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BIOLOGY
STANDARD LEVEL
PAPER 2

Candidate session number

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Thursday 17 May 2012 (afternoon)

1 hour 15 minutes

Examination code

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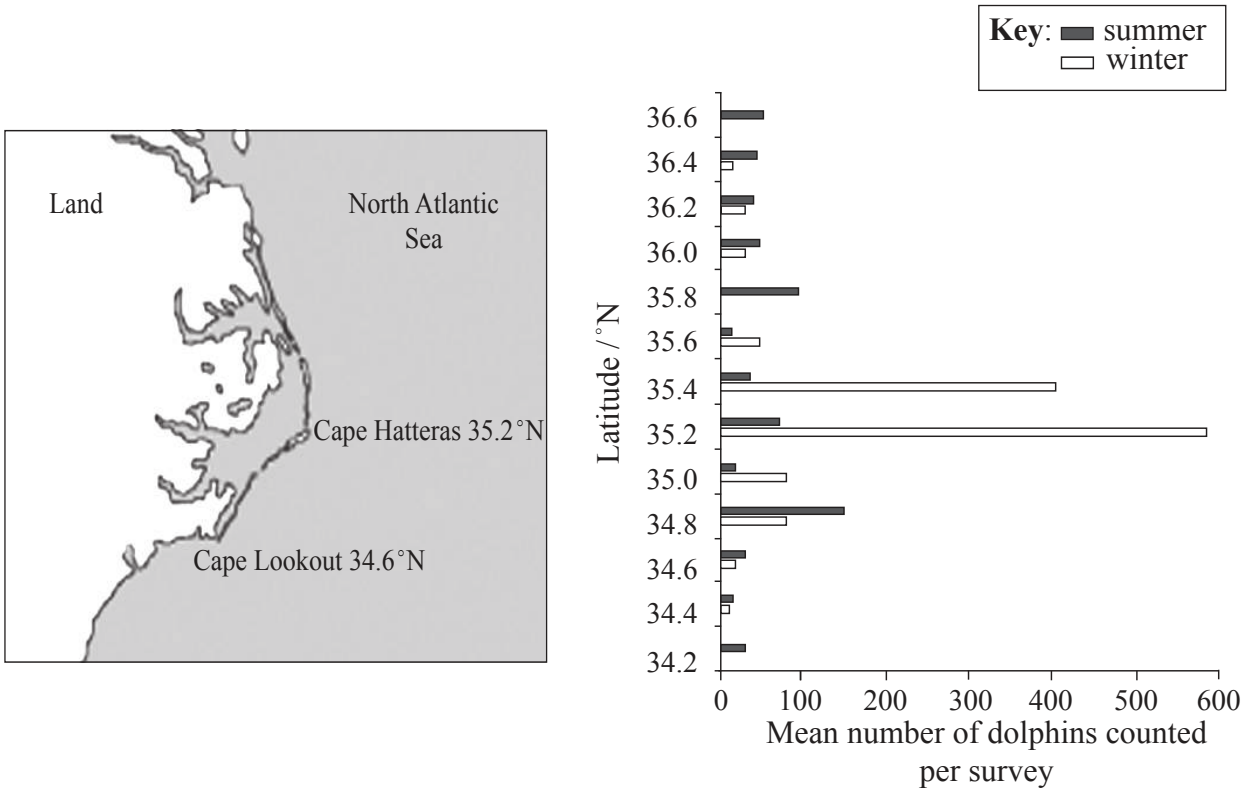
INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[50 marks]*.

SECTION A

*Answer **all** questions. Write your answers in the boxes provided.*

1. Bottlenose dolphins (*Tursiops truncatus*) inhabit almost all tropical and temperate oceans between 45°N and 45°S. Over a two-year period, aerial surveys were carried out to investigate the seasonal distribution of these animals along the mid-Atlantic and eastern coastal waters of the USA. Sightings were recorded using a global positioning system (GPS) while flying parallel to the coast approximately 500 m offshore. The diagram below shows a map of the section of coast surveyed. The bar graph shows the seasonal data for summer and winter at the corresponding latitudes (°N). A total of 5431 bottlenose dolphins were sighted during these surveys.



[Source: adapted from Leigh G. Torres, William A. McLellan, Erin Meagher and D. Ann Pabst (2005) 'Seasonal distribution and relative abundance of bottlenosedolphins, *Tursiops truncatus*, along the US mid-Atlantic Coast.' *Journal of Cetacean Research and Management*, 7 (2), pp. 153–161.]

