INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

N01/410/H(2)

BIOLOGY
HIGHER LEVEL
PAPER 2

Name

Number

Monday 5 November 2001 (afternoon)

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: Answer all of Section A in the spaces provided.
- Section B: Answer two questions from Section B. Write your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
- At the end of the examination, indicate the numbers of the Section B questions answered in the boxes below.

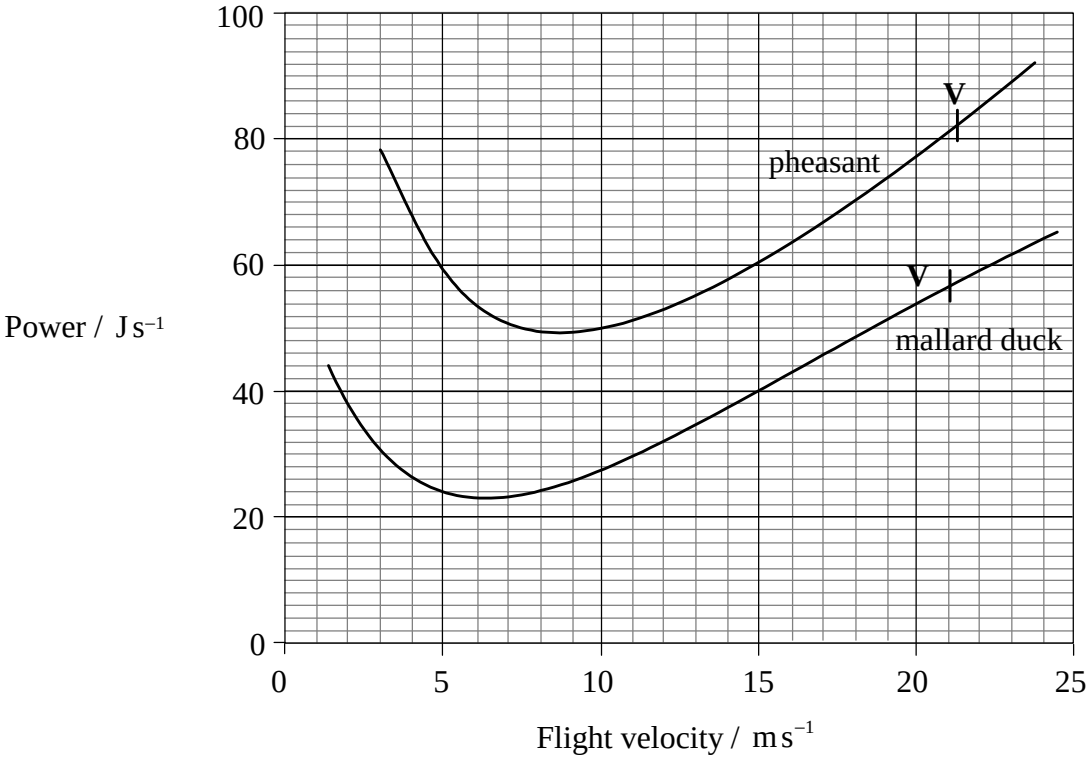
QUESTIONS ANSWERED		EXAMINER	TEAM LEADER	IBCA
SECTION A	ALL	/32	/32	/32
SECTION B				
QUESTION	. . . . .	/20	/20	/20
QUESTION	. . . . .	/20	/20	/20
NUMBER OF CONTINUATION BOOKLETS USED	. . . . .	TOTAL /72	TOTAL /72	TOTAL /72

SECTION A

*Candidates must answer **all** questions in the spaces provided.*

1. Energy released in cell respiration can be used for the muscle contractions that cause movement. The amount of energy used per second ($J\,s^{-1}$) is the power needed for movement. The graph below shows the power used by two birds for flying. The pheasant (*Phasianus colchicus*) has a mass of 1.66 kg and the mallard duck (*Anas platyrhynchos*) a mass of 1.105 kg.

The most efficient flying velocity for each bird, defined as the minimum number of Joules used per metre travelled, is indicated by **V** on the graph.



