IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

M05/4/BIOLO/SP2/ENG/TZ2/XX

22056017

BIOLOGY
STANDARD LEVEL
PAPER 2

Wednesday 11 May 2005 (afternoon)

1 hour 15 minutes

Candidate session number

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INSTRUCTIONS TO CANDIDATES

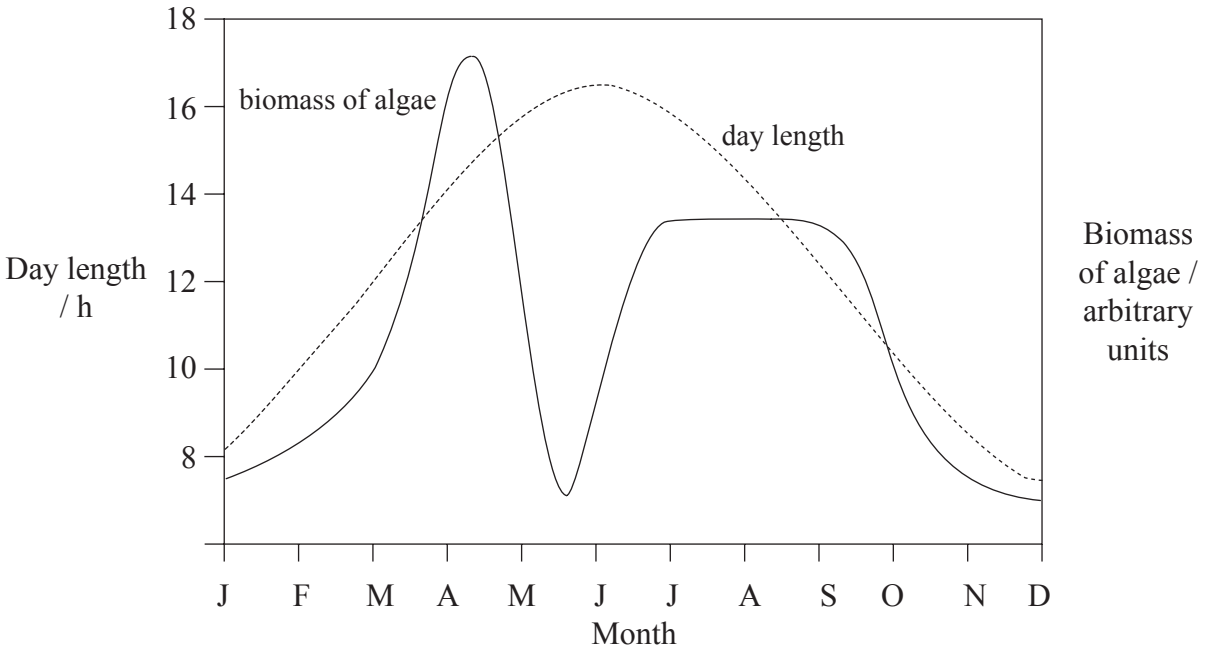
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer one question from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

SECTION A

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

1. The water flea (*Daphnia sp.*) normally produces eggs asexually. Under certain conditions, *Daphnia* will switch to sexual reproduction, producing "resting" eggs that can survive dormant for many years.

The graph below shows how the day length and biomass of algae (a food source for *Daphnia*) varies over the course of the year in the habitat of *Daphnia*.



[Source: V Alekseev and W Lampert, *Nature*, (2001), **414**, pages 899–901]

(a) Identify the month during which the quantity of food is at a maximum. *[1]*

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(b) Compare the changes in biomass of algae with the changes in day length from January to June. *[3]*

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(This question continues on the following page)

(Question 1 continued)

An investigation was conducted to determine how conditions experienced by one generation of *Daphnia* can affect resting egg production by the next generation. The investigation examined the influence of three variables on resting egg production: day length, quantity of food (photosynthetic algae), and conditions experienced by the previous generation.

The table below shows the percentage of resting eggs produced under the various conditions.

Conditions experienced by 1st generation mother		**Conditions experienced by 2nd generation mothers**		**Percentage of resting eggs produced by 2nd generation**
Food Levels	**Day Length**	**Food Levels**	**Day Length**	
High	Short Day	High	Short Day	0.0
		High	Long Day	0.0
		Low	Short Day	52.3
		Low	Long Day	38.0
High	Long Day	High	Short Day	0.0
		High	Long Day	0.0
		Low	Short Day	13.0
		Low	Long Day	11.0
Low	Short Day	High	Short Day	0.0
		High	Long Day	0.0
		Low	Short Day	7.5
		Low	Long Day	15.8
Low	Long Day	High	Short Day	0.0
		High	Long Day	0.0
		Low	Short Day	0.0
		Low	Long Day	30.7

(c) Discuss the conditions in the 2nd generation which favour resting egg production. *[3]*

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(d) Using the graph, deduce, giving a reason, whether resting egg production is likely in April. *[1]*

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(Question 1 continued)

(e) Determine the change between the 1st generation and the 2nd generation which is most likely to trigger resting egg production. *[1]*

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(f) Suggest the advantages of having asexual and sexual reproduction in *Daphnia*. *[3]*

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2. (a) State **two** examples of cells that can have more than one nucleus in their cytoplasm. *[1]*

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(b) Define the term *organelle*. *[1]*

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(c) Explain the process of cellular differentiation. *[2]*

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(d) Outline how gender is determined in humans. *[2]*

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(e) State the **two** properties of DNA fragments that are used to separate them in gel electrophoresis. *[1]*

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3. (a) Define the term *random sample*. *[1]*

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(b) Draw and label a graph showing the sigmoid (S-shaped) population growth curve. *[3]*

(c) The masses of two different populations of sparrows (*Passer domesticus*) are shown in the table below.

Population 1: mass of birds / g	**Population 2: mass of birds / g**
24.5	26.9
25.0	23.2
24.0	23.6
25.0	31.0
24.5	27.9
24.8	28.3

(i) Calculate the mean value of the mass of birds for population 1. *[1]*

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(ii) With reference to the data shown, explain what is meant by the term *standard deviation*. No calculation is expected. *[2]*

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4. (a) List **two** different types of blood cells. *[1]*

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(b) Explain why antibiotics are effective against bacteria but not viruses. *[3]*

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SECTION B

*Answer **one** question. Up to two additional marks are available for the construction of your answer. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.*

5. (a) Describe the genetic code. *[6]*

(b) Outline early embryo development in the human until implantation in the uterus. *[4]*

(c) Discuss the theory of evolution by natural selection. *[8]*

6. (a) Describe the role of enzymes in digestion with reference to two named examples. *[5]*

(b) Outline **two** examples of the commercial application of enzymes in biotechnology. *[6]*

(c) Discuss the potential benefits and possible harmful effects of genetic modification. *[7]*

7. (a) State **one** function for each of the main four elements in organisms. *[4]*

(b) Describe homeostasis in relation to blood glucose concentration in humans. *[6]*

(c) Explain the various methods cells use to transport materials across membranes. *[8]*