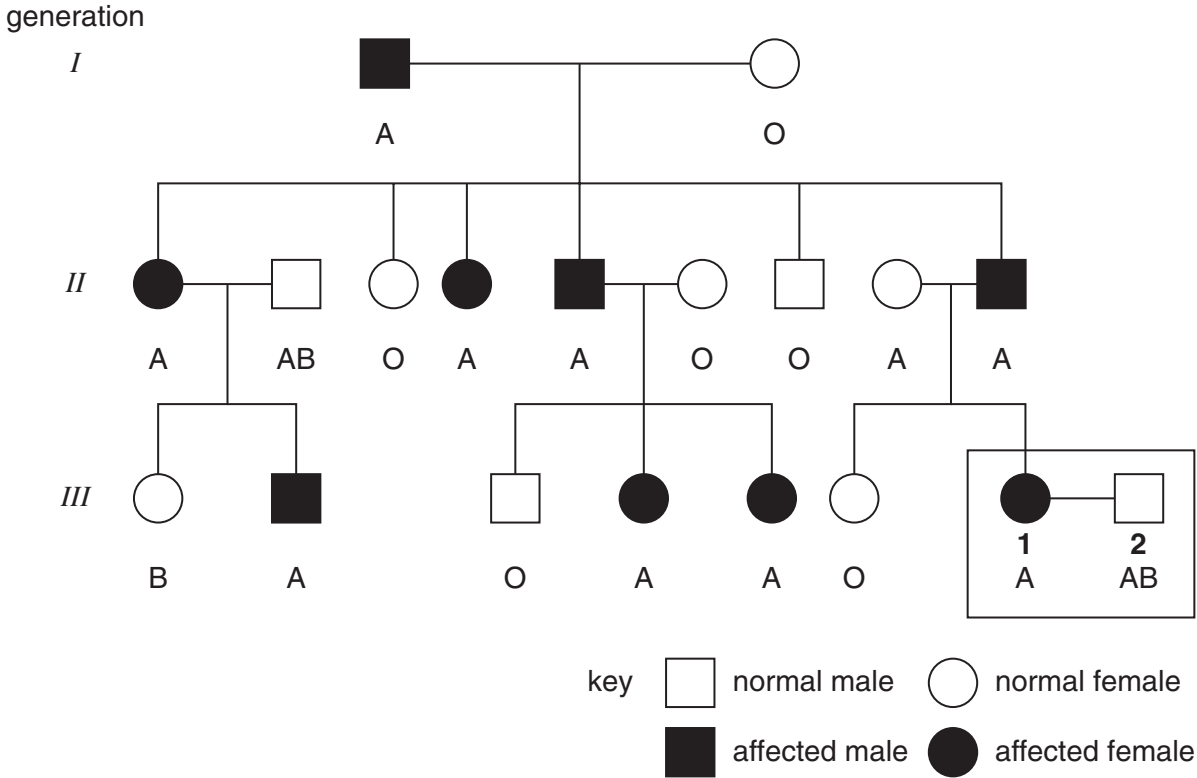


Fig. 4.1

- (a) (i) Using the symbols **N/n** for the nail patella locus and **I^A / I^B / I^O** for the ABO blood group locus, state the genotype of the parents in **generation I**.

male

female

[4]

- (ii) State **and** explain the type of inheritance shown by nail patella syndrome.

.....

[3]

- 5 The kidney helps to regulate blood chemistry and removes toxic waste from the body.
- (a) Fig. 5.1 shows a vertical section through a kidney.

