



22126011

**BIOLOGY**
STANDARD LEVEL
PAPER 2

Thursday 17 May 2012 (afternoon)

1 hour 15 minutes

Candidate session number

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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].

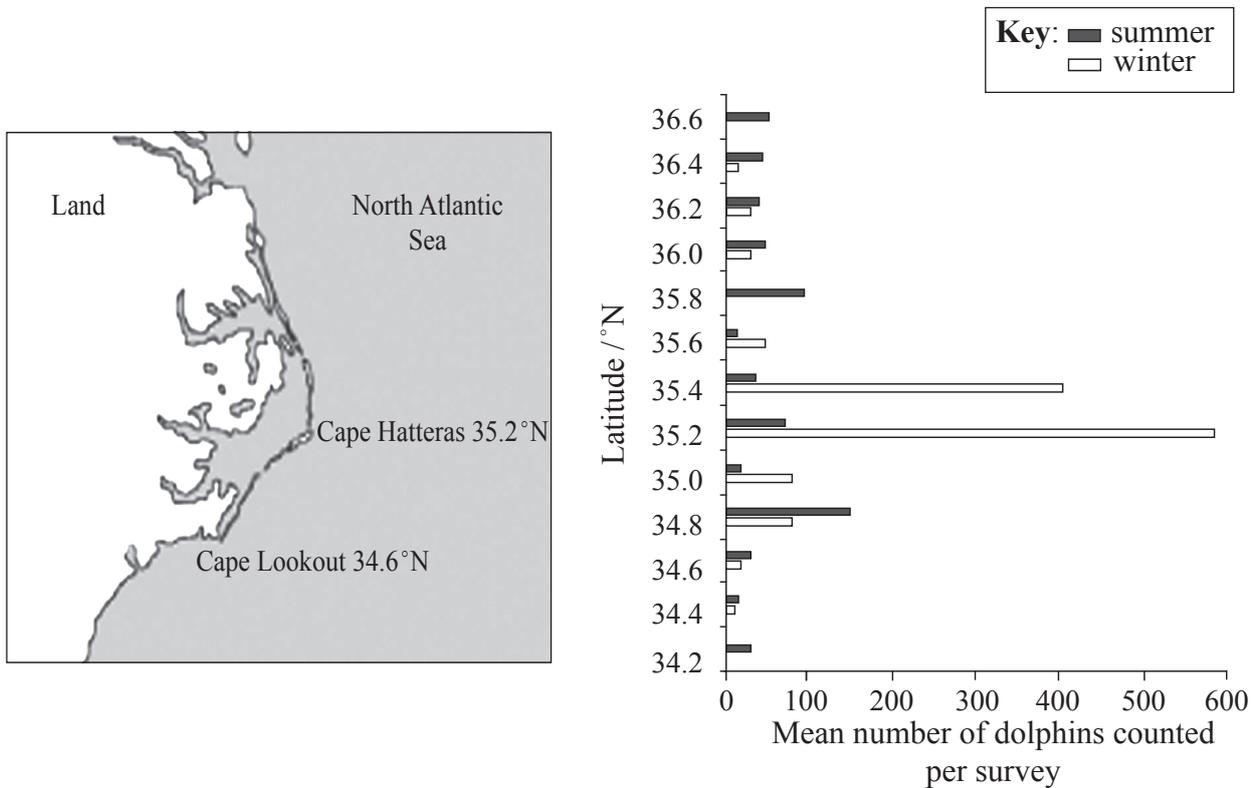


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SECTION A

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 500m 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]

(This question continues on the following page)



(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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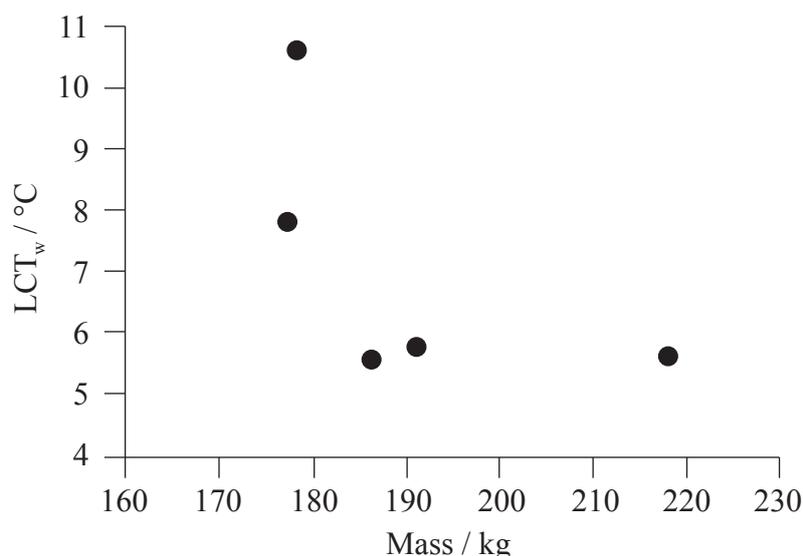
(Question 1 continued)

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	$LCT_w / ^\circ C$
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]

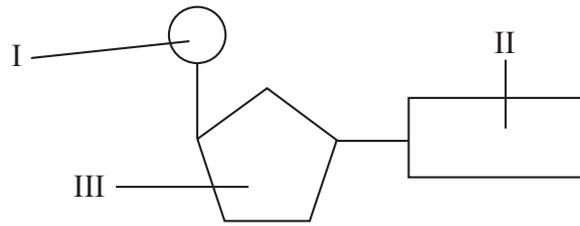
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- (c) Explain the role of protein pumps in active transport. [2]

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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]

A large empty rectangular box intended for drawing a double-stranded DNA molecule with two base pairs.

(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]



