Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Level

BIOLOGY **9700/04**

Paper 4 Structured Questions

For Examination from 2007

Specimen Paper

. **2 hours**

Additional Materials: Answer Booklet/Paper

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer **one** question.
Write your answer on the separate Answer Booklet/Paper.

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.

This document consists of **14** printed pages.

For Examiner's Use

1 **(a)** State what is meant by the term *respiratory quotient* (RQ).

.....

..... [1]

(b) **(i)** Complete the following equation for the aerobic respiration of the respiratory substrate A.

$C_{18}H_{36}O_2 + 26O_2$ ..... + ... [2]

(ii) Calculate the respiratory quotient (RQ) of this respiratory substrate.

[2]

(c) Explain the significance of the different values that may be obtained of RQ.

.....

.....

..... [2]

Two respirometers were set up as shown in Fig. 1.1.

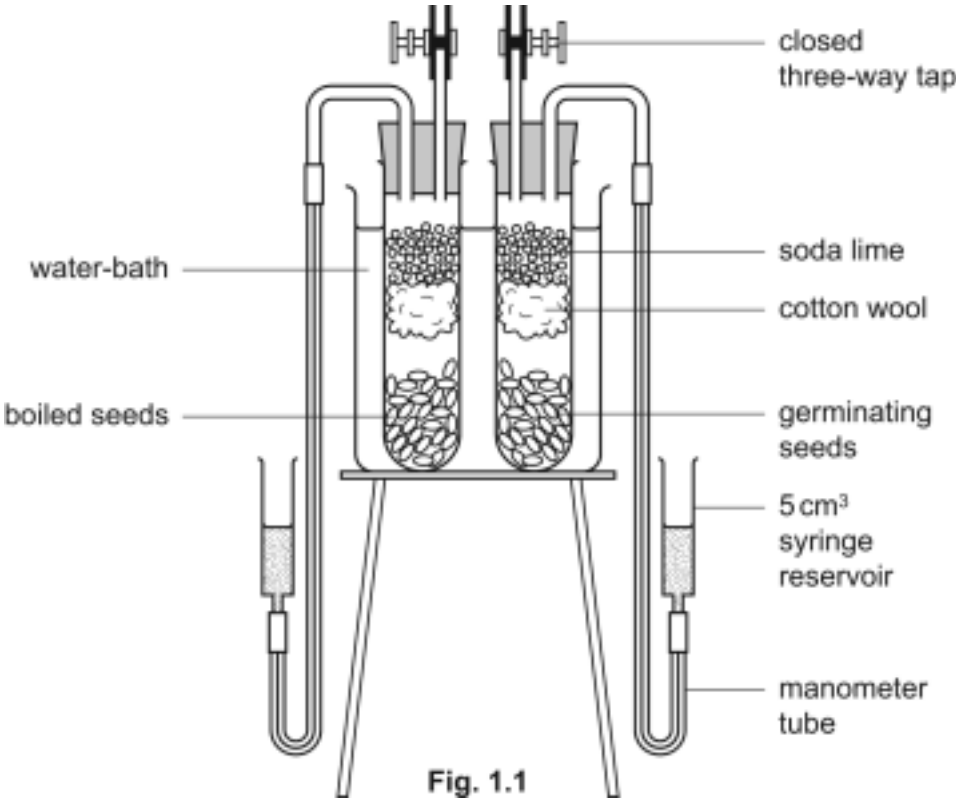

Fig. 1.1

For Examiner's Use

(d) Outline how this apparatus is used to measure the rate of oxygen uptake by a known mass of germinating seeds.

.....

.....

.....

.....

.....

..... [4]

(e) Explain how the apparatus could be modified to measure the RQ of the germinating seeds.

.....

.....

..... [2]

(f) Explain why an increase in temperature from 15 ^{o}C to 25 ^{o}C will increase the rate of oxygen uptake in germinating seeds.

.....

.....

