Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Education
January 2003
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY (SPECIFICATION B) BYB678/B
Unit 6 Section B Applying Biological Principles
Unit 7 Section B Applying Biological Principles
Unit 8 Section B Applying Biological Principles

Tuesday 28 January 2003 9.00 am to 11.15 am

In addition to this paper you will require:
- Section A;
- a ruler with millimetre measurements.

You may use a calculator.

Time allowed: The total time for Section A and Section B of this paper is 2 hours 15 minutes.

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** the questions in **Section B** in the spaces provided. All working must be shown.
- **Section A** and **Section B** will be marked by different examiners. You must ensure that any supplementary sheets are fastened to the appropriate question paper answer book.
- Do all rough work in this book. Cross through any work you do not want marked.

Information
- The maximum mark for **Section B** is 50.
- Mark allocations are shown in brackets.
- You are reminded that all questions in this **Section B** are synoptic (indicated by the letter **S**). You must use your knowledge of Modules 1-5 when answering this section.
- You are advised to spend 1 hour 15 minutes on **Section B**.
- You are reminded of the need for clear presentation in your answers. All answers should be in good English and should use accurate scientific terminology.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

SECTION B

Answer **all** questions in the spaces provided.

S 1 Chloroplasts contain both polypeptides and ribosomes. An investigation was carried out to find out whether any of the chloroplast polypeptides are synthesised by chloroplast ribosomes.

An extract containing a suspension of isolated chloroplasts from spinach leaves was used in the investigation. The number of different, newly synthesised polypeptides produced in this extract was measured after incubating in the light and in the dark.

(a) Briefly describe how you could obtain a suspension of intact isolated chloroplasts from spinach leaves.

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(3 marks)

(b) The isolated chloroplasts were washed repeatedly with isotonic saline solution before they were used in this investigation. Explain why

(i) isotonic saline solution was used to wash the isolated chloroplasts;

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(2 marks)

(ii) it was necessary to wash the isolated chloroplasts repeatedly.

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(2 marks)

(c) Radioactive amino acids were added to the extract. Explain why the use of radioactive amino acids would enable the investigators to find and identify the polypeptides which had been newly synthesised.

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(2 marks)

(d) In the investigation, more polypeptides were synthesised in the light than in the dark. Suggest an explanation for this.

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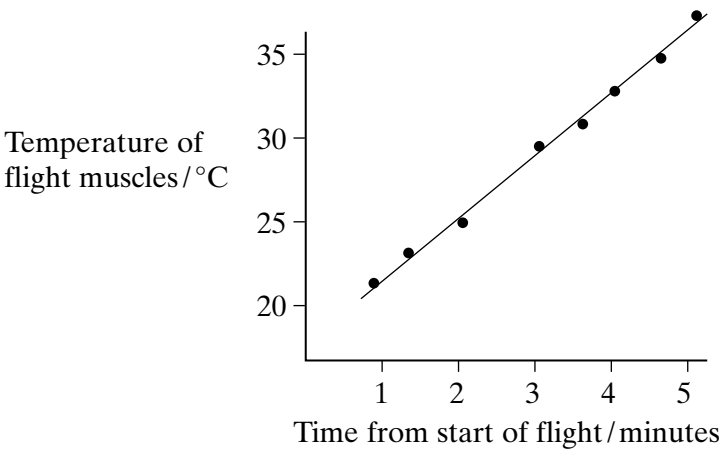
(1 mark)

10

TURN OVER FOR THE NEXT QUESTION

S 2 (a) The graph shows the relationship between the time spent flying by a butterfly and the temperature of its flight muscles.



Explain what causes the temperature of the muscles to rise during flight.

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(2 marks)

(b) Food reserves are found in special storage tissue in an insect's body. Flight uses up these food reserves. The table shows some metabolic features related to flight in three insects.

Insect	Main food reserve	Energy value of food reserve / kJ g^{-1}	Metabolic rate / kJ g^{-1} h^{-1}	Hourly consumption of food reserve as a percentage of body mass
Honeybee	Carbohydrate	17.6	1.23	20.0
Fly	Carbohydrate	17.6	0.50	10.0
Locust	Fat	39.3	0.27	0.7

A locust is able to fly without stopping for many more hours than a honeybee or a fly. Using information from the table, explain why a locust has a longer flight endurance.

