

**ADVANCED GCE****HUMAN BIOLOGY**

Genetics, Homeostasis and Ageing

2867

Candidates answer on the Question Paper

OCR Supplied Materials:

None

Other Materials Required:

- Electronic calculator
- Ruler (cm/mm)

Friday 25 June 2010**Afternoon****Duration: 2 hours**Candidate
ForenameCandidate
Surname

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **120**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You are advised to show all the steps in any calculations.
- This document consists of **20** pages. Any blank pages are indicated.

Examiner's Use Only:

1			
2			
3			
4			
5			
6			
7			
8			
Total			



Answer **all** the questions.

- 1 (a) Describe the effects of ageing on the respiratory system.

.....

.....

.....

.....

.....

..... [3]

- (b) (i) State **three** effects of ageing on the cardiovascular system.

1

2

3 [3]

- (ii) Outline the **consequences** for the individual of the changes you have described in (i).

.....

.....

.....

.....

..... [3]

- (c) Explain **three** ways in which society can help people suffering from the effects of ageing on the cardiovascular system.

1

.....

2

.....

3

..... [3]

[Total: 12]

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

(a) Fig. 2.1 is a diagram of the islets of Langerhans, surrounded by the cells of the pancreas that secrete digestive enzymes.

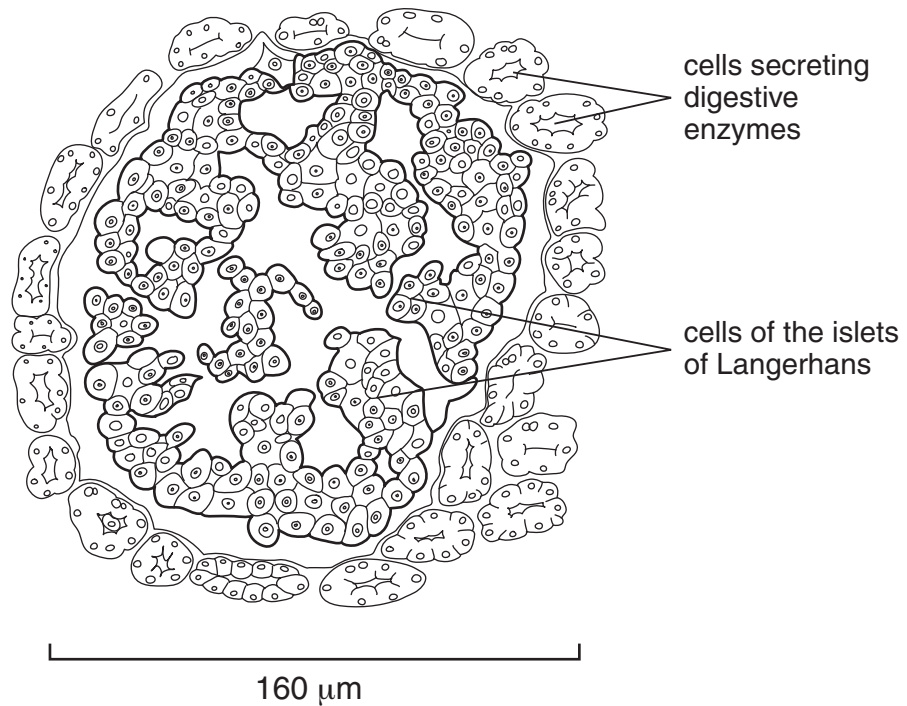


Fig. 2.1

- (i) Calculate the magnification of Fig. 2.1.

Show your working and give your answer to the **nearest whole number**.

Magnification = \times [2]

- (ii) State **two** features of the islets of Langerhans that 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**.

.....

.....

.....

.....

.....

..... [3]

- (b) Glucose is the main respiratory substrate in cells. Fig. 2.2 shows the molecular structure of an alpha glucose molecule.

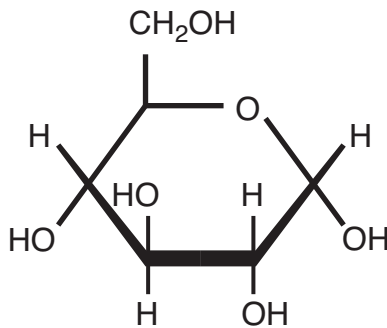


Fig. 2.2

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

.....

.....

.....

.....