..... [2]

[Total: 15]

For Examiner's Use

2 Fig. 2.1 shows the main stages of the Calvin cycle.

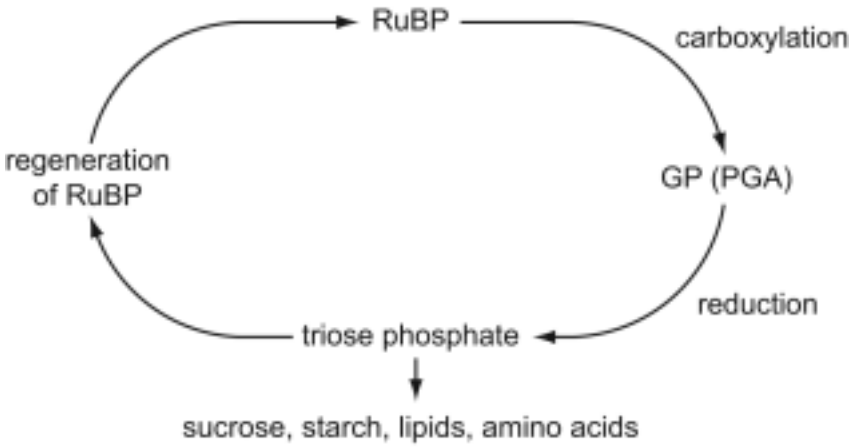

Fig. 2.1

(a) State precisely where the Calvin cycle occurs in plant cells.

.....

[1]

(b) Describe how carbon dioxide is fixed in the Calvin cycle.

.....

.....

.....

[2]

(c) Explain how the products of photophosphorylation are used in the Calvin cycle.

.....

.....

.....

.....

[3]

(d) Explain what initially happens to the concentration of RuBP and GP if the supply of carbon dioxide is reduced.

RuBP .....

.....

GP .....

.....

[2]

[Total: 8]

For Examiner's Use

3 Scallops, which are bivalve molluscs, are important commercially throughout the world. The marine bay scallop, *Agropecten irradians*, has three distinct shell colours, yellow, orange and black. The shell colour is controlled by a gene with three alleles, yellow, $\mathbf{S^y}$, orange, $\mathbf{S^o}$, and black, $\mathbf{S^b}$.

Scallops are hermaphrodite and are able to fertilise themselves to produce offspring.

Single mature adult specimens of yellow, orange and black scallops were collected and kept in separate tanks of seawater until they produced young. The young were then scored for shell colour. The results were as follows:

yellow scallop – 25 yellow and 8 black
orange scallop – 31 orange and 9 black
black scallop – 27 black

(a) Explain the results from the orange and black scallops, using the symbols given.

[6]

(b) Orange scallops are more valued for human consumption.

Describe how a marine biologist could produce a pure-breeding line of orange scallops for commercial exploitation using the offspring from the single orange scallop.

[2]

[Total: 8]

For Examiner's Use

4 **(a)** The table shows information about some organisms and their classification.

Complete the table by putting the correct kingdom for each organism described. The first one has been done for you. Each kingdom may be required once, more than once or not at all.

Features of organism	kingdom
Body composed of single isolated cells. Heterotrophic eukaryotic cells without a cell wall. Organism motile.	Protoctista
Body composed of a mass of undifferentiated cells. Heterotrophic eukaryotic cells with a chitin cell wall. Not motile.	
Body composed of a small ball of undifferentiated cells. Autotrophic eukaryotic cells with a cellulose cell wall and flagellum. Organism motile.	
Body complex and multicellular, differentiated into a variety of tissues and organs. Heterotrophic eukaryotic cells with no cell wall, some cells have flagellae. Organism motile.	
Body a string of tiny undifferentiated cells. Heterotrophic prokaryotic cells with a peptidoglycan (murein) cell wall. Not motile.	
Body complex and multicellular, differentiated into a variety of tissues and organs. Autotrophic eukaryotic cells with a cellulose cell wall. Not motile.	

[5]

(b) In traditional classification there were considered to be only two kingdoms; animals were in one kingdom, and all other organisms were in the other.

Suggest the advantages and disadvantages of such a two-kingdom classification compared to the five kingdom classification often used today.

.....

.....

.....

.....

For Examiner's Use

.....

.....

..... [4]

(c) A student stated that 'maintaining biodiversity is not important because there are already hundreds of sorts of different animals and anyway, you just can't protect these protected species properly.'

Discuss the extent to which this statement,

(i) defines biodiversity

.....

.....

.....

.....

(ii) addresses the need to maintain biodiversity

.....

.....

.....

.....

