



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE
NAME

CENTRE
NUMBER

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BIOLOGY

9700/43

Paper 4 A2 Structured Questions

October/November 2011

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black ink.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Section A

Answer **all** questions.

Section B

Answer **one** question

Circle the number of the Section B question you have answered in the grid below.

At the end of the examination, fasten all your work securely together.

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

For Examiner's Use	
Section A	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Section B	
10 or 11	
Total	

This document consists of **21** printed pages, **2** lined pages and **1** blank page.



Section A

Answer **all** the questions.

For
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Use

- 1 The Bengal Tiger, *Panthera tigris tigris*, is an endangered mammalian species of Southern Asia. It lives mostly in a forest habitat.

Fig. 1.1 shows a Bengal Tiger.



Fig. 1.1

- (a) Table 1.1 shows the relationship between available forest habitat and Bengal Tiger numbers between 1970 and 2010.

Table 1.1

year	forest habitat remaining compared to 1970 (%)	Bengal Tiger numbers
1970	100	37 000
1980	79	27 000
1990	42	12 000
2000	26	3 600
2010	18	1 400

Give your answer to the **nearest whole number**.

(b) Suggest methods to conserve the Bengal Tiger.

[4]

.....[2]

[Turn over

- 2 (a) In the small intestine, the enzyme lactase hydrolyses the disaccharide lactose into the monosaccharides glucose and galactose. A deficiency of lactase can lead to a condition known as lactose intolerance. The lactose passes undigested into the large intestine resulting in diarrhoea. Some babies are born with congenital lactase deficiency, which is an inherited condition, and require lactose-free milk from birth.

Suggest how two parents, who can digest lactose, can have a child with congenital lactase deficiency.

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.....[2]

- (b) The enzyme lactase can be produced by biotechnology and then used to produce lactose-free dairy products. Lactase is frequently used immobilised in alginate beads.

Fig. 2.1 shows a comparison between the activity of lactase free in solution and lactase immobilised in alginate beads, over a range of temperatures. Equal concentrations of free lactase and immobilised lactase were used.