.....

..... [3]

- (c) If an **increase** in blood glucose concentration is not corrected for some time, changes may occur in the body that are characteristic of diabetes mellitus.

Explain how an excess of blood glucose may cause the signs and symptoms of diabetes mellitus.

..... [6]

[Total: 16]

3 Fig. 3.1 shows a vertical section of the human brain.

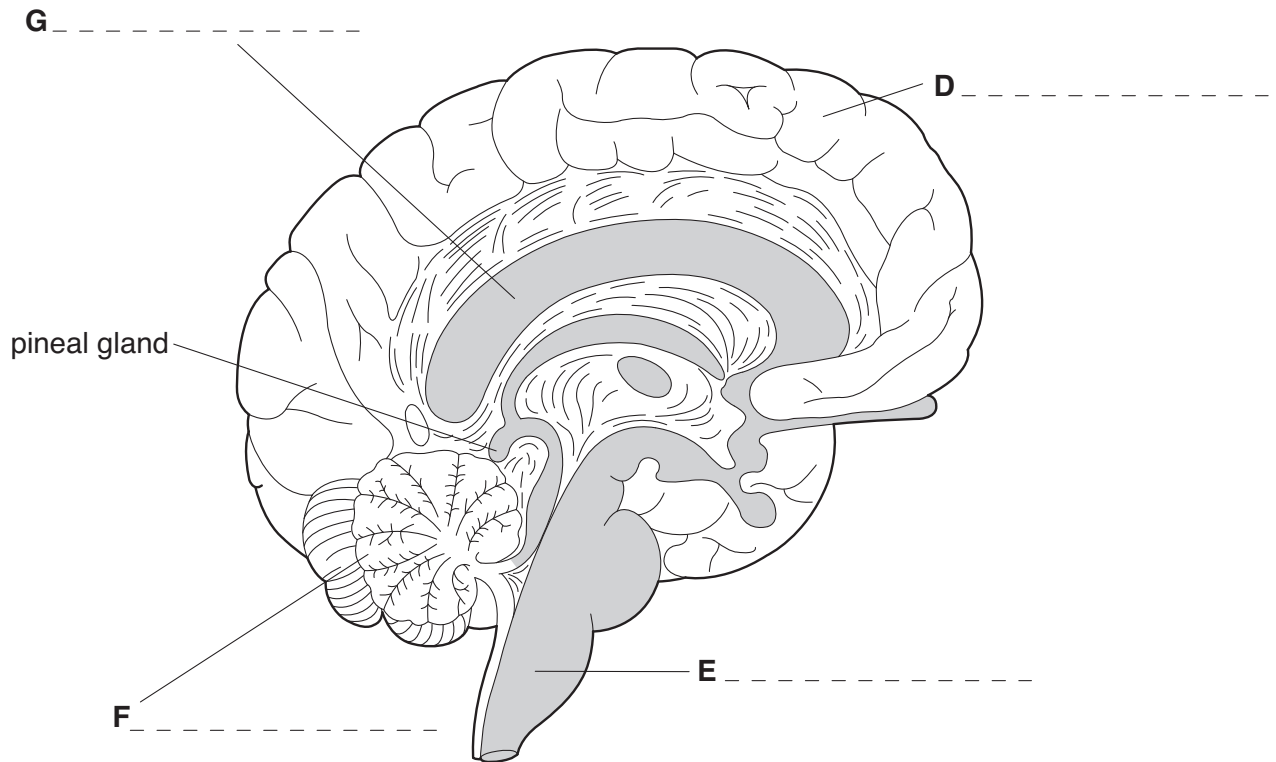


Fig. 3.1

(a) (i) Name the regions of the brain labelled **D**, **E**, **F** and **G**. Write your answers on the answer lines next to the correct label letters on Fig. 3.1. [4]

(ii) State **one function** of each of the regions labelled **D**, **E**, **F** and **G**.

D.....

.....

E.....

.....

F.....

.....

G.....

..... [4]

- (b)** In this question, one mark is available for the quality of spelling, punctuation and grammar.

Describe **changes** that may occur in the brain in Alzheimer's disease and outline the **symptoms** that can result.

