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Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Level

BIOLOGY **9700/04**

Paper 4 Structured Questions A2 Core

October/November 2005

1 hour 15 minutes

Candidates answer on the Question Paper.
Additional Materials: Answer Paper should be available on request.

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 pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in Section A and **one** question from Section B.
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	
1	
2	
3	
4	
5	
Section A	
6 or 7	
Total	

This document consists of **10** printed pages and **2** lined pages.

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For Examiner's Use

Section A

Answer **all** questions.

Write your answers in the spaces provided.

1 Fig. 1.1 shows the Krebs cycle and the reactions preceding it.

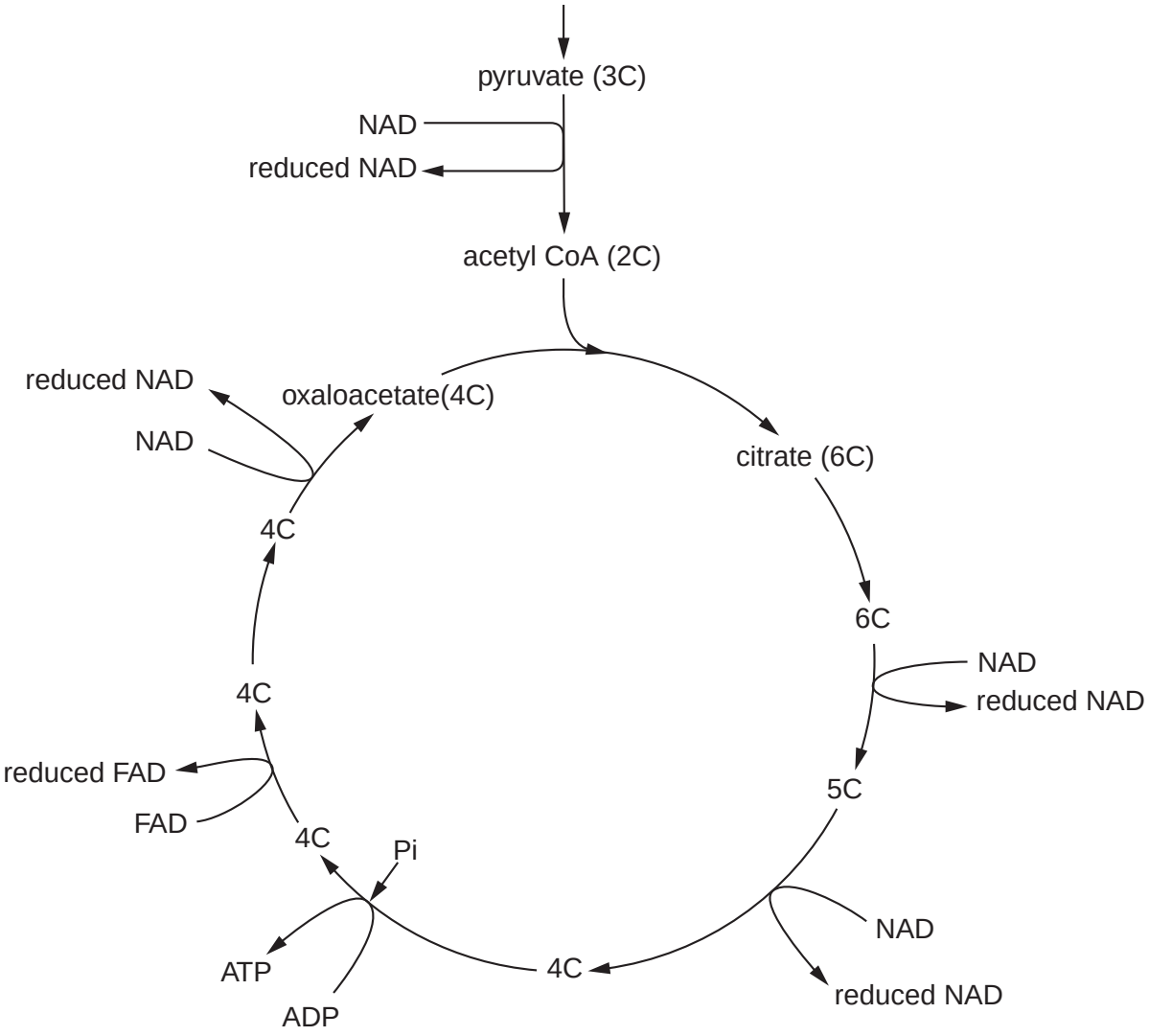


Fig. 1.1

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

.....[1]

(b) **Label on Fig. 1.1 all** the stages where

(i) decarboxylation reactions occur with a letter **X**. [2]

(ii) dehydrogenation reactions occur with a letter **H**. [2]

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(c) Explain how NAD is regenerated.