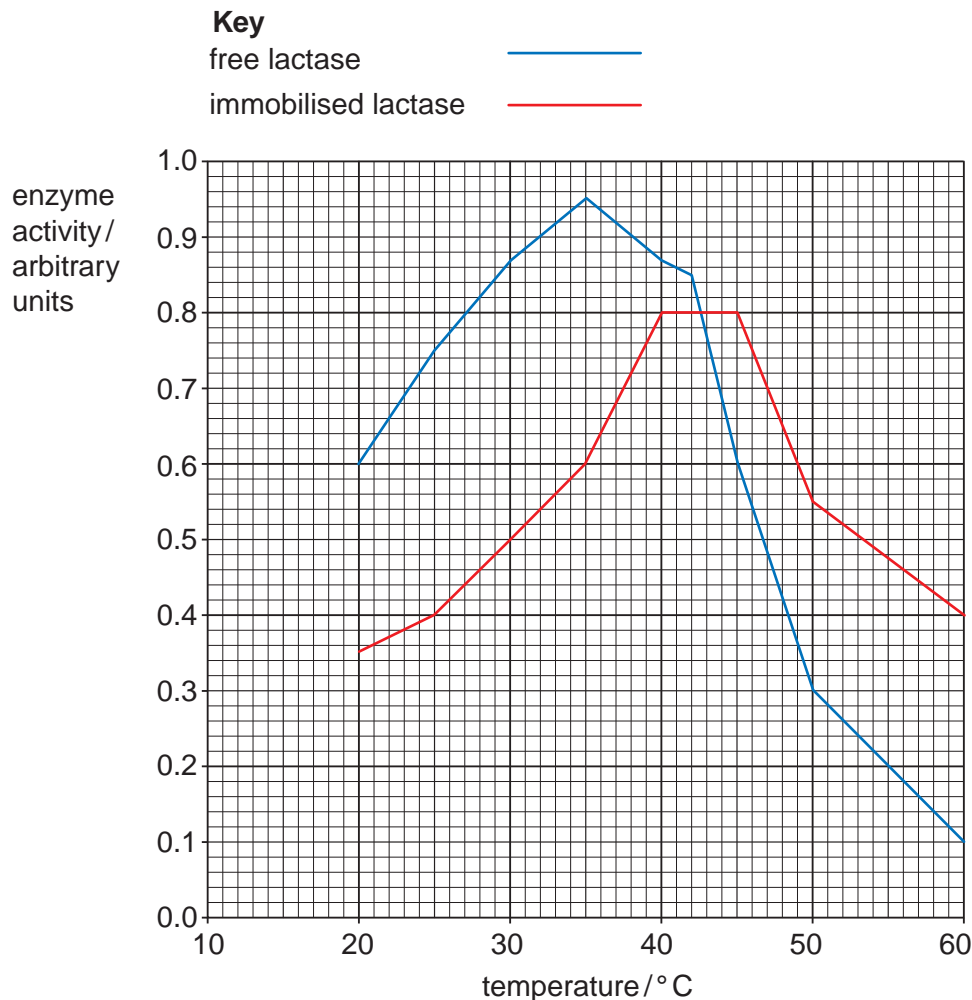


Fig. 2.1

(i) describe the effect of immobilisation on the activity of lactase

[3]

.....[2]

..... [3]

[Turn over

- 3 (a) Spermatogenesis, the production of male gametes, occurs in the testes of a human male from the age of puberty.

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Use

Fig. 3.1 outlines the sequence of events that occur during oogenesis.

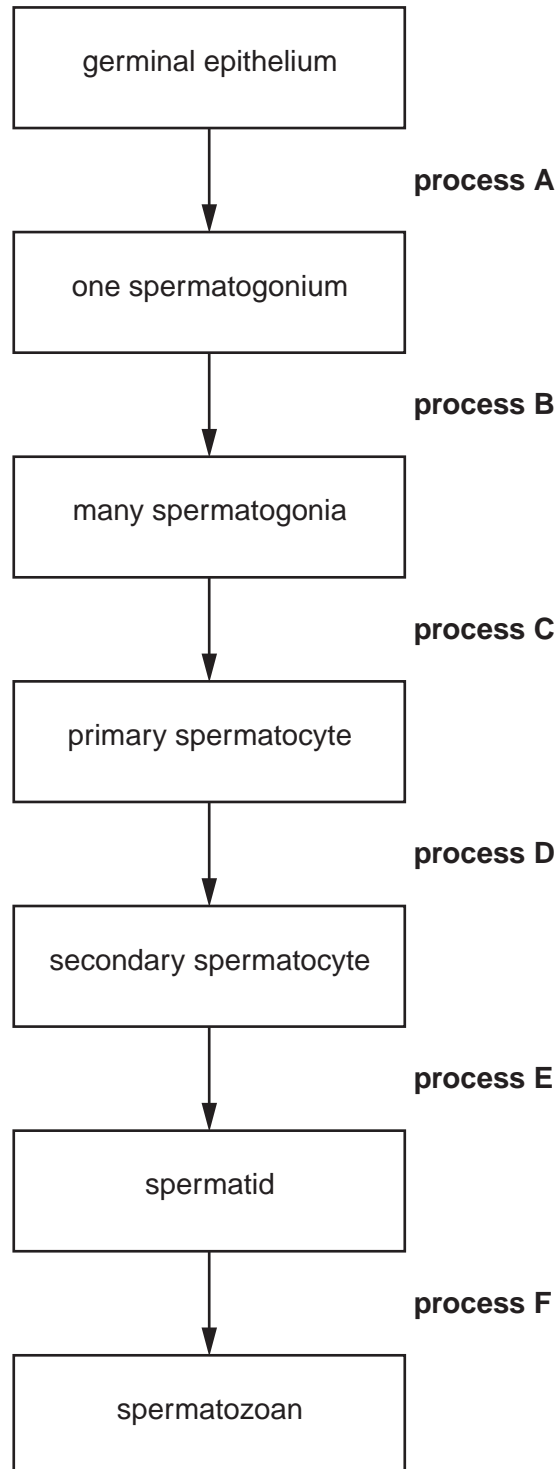


Fig. 3.1

With reference to Fig. 3.1, state what is happening to cells during:

(i) process B

..... [1]

(ii) process D

..... [1]

(iii) process F.

..... [1]

(b) Female gametes develop inside follicles.