..... [8]

Quality of Written Communication [1]

[Total: 17]

Turn over

4 Fig. 4.1 shows a nephron from the human kidney and its associated blood vessels.

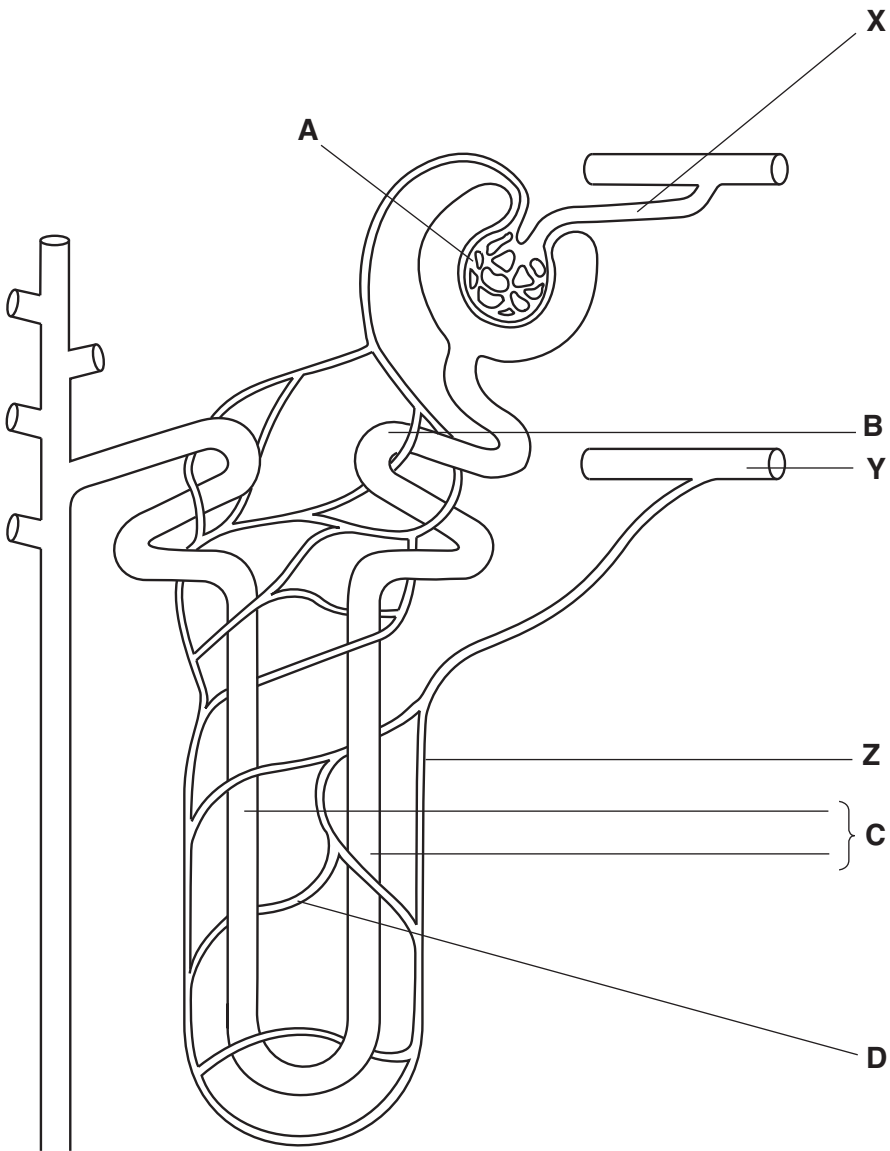


Fig. 4.1

(a) (i) Name the parts labelled **A** to **D** on Fig. 4.1.

A.....

B.

C.....

D..... [4]

- (ii) For the parts labelled **A** to **D** in Fig. 4.1, state **one** structural feature and explain how this feature adapts the part to its function. Write your answers in the table below.

	structural feature	adaptation to function
A		
B		
C		
D		

[8]

- (b) Draw arrows **on Fig. 4.1** to show the direction of blood flow in the blood vessels at points **X**, **Y** and **Z**. [1]

- (c) The concentration of the fluid in a kidney dialysis machine is similar to that of blood plasma.

Outline the **disadvantages** of dialysis as a substitute for the normal function of the nephron.

.....

.....

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.....

.....

..... [4]

[Total: 17]

5 The function of growth hormone is to regulate growth in all parts of the body.

- Children with a growth hormone deficiency do not increase their height at the normal rate.
- Unless the deficiency is treated before puberty, they remain unusually short throughout life.
- The children are treated with regular doses of genetically engineered growth hormone.