.....

.....

.....

.....[3]

(d) State how the formation of ATP in the Krebs cycle differs from the formation of ATP in oxidative phosphorylation.

.....

.....[1]

[Total : 9]

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[Turn over

2 A maize plant produced a total of 381 grains, 216 purple and smooth, 79 purple and shrunken, 65 yellow and smooth and 21 yellow and shrunken.

(a) Using the symbols **A** for purple and **a** for yellow and **B** for smooth and **b** for shrunken, draw a genetic diagram to explain these results.

[4]

(b) Explain why yellow shrunken grains breed true.

.....

.....

.....[2]

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A chi-squared test was carried out to test the significance of the differences between the observed and expected results.

Table 2.1

grain phenotype	observed number	observed ratio	expected ratio	expected number	[obs no. – exp no.]^2 ÷ expected no.
purple and smooth	216	10.3	9	381 × 9/16 = 214	4/214 = 0.019
purple and shrunken	79	3.8	3	381 × 3/16 = 71	64/71 = 0.901
yellow and smooth	65	3.1	3	.....	.....
yellow and shrunken	21	1.0	1	.....	.....
total number	381			chi square value	.....

(c) Complete the missing spaces in the Table 2.1 [3]

Table 2.2

	probability greater than						
degrees of freedom	0.50	0.20	0.10	0.05	0.02	0.01	0.001
3	2.37	4.64	6.25	7.82	9.84	11.34	16.27

(d) Use the calculated values of chi-squared test and the table of probabilities to find the probability of the observed ratio of phenotypes differing significantly from the expected.

.....[1]

(e) State what conclusions may be drawn from the probability found in **(d)**.

.....

.....

.....[2]

[Total : 12]

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[Turn over

3 **(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]

(iii) Identify respiratory substrate A from the respiratory quotient value calculated.

.....[1]

(c) Explain why carbohydrates release half as much energy per unit mass as fats and oils.

.....

.....

.....[2]

[Total : 8]

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4
- There are over 40 Galapagos Islands including the small and isolated island named Daphne Major.
- Only two species of Darwin finches are found on this island.
- Studies were made every year from 1970 to 1989 on the beak size of the island's population of ground finch, *Geospiza fortis*, by measuring the beak length of every bird (Fig. 4.1). Larger finches with larger beaks are better at opening large seeds. From 1976 to 1978 there was a drought and only 15% of the ground finches survived and these did not breed during drought years.

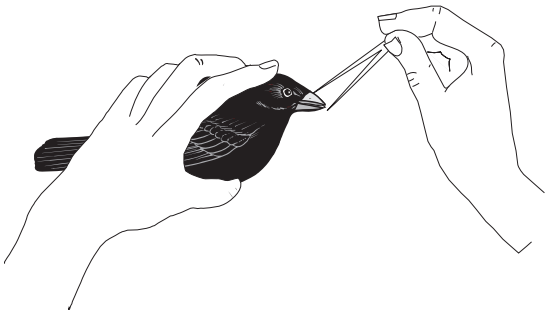


Fig. 4.1

- All finches were reduced in number. The most conspicuous feature of the survivors of the drought years was their large beak size.
- The main environmental consequences of drought is the decline in food supply, mainly seeds. During normal years, many grasses and herbs produce an abundance of small seeds. A few other plants produce a much smaller number of large seeds which are not normally eaten.

(a) Describe how environmental factors appear to have acted, during drought years, on the beak size of finches as an evolutionary force of natural selection.

.....

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.....[3]

Finches with small beaks were found to be smaller than finches with larger beaks.

(b) Explain the stabilizing force of natural selection on the beak size and size of birds in normal years.

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.....[3]

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(c) Outline the mechanisms that may have let natural selection lead to the evolution of the thirteen species of Darwin finches now found on the Galapagos Islands.