Fig. 3.2 shows a section through a mature (Graafian) follicle in a human ovary.

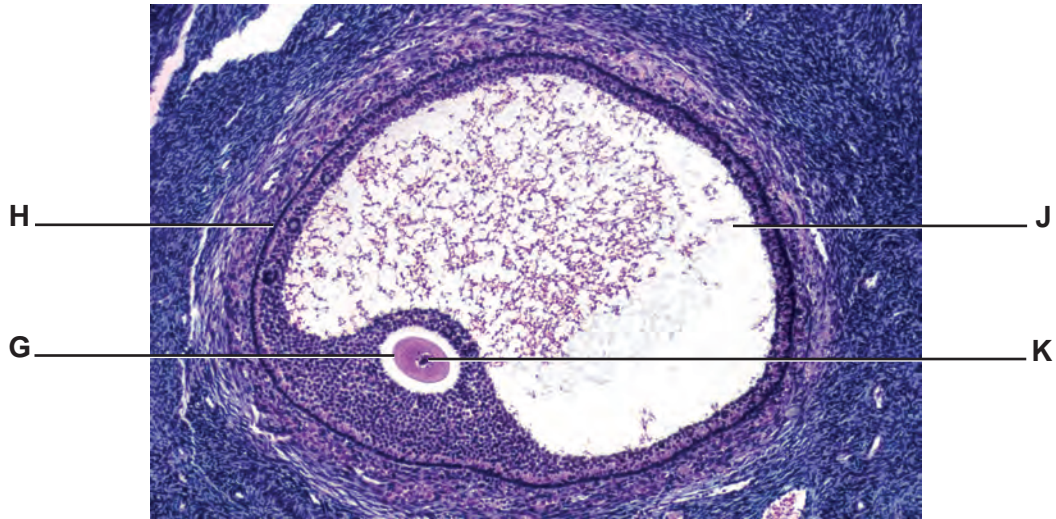


Fig. 3.2

Table 3.1 below lists a number of statements about the mature follicle. Each statement refers to one of the letters **G**, **H**, **J** and **K** shown in Fig. 3.2.

Complete the table using the letters **G**, **H**, **J** and **K**.

Table 3.1

statement	letter
contains protective fluid	
produces oestrogen	
has glycoprotein receptors	
contains 23 chromosomes	

[4]

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- Outline the technique of IVF.

.....[5]

- 85% of these pregnancies result in live births for women under 35 years old
- 66% of these pregnancies result in live births for women between 38–40 years old.

.....[2]

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Question 4 starts on page 10

- 4 (a) Fig. 4.1 shows the male and female flowers of maize.

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Fig. 4.1

- (i) With reference to Fig. 4.1 suggest how the flowering habit of maize encourages wind pollination.

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.....[3]

- (ii) In a maize plant, the anthers normally ripen and release pollen before the stigmas are mature and ready to receive pollen. This encourages cross-pollination.

Explain **two** potential advantages of cross-pollination to a plant species.

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.....[2]

- (b) The conditions in which wheat and maize are grown affect their ability to photosynthesise.

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Fig. 4.2 compares the rate of photosynthesis of wheat and maize at different temperatures.