(a) In this question, one mark is available for the quality of use and organisation of scientific terms.

Outline how the human growth hormone gene may be inserted into a bacterium such as *Escherichia coli*. **Details of replica plating to identify the bacteria which contain the gene need not be given.**

[7]

Quality of Written Communication [1]

- (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 height
- blood tests 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

.....

tests for malnutrition

.....

CT scans of the brain

.....

 [6]

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

.....

 [2]

[Total: 18]

Turn over



- With reference to Fig. 6.1, complete Table 6.1 by writing in the names of the primates against the percentage of precipitation that might be expected.

primate	expected percentage of precipitation
human	100
.....	95
.....	82
.....	85
.....	95

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- (ii) Fig. 6.2 shows the characteristic banding patterns on a human chromosome and the corresponding chromosome in three other primates.

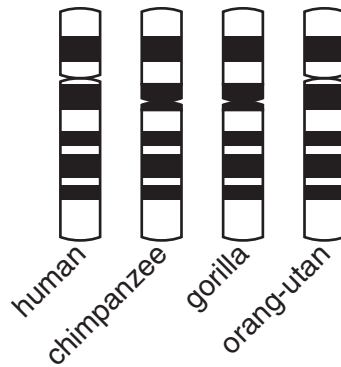


Fig. 6.2

With reference to Fig. 6.2, explain how this chromosomal evidence supports, or contradicts, the evidence in Fig. 6.1.

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.....

.....

.....

..... [2]

- (b) Fig. 6.3 shows the banding patterns on human chromosome 2 and chimpanzee chromosomes 12 and 13.

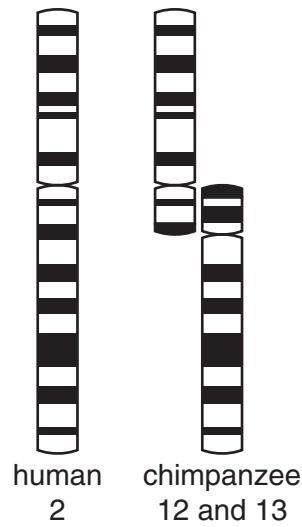


Fig. 6.3

Humans have 46 chromosomes in the nuclei of each of their body cells, whilst chimpanzees have 48.

Suggest why humans have two fewer chromosomes than the chimpanzee.

.....

 [1]

- (c) DNA is found not only in the nucleus but also in the mitochondria.

Suggest **one advantage** and **one disadvantage** of using mitochondrial DNA, rather than nuclear DNA, to study human evolution.

advantage

 disadvantage

 [2]

[Total: 7]

- 7 Red-green colour blindness in humans is a condition that is determined by an allele situated on the X chromosome. The dominant allele, **N**, determines normal colour vision, whereas the recessive allele, **n**, causes inability to distinguish between red and green.

(a) (i) State the name given to this method of inheritance.

..... [1]

(ii) Explain what is meant by the term *recessive allele* in this context.

.....

.....

..... [2]

(b) Using a genetic diagram, determine the probability of a colour blind son being born to a woman who is a carrier and a man who is red-green colour blind.

Probability = [4]

- (c) Explain whether a father who possesses the allele for red-green colour blindness can pass this allele to his son.

.....

.....

.....

[1]

- (d) Table 7.1 provides information about three inherited conditions.

Table 7.1

condition	details	% male sufferers	% female sufferers
red-green colour blindness	inability to distinguish between red and green	8.00	0.70
haemophilia	blood fails to clot properly	0.10	less than 0.01

With reference to Table 7.1,

- (i) explain the occurrence of the female sufferers of red-green colour blindness;

.....

.....

..... [2]

- (ii) suggest why the incidence of red-green colour blindness, in both males and females, is higher than that of haemophilia.

.....

.....

..... [2]

- (e) Individuals with haemophilia may have uncontrolled bleeding from a minor wound.

Suggest how the application of an ice pack would help to control the bleeding from the wound.

.....

.....

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.....

..... [3]

- (f) If individuals with haemophilia play contact sports they may bruise any part of their bodies. The resulting damage may cause uncontrolled **internal** bleeding. This is treated with injections of genetically engineered Factor VIII.

Table 7.2 shows the percentage of a full dose of Factor VIII that is required depending on which part of the body is bleeding.