(a) State the largest number of dolphins counted in a single summer survey. *[1]*

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(Question 1 continued)

(b) Compare the distribution of dolphins in summer and winter. *[2]*

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(c) Suggest **one** reason for the differences in distribution. *[1]*

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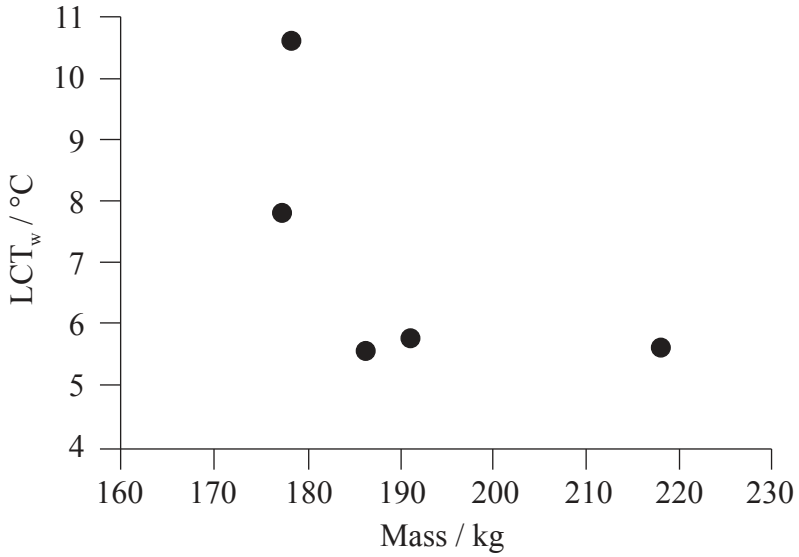
(Question 1 continued)

In a different study, researchers investigated the role of water temperature as a possible factor in the distribution of bottlenose dolphins. The rate of metabolism (measured as the rate of oxygen uptake per unit mass) of five captive adults was measured under a range of water temperatures. The rate of metabolism was found to increase significantly when the water temperature fell below a certain value known as the lowest critical water temperature (LCT_w). Below this temperature the body uses more energy to combat the cooling effect of the surrounding water. The data for these animals are summarized below.

Animal	Sex	Age / years	Mass / kg	LCT_w / °C
1	male	27	177.3	7.8
2	male	24	191.4	5.7
3	male	26	219.7	5.6
4	male	14	187.0	5.5
5	female	33	178.2	10.6

[Adapted with permission from L.C. Yeates and D.S. Houser (2008) 'Thermal tolerance in bottlenose dolphins (*Tursiops truncatus*).' *Journal of Experimental Biology*, 211, pp. 3249–3257, Table 1.doi:10.1242/jeb.020610: The Journal of Experimental Biology: jeb.biologists.org]

The graph below summarizes the relationship between LCT_w and body mass.



[Adapted with permission from L.C. Yeates and D.S. Houser (2008) 'Thermal tolerance in bottlenose dolphins *Tursiops truncatus*).' *Journal of Experimental Biology*, **211**, pp. 3249–3257, Figure 4.doi:10.1242/jeb.020610: The Journal of Experimental Biology: jeb.biologists.org]

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(Question 1 continued)

(d) Outline the relationship between body mass and LCT_w for male dolphins. *[2]*

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(e) Evaluate the hypothesis that water temperature determines the range and distribution of bottlenose dolphins in the wild. *[2]*

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(f) Explain how an increase in water temperature due to global warming could affect the distribution of bottlenose dolphins along the eastern coast of the USA. *[2]*

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(g) Suggest how research into the range and distribution of bottlenose dolphins could benefit from international cooperation. *[1]*

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2. (a) State **two** differences in structure between plant and animal cells. *[2]*

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(b) Outline how molecules move across a membrane by simple diffusion. *[2]*

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(c) Explain the role of protein pumps in active transport. *[2]*

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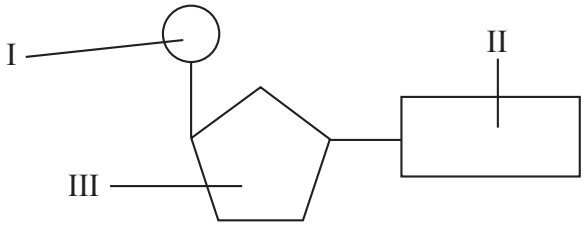
3. (a) The diagram below represents a DNA nucleotide.



Identify the phosphate group and deoxyribose. *[1]*

Phosphate group: . . . . . .

Deoxyribose: . . . . . .

(b) Draw a labelled diagram to show how four nucleotides are joined together to form a double-stranded DNA molecule with two base pairs. *[3]*

(c) State **two** differences between RNA and DNA nucleotides. *[2]*

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4. (a) Outline **two** possible consequences of global warming for organisms living in arctic ecosystems. *[2]*

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(b) The changes that result from global warming may lead to evolution. Define *evolution.* *[2]*

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(c) Explain how sexual reproduction promotes variation in a species. *[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 in the boxes provided.*

5. (a) Outline, with examples, the types of carbohydrate found in living organisms. *[4]*

(b) Describe the importance of hydrolysis in digestion. *[6]*

(c) Explain the flow of energy between trophic levels in ecosystems. *[8]*

6. (a) Describe the characteristics of stem cells that make them potentially useful in medicine. *[5]*

(b) Outline the inheritance of a **named** sex-linked condition in humans. *[5]*

(c) Explain the use of karyotyping in human genetics. *[8]*

7. (a) Outline what is meant by homeostasis. *[4]*

(b) Describe how body temperature is maintained in humans. *[6]*

(c) Explain the need for a ventilation system and the mechanism of ventilation of the lungs in humans. *[8]*