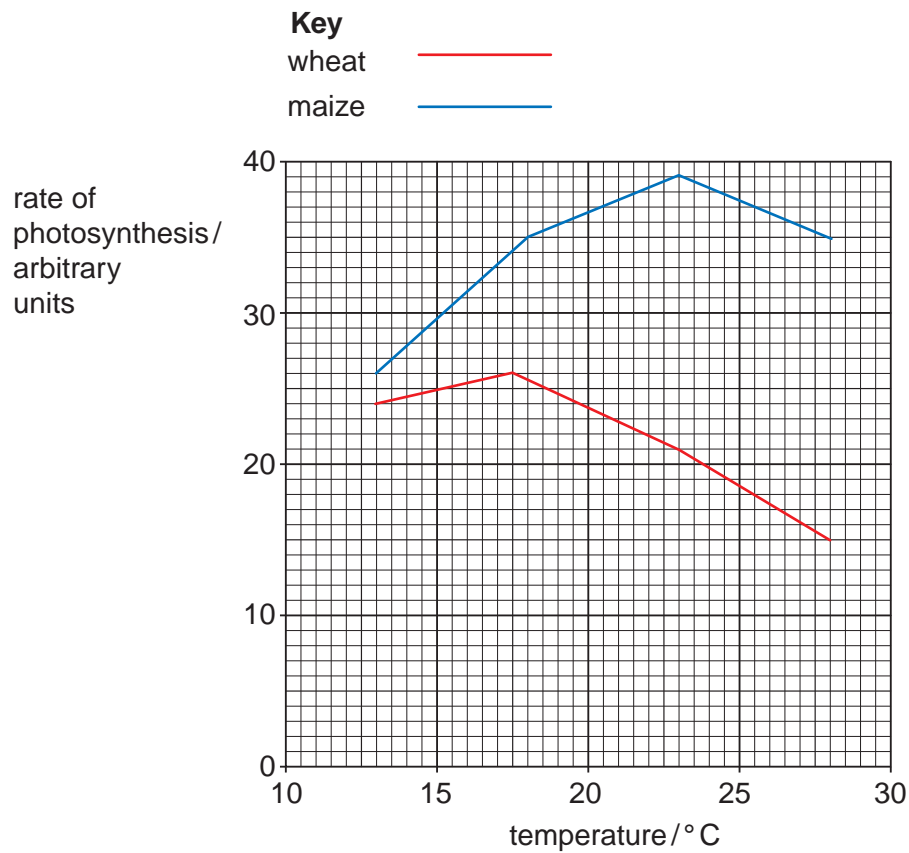


Fig. 4.2

With reference to Fig. 4.2:

- (i) **compare** the effect of temperature on the rates of photosynthesis of wheat and maize

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..... [2]

-[3]

- Table 4.1 shows some of the nutrient contents of 100g samples of grains of wheat, white rice and maize.

	wheat	white rice	maize
protein / g	12.3	7.5	8.9
fat / g	2.0	2.8	4.7
carbohydrate / g	75.0	77.0	74.0
fibre / g	2.3	0.9	2.0
calcium / mg	34.0	28.0	7.0
iron / mg	5.4	1.6	2.7
sodium / mg	2.0	6.0	35.0

-[2]

- (ii) State, giving a reason, which type of grain would be beneficial for a person with anaemia.

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.....[2]

[Total: 14]

- 5 (a) The steps involved in a method of production of human insulin by gene technology are listed in Table 5.1.
The steps are **not** listed in the correct order.

For
Examiner's
Use

Table 5.1

step	description
A	DNA coding for human insulin inserted into cut plasmid vector
B	genetically modified bacteria identified
C	mRNA for human insulin isolated in β cells
D	plasmid vector inserted into bacterium
E	genetically modified bacteria cloned
F	DNA for human insulin cloned
G	human insulin harvested
H	cDNA coding for human insulin synthesised

- (i) Complete Table 5.2 to show the steps in the correct order.

Two of the steps have been done for you.

Table 5.2

correct order	letter of step
1	C
2	
3	
4	
5	D
6	
7	
8	

[4]

- (ii) Name the enzymes responsible for the following steps:

step A

step H

[2]

- (b) Explain **two** advantages of treating diabetes with human insulin produced by gene technology rather than using insulin from animals.

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..... [2]

[Total: 8]

- 6 (a) Fig. 6.1 outlines anaerobic respiration in yeast cells.