(Source: J M V Rayner (1979) *J. Exp. Biol*. **80** pages 17–54)

(a) Compare the data for the two birds shown in the graph. *[3]*

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(b) Suggest **one** reason for the difference between the data for these two birds. *[1]*

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(This question continues on the following page)

(Question 1 continued)

(c) Select **one** of the species and analyse the data in the graph to show that at velocity **V** the efficency is greater than at the velocity that requires the least power. Show your working. *[3]*

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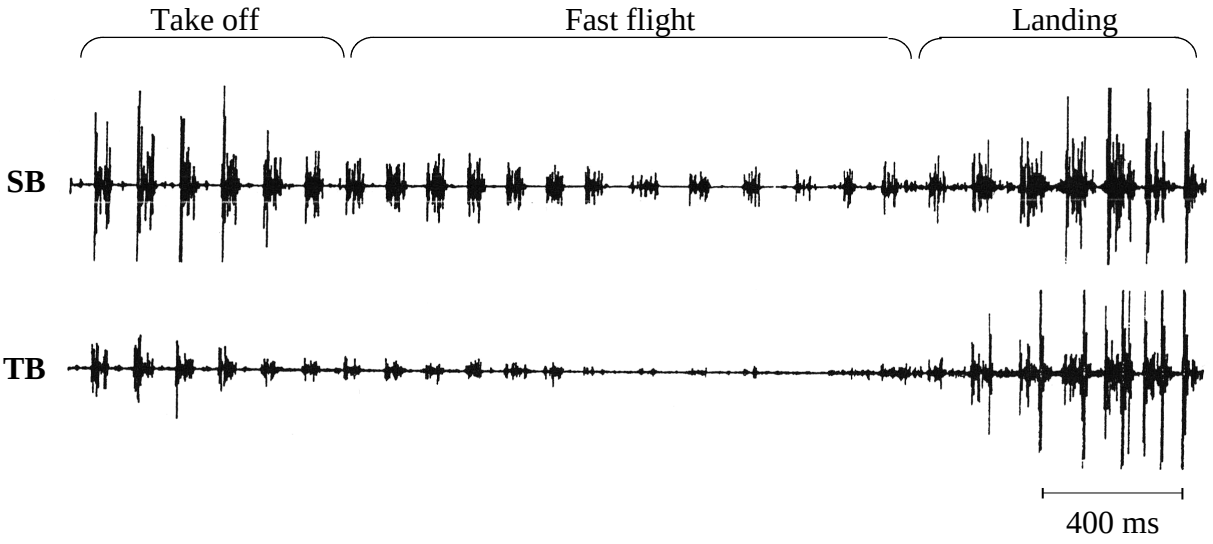
In one research project, pigeons (*Columba livia*) were trained to take off, fly 35 metres and land on a perch. During the flight the activity of two muscles, the sternobrachialis (**SB**) and the thoracobrachialis (**TB**), was monitored using an electromyograph. The trace is shown below. The spikes show electrical activity in contracting muscles.

Contraction of the sternobrachialis causes a downward movement of the wing.



(Source: K P Dial *et al* (1988) *J. Exp. Biol*. **134** pages 1–16)

(d) Deduce the number of down-strokes of the wing during the whole flight. *[1]*

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(e) Compare the activity of the sternobrachialis muscle during the three phases of the flight. *[3]*

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(This question continues on the following page)

(Question 1 continued)

(f) Deduce from the data in the electromyograph how the thoracobrachialis is used. *[1]*

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Another muscle, the supracoracoideus, is antagonistic to the sternobrachialis.

(g) State the movement produced by a contraction of this muscle. *[1]*

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(h) Predict the pattern of the electromyograph trace for the supracoracoideus muscle during the 35 metre flight. *[2]*