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.....[2]

[Total : 8]

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

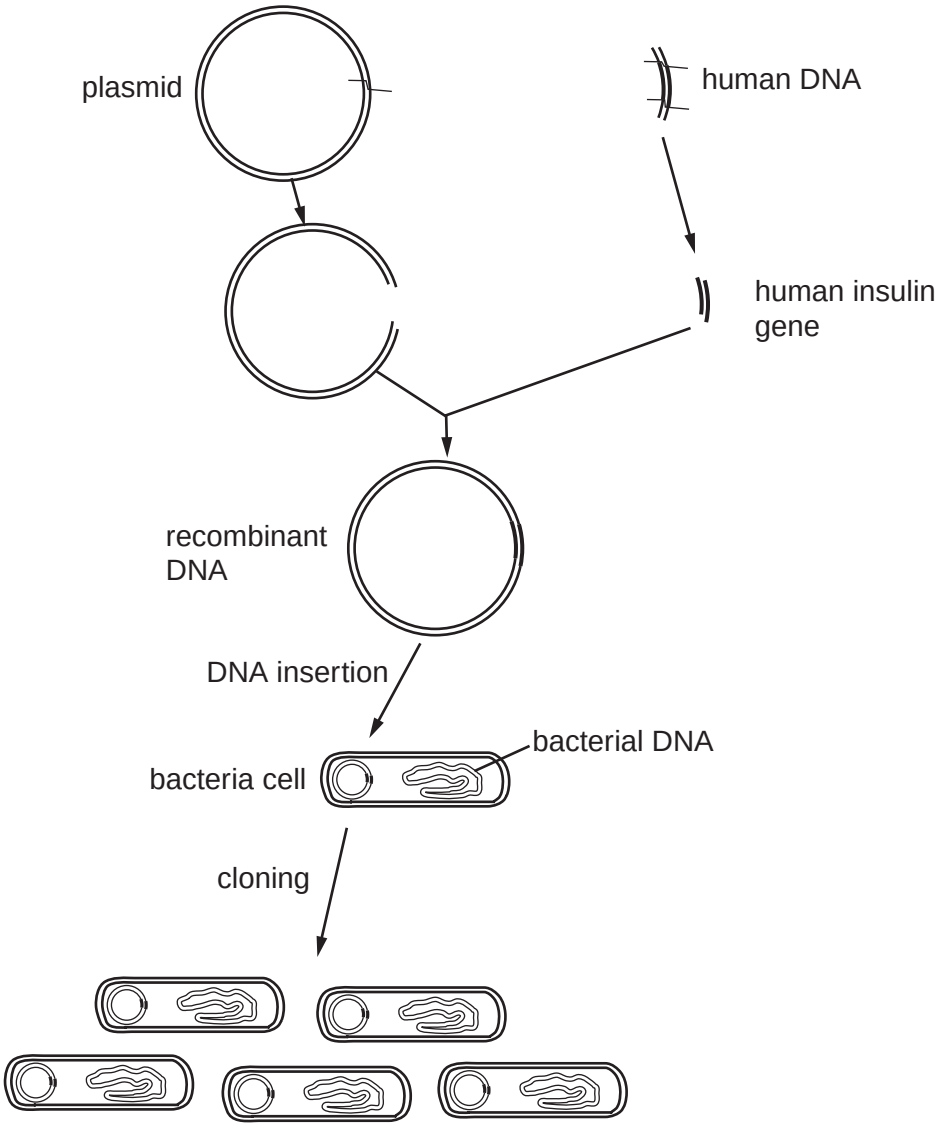


Fig. 5.1

(a) Describe how the plasmid DNA is cut.

.....

.....

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.....[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]

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Section B

Answer only **one** question from this section.

In this section, answers should be illustrated by large, clearly labelled diagrams wherever possible.

Your answer to Section B must be in continuous prose, where appropriate.

Your answer must be set out in sections **(a)** and **(b)**, as indicated in the question.

6 **(a)** Describe how the structure of a dicotyledonous leaf is related to its functions in photosynthesis. [7]

(b) Discuss the effects that variations in carbon dioxide concentration and light intensity have on the rate of photosynthesis. [8]

7 **(a)** Describe how nitrogenous waste products are formed and explain why they need to be removed from the body. [6]

(b) Describe how the kidney removes metabolic wastes from the body. [9]

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