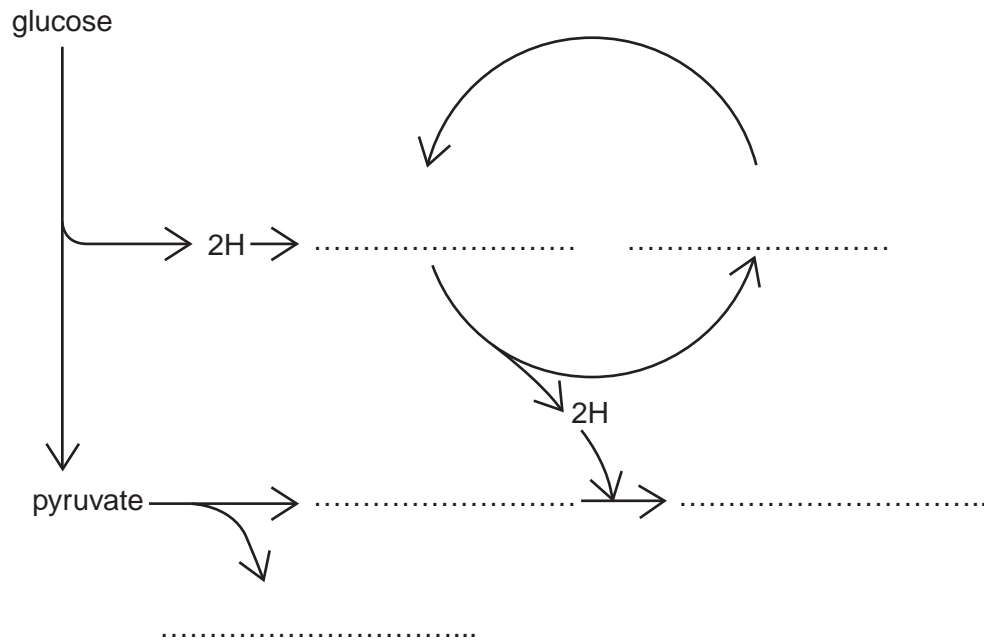


Fig. 6.1

Complete Fig. 6.1 by writing in the missing compounds.

[5]

- (b) Describe how anaerobic respiration in mammalian cells differs from anaerobic respiration in yeast cells.

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[3]

- (c) Explain why anaerobic respiration results in a small yield of ATP compared with aerobic respiration.

*For
Examiner's
Use*

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..... [3]

[Total: 11]

- The first row has been done for you.

Table 7.1

	initial effect of event on blood concentration of		
event	glucose	insulin	glucagon
meal containing sucrose	increase	increase	decrease
meal containing only protein			
fasting			
exercising			
meal containing starch			

.....[3]

[Total: 7]

- 8 The following passage is a summary of the main principles of artificial selection.

Some of the words have been omitted.

Write the most appropriate term in each space.

When humans purposefully apply selection to members of a population, the process is known as artificial selection. For example, people have tried to 'improve' their cattle for thousands of years. It is desirable for a dairy farmer to have cows with a high milk yield. The farmer will select cows with high milk yields and mate them with bulls whose have high milk yields. Some of the conferring high milk yield are passed onto their female offspring who are then chosen for breeding. This will continue for many Artificial selection can have disadvantages such as depression which can lead to infertility. [5]

[Total: 5]

- 9 (a) When a part of the body is damaged or injured, action potentials are sent to the areas of the brain responsible for the perception of pain.

Explain how the structure of a sensory neurone can enable the action potentials to reach the brain very quickly.

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.....[2]

- (b) The pain associated with osteoarthritis can be relieved using transcutaneous electrical nerve stimulation (TENS). It uses electrical impulses to stimulate the nerve endings at, or near, the site of the pain. Self-adhesive electrodes are stuck on the skin and attached to a small, portable power unit.

Fig. 9.1 shows a TENS machine in use.



Fig. 9.1

It is thought that TENS triggers the release of natural painkillers called endorphins, which are similar in shape to painkilling drugs such as morphine.

The diagram illustrates the following components and processes:

- Impulse from damaged joint:** Triggers the release of ACh from vesicles in the presynaptic knob.
- Presynaptic knob:** Contains vesicles containing ACh and morphine receptors.
- Postsynaptic neurone:** Contains ACh receptors and is responsible for transmitting the impulse to the pain centre in the brain.
- Impulse from TENS machine:** Triggers the release of endorphins from vesicles.
- Vesicle containing ACh:** Releases ACh into the synaptic cleft.
- Vesicle containing endorphins:** Releases endorphins into the synaptic cleft.
- ACh receptor:** Binds to ACh, initiating the impulse in the postsynaptic neurone.
- Morphine receptor:** Binds to endorphins, potentially modulating the pain signal.
- To pain centre in brain:** The final destination of the transmitted impulse.

(i) Suggest how endorphins may act to reduce pain.

.....[4

(ii) Suggest advantages of using TENS for pain relief instead of more conventional treatment.

.....[2]

Answer **one** question.

- [Total: 15]

- [Total: 15]

[illegible]

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