Table 7.2

part of the body	percentage of full dose of Factor VIII required
elbow	35
ankle	25
muscle	35
head	100

- (i) Suggest why there is such a variation in the dosage required to treat internal bleeding in different parts of the body.

.....

.....

.....

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.....

..... [3]

- (ii) What might be the consequences if too little Factor VIII was given for internal bleeding from a head injury?

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.....

..... [3]

- (iii) Before genetically engineered Factor VIII was available, the only source of Factor VIII was donated blood.

State **two** advantages of using genetically engineered Factor VIII.

1

.....

2

..... [2]

[Total: 23]

8 The risk of developing prostate cancer increases as a man ages.

(a) State the function of the prostate gland.

.....
 [1]

(b) (i) The prostate specific antigen (PSA) test is the initial test for prostate cancer. PSA is a protein produced by the prostate gland, which is found in the blood in normal concentrations of 4 ng cm^{-3} . This concentration increases slightly as men age.

State what is meant by the term *prostate specific antigen*.

.....

 [1]

(ii) If the prostate is enlarged by a benign or a cancerous growth, more PSA leaks into the blood. 60% of the men who have a PSA level above 10 ng cm^{-3} have prostate cancer.

Suggest why the PSA test is not made available in a national screening programme for prostate cancer.

.....

 [3]

(iii) Suggest **two** other techniques that could be used to detect prostate cancer.

1

 2
 [2]

QUESTION 8 CONTINUES ON PAGE 20

(c) Fig. 8.1 shows the incidence per year of prostate cancer in different populations.

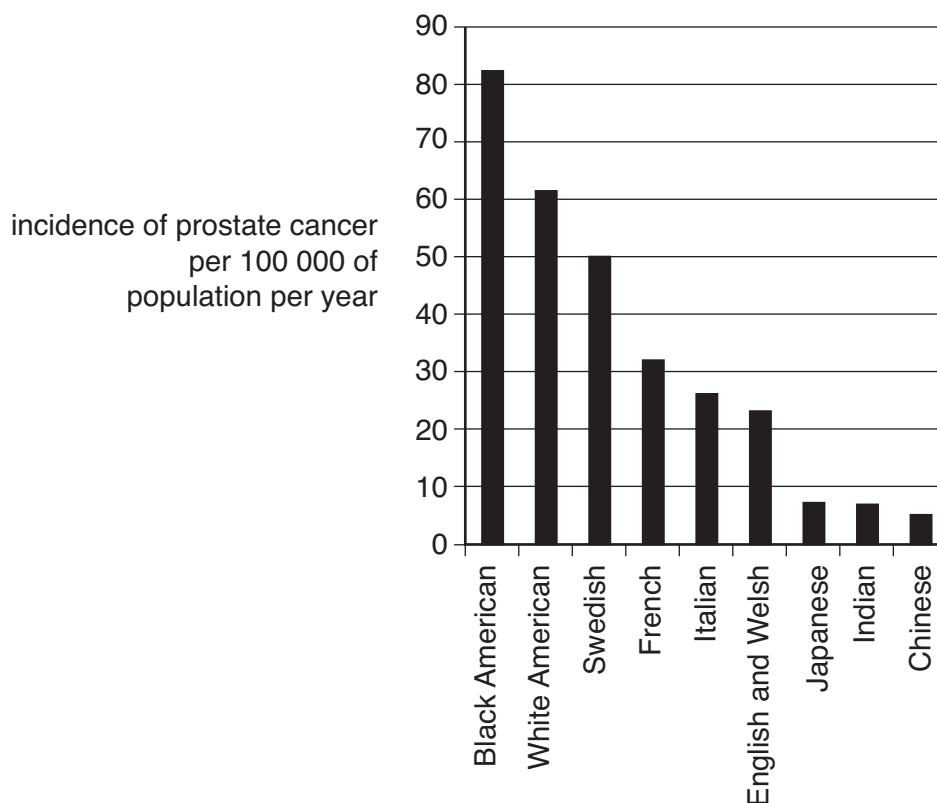


Fig. 8.1

Ageing has been identified as a risk factor in the development of prostate cancer.

What might these data suggest about **other** possible causes of prostate cancer? Support your answer using the information in Fig. 8.1.

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..... [3]

[Total: 10]

END OF QUESTION PAPER

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