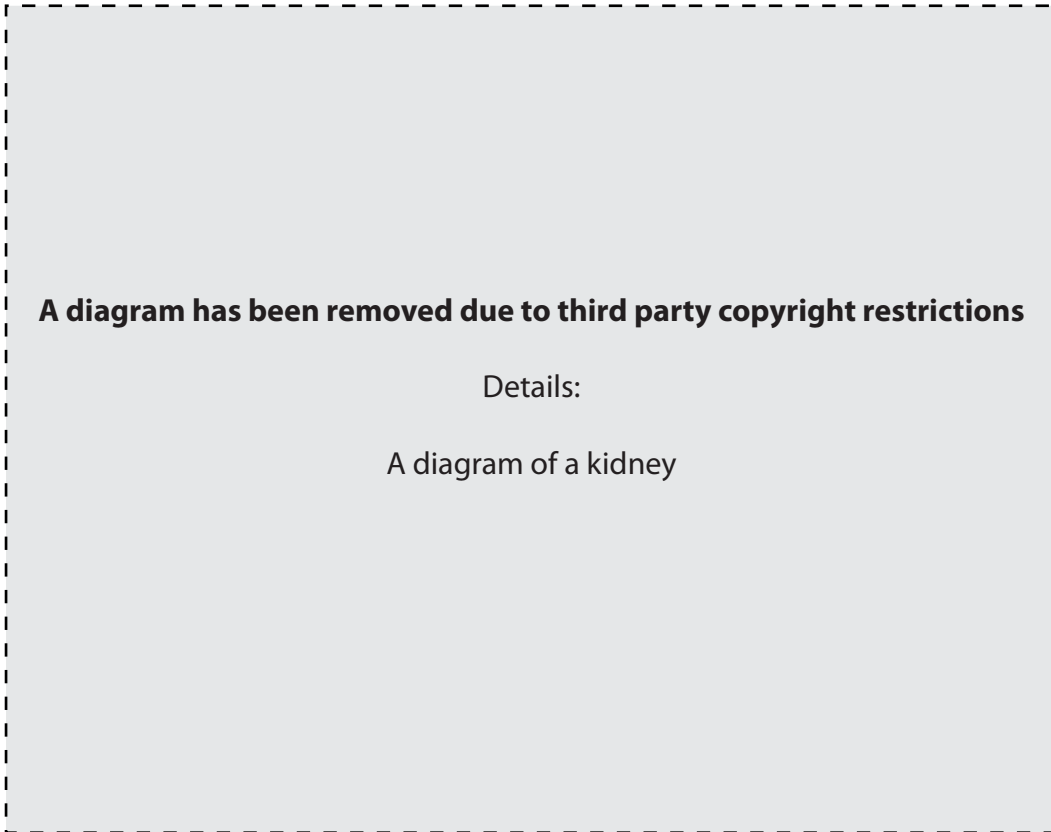


Fig. 5.1

- (i) State which of the letters indicate the
- medulla
- pelvis

[2]

(ii) The arrows on Fig. 5.1 indicate three types of fluid that flow through the kidney.

Identify the **fluid** indicated by each arrow **and** explain the importance of this fluid.



importance

.....

.....



importance

.....

.....



importance

.....

.....[6]

(b) To function efficiently, the kidney must maintain a high blood pressure in the glomerulus.

(i) Explain how high blood pressure in the glomerulus is maintained.

.....

.....

.....[2]

(ii) Suggest **two** circumstances that could cause the blood pressure in the glomeruli to fall low enough to prevent the kidneys working normally.

1

.....

2

.....[2]

- (c) The waste products from the kidney are removed by contraction of the bladder. This is controlled by the nervous system.

Fig. 5.2 is a diagram of a reflex arc.



Fig. 5.2

Small babies do not have conscious control of their bladders.

- (i) Using the information in Fig. 5.2, describe how a small baby removes urine from its bladder.

.....

.....

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.....

.....

.....[4]

- (ii) Suggest how conscious bladder control may be achieved as the baby matures.

.....

.....

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.....[2]

[Total: 18]

(b) A six-year-old boy was brought to an outpatient clinic by his mother, to be investigated for growth hormone deficiency.

The boy's height was below the height at the tenth centile on a growth chart.

The doctor ordered the following investigations:

- the family history regarding their height
- blood tests to test for malnutrition
- CT scans to check for tumours or brain trauma

(i) Explain the meaning of the phrase '*below the height at the tenth centile*'.

.....

.....

.....[2]

(ii) Suggest the importance of each of the investigations ordered by the doctor.

family history

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tests for malnutrition

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.....

CT scans of the brain

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.....[6]

(iii) Explain why it is important to diagnose and treat the boy's condition before puberty.

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.....[2]

[Total: 19]