(iii) evaluates the available methods of protecting endangered species.

.....

.....

.....

..... [6]

[Total: 15]

For Examiner's Use

5 Fig. 5.1 outlines the way in which the gene for human insulin is incorporated into plasmid DNA and inserted into a bacterium.

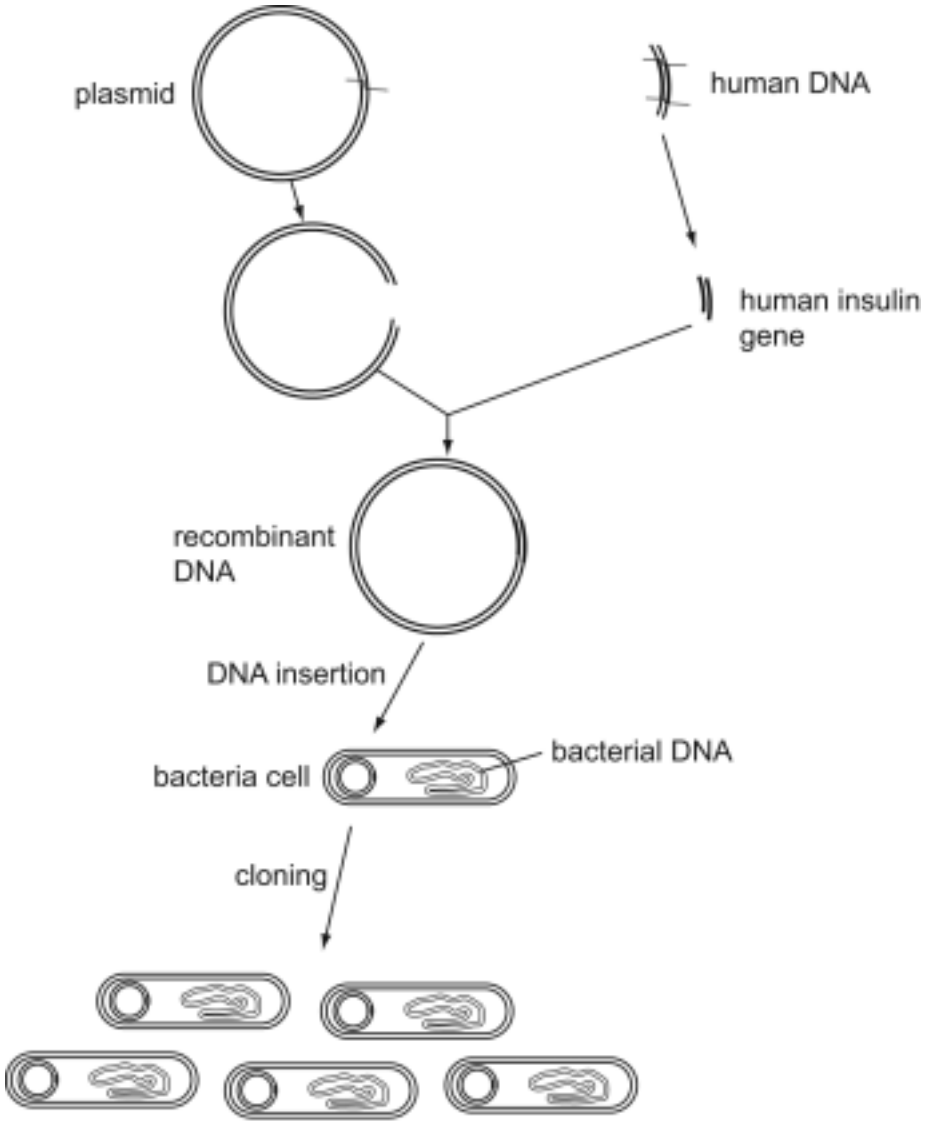

Fig. 5.1

For Examiner's Use

(a) Describe how the plasmid DNA is cut.

.....

.....

.....

..... [3]

(b) Explain how the human insulin gene is joined to the plasmid DNA.

.....

.....

.....

..... [3]

(c) List **two** advantages of treating diabetics with human insulin produced by genetic engineering.

1 .....

.....

2 .....

..... [2]

[Total: 8]

For Examiner's Use

6 **(a)** Beer contains ethanol. Suggest and explain the role of yeast enzymes in beer production.