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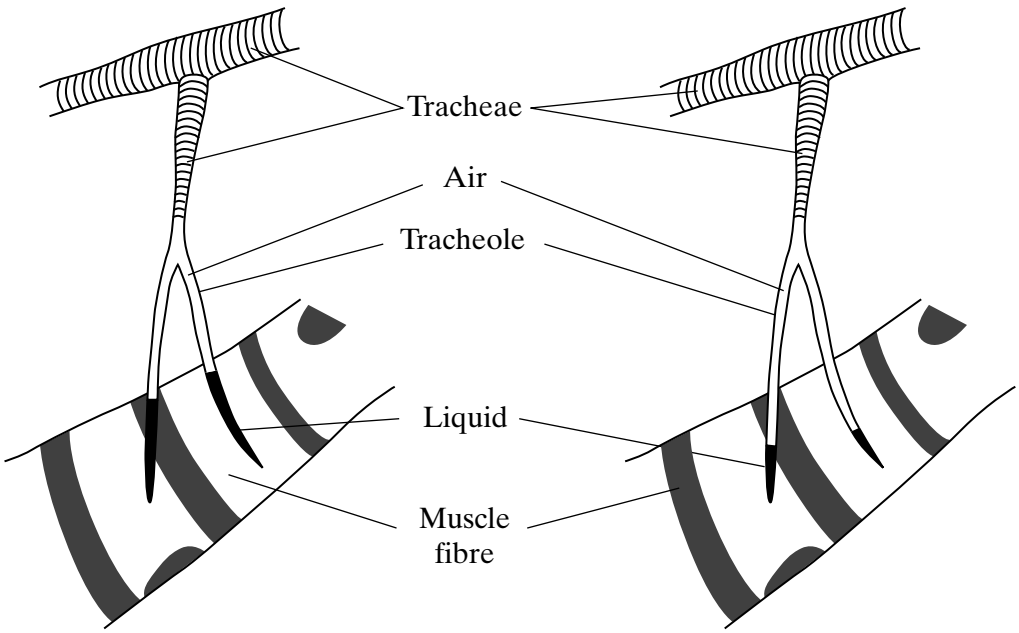
(3 marks)

QUESTION 2 CONTINUES ON THE NEXT PAGE

(c) In insects, air is supplied directly to the tissues through a system of tubes called tracheae, which branch to form smaller permeable tubes called tracheoles. The diagrams show the change that occurs in the tracheoles supplying muscle fibres during flight.



During flight, the liquid in the tracheoles passes from the tracheole into the muscle fibre.

(i) How does this change benefit gas exchange in the insect?

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(1 mark)

(ii) Substances which are produced during metabolism cause the liquid in the tracheoles to pass into the muscle fibre during flight. Explain how.

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(2 marks)

(iii) Suggest why a muscle fibre, in which the tracheoles are restricted to the outside of the fibre, cannot be larger than 20 µm in diameter.

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(2 marks)

S 3 The table shows factors which affect oxygen transport to the body tissues in different groups of animals.

Animal group	Mean rate of blood flow to body tissues / $cm^3\,kg^{-1}\,minute^{-1}$	Mean haemoglobin concentration in blood / $g\,cm^{-3}$
Reptiles	45	0.072
Fish	17	0.038
Amphibians	25	0.070
Mammals	75	0.132

(a) Suggest why values for mean rate of blood flow to the tissues are expressed per kilogram of body mass.

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(2 marks)

(b) Describe the relationship between the mean rate of blood flow and haemoglobin concentration.

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(1 mark)

(c) Each gram of haemoglobin can transport up to 1.38 cm^3 of oxygen. Calculate the difference between mammals and fish in the maximum amount of oxygen that can be transported per cm^3 of blood. Show your working.

Answer ..... cm^3

(2 marks)

Turn over ▶

S 4 Write an essay on **one** of the topics below.

EITHER

(a) The biological importance of water. *(25 marks)*

OR

(b) The movement of substances within living organisms. *(25 marks)*

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

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