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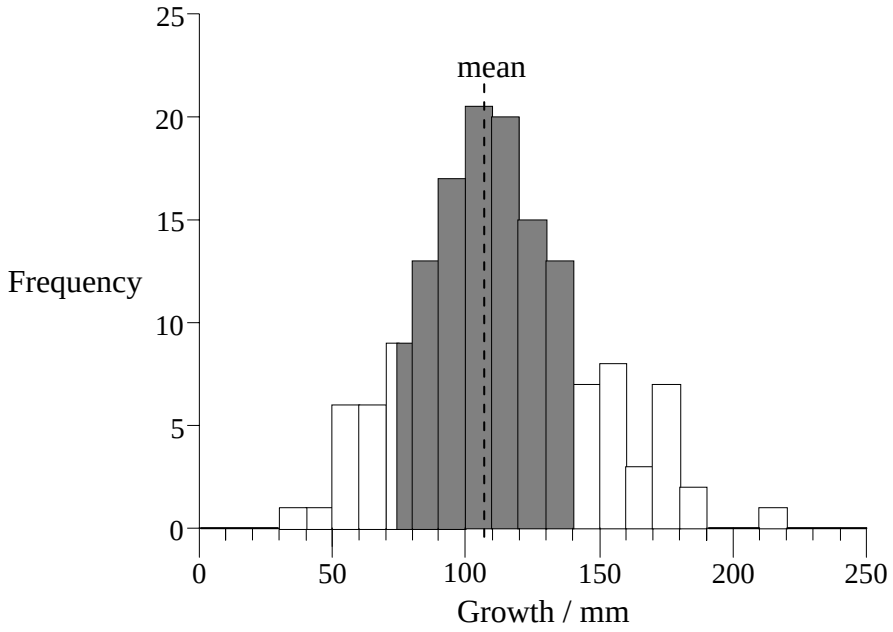
2. The histogram below shows one year's growth of 150 specimens of an alga, *Ascophyllum nodosum*, found on rocky sea shores.



(a) Identify the category which is the mode. *[1]*

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(b) Outline how the median value of the sample can be found. *[1]*

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The shaded area in the histogram shows the range of one standard deviation above and below the mean.

(c) State the percentage of the values covered by the shaded area. *[1]*

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(d) Outline **two** uses of the standard deviation. *[2]*

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(This question continues on the following page)

(Question 2 continued)

(e) The data in the histogram is an example of continuous variation. State **two** examples of a human characteristic that shows continuous variation. *[2]*

1 . . . . . .

2 . . . . . .

(f) Some examples of continuous variation are inherited. Explain the pattern of inheritance that can cause continuous variation. *[2]*

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3. The diagram below shows base sequences of messenger RNA from two different species and their corresponding amino acid sequence.

Species **I**					Species **II**				
UUC	**AGC**	**GGC**	**AGU**	**ACA**	**CCA**	**GUC**	**GCG**	**UUC**	**GGC**
leucine	serine	glycine	serine	threonine	proline	valine	alanine	leucine	glycine

(a) Using these sequences, explain the evidence that indicates that the genetic code is universal. *[2]*

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(b) Mutations to the base sequence of a gene may fail to cause changes in the amino acid sequence. Using evidence from the base sequences above, explain how this may happen. *[2]*

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(c) Deduce the DNA base sequence that is complementary to the messenger RNA base sequence of species **I**. *[1]*

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(d) There is an enzyme which can synthesise DNA with a base sequence complementary to messenger RNA.

(i) State the name of this enzyme. *[1]*

. . . . . .

(ii) State which cells synthesise this enzyme. *[1]*

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In eukaryotes, the base sequence of the DNA synthesised using this enzyme may differ from the DNA used to make the messenger RNA.

(e) Suggest a reason for this difference. *[1]*

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SECTION B

*Answer **two** questions. Up to two additional marks are available for the construction of your answers. Write your answers in a continuation answer booklet. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.*

4. (a) Describe the structure of proteins. *[9]*

(b) Discuss the solubility of proteins in water. *[4]*

(c) Explain the relationship between genes and polypeptides. *[5]*

5. (a) Explain the role of water in photosynthesis. *[4]*

(b) Discuss the relationship between the different nitrogenous waste products and the habitats of birds and amphibians. *[5]*

(c) Describe the ways in which water is important to animals. *[9]*

6. (a) Describe the behaviour of chromosomes in the phases of meiosis. *[9]*

(b) Explain oogenesis. *[5]*

(c) Discuss how, in humans, a larger number of sperms are produced than eggs. *[4]*

7. (a) Outline the structural features which characterise bryophytes, filicinophytes, coniferophytes and angiospermophytes. *[9]*

(b) Explain the conditions needed for seed germination. *[6]*

(c) Discuss which wild plants need to be conserved as a priority. *[3]*