.....

.....

.....

.....

.....

..... [3]

(b) Most beers contain starch. Recently, 'light' beers of low energy content have become more popular. Light beers have a low starch content. This is achieved by the addition of immobilised fungal amylase after the mashing process.

(i) Explain the advantage of using immobilised enzymes in this process.

.....

.....

.....

.....

..... [3]

(ii) The effect of two different types of immobilised fungal amylase on the hydrolysis of starch is shown in Table 6.1. In these reactions, starch is not a limiting factor.

Table 6.1

time/h	mass of maltose produced/g	
	α amylase	β amylase
0	0	0
1	0.05	0.05
2	0.20	0.10
3	0.60	0.20

With reference to Table 6.1, explain which of these enzymes would be used in the production of light beers with a low starch content.

.....

.....

..... [2]

[Total: 8]

For Examiner's Use

7 **(a)** Describe the structural features of wind pollinated plants such as grasses.

[4]

(b) State two advantages of self pollination and two advantages of cross pollination.

self pollination

1

2

cross pollination

1

2

[4]

[Total: 8]

For Examiner's Use

8 **(a)** Name the precise sites of production in the human female of the following hormones:

(i) follicle stimulating hormone (FSH);

.....

(ii) oestrogen;

.....

(iii) progesterone.

.....

[3]

(b) Fig. 8.1 shows the concentration of the hormones FSH, lutenising hormone (LH) oestrogen and progesterone in the blood of a human female over 28 days.

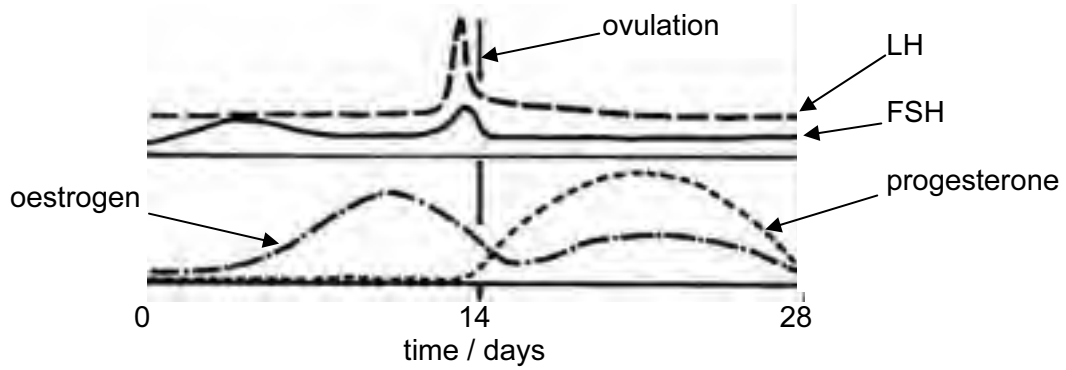

Fig. 8.1

(i) Explain the relationship between the rise of FSH from 0-4 days and ovulation

.....

.....

.....

.....

.....

.....

[4]

For Examiner's Use

(ii) Explain how the changes in ovarian hormones shown in Fig. 8.1 are linked to changes in the uterus during the cycle.

.....

.....

.....

.....

.....

..... [4]

(c) Table 8.1 shows the mean volume of a human ovary at different ages.

Table 8.1

age/years	mean volume of a human ovary/cm^3
8	0.5
10	0.7
12	2.2
14	3.1
16	4.0

Absolute growth rate may be defined as:
- increase in mass per unit time.

Relative growth rate may be defined as:
- absolute growth rate / mass at the start of the time.

With reference to Table 8.1 and these definitions, calculate, showing your working in each case,

(i) the **absolute** growth rate of the ovary between ages 12 and 16 years;

.....

.....

..... [2]

(ii) the **relative** growth rate of the ovary between ages 12 and 16 years.

.....

.....

..... [2]

[Total: 15]

Section B

Answer **one** question

9 **(a)** Explain how a synapse functions. [9]

(b) Describe the role of glucagon in regulating blood glucose. [6]

[Total: 15]

10 **(a)** Describe why variation is important in natural selection. [6]

(b) Explain the role of isolating mechanisms in the evolution of new species. [9]

[Total: 15]