

**BIOLOGY
HIGHER LEVEL
PAPER 2**

Candidate number

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Tuesday 11 May 2004 (afternoon)

2 hours 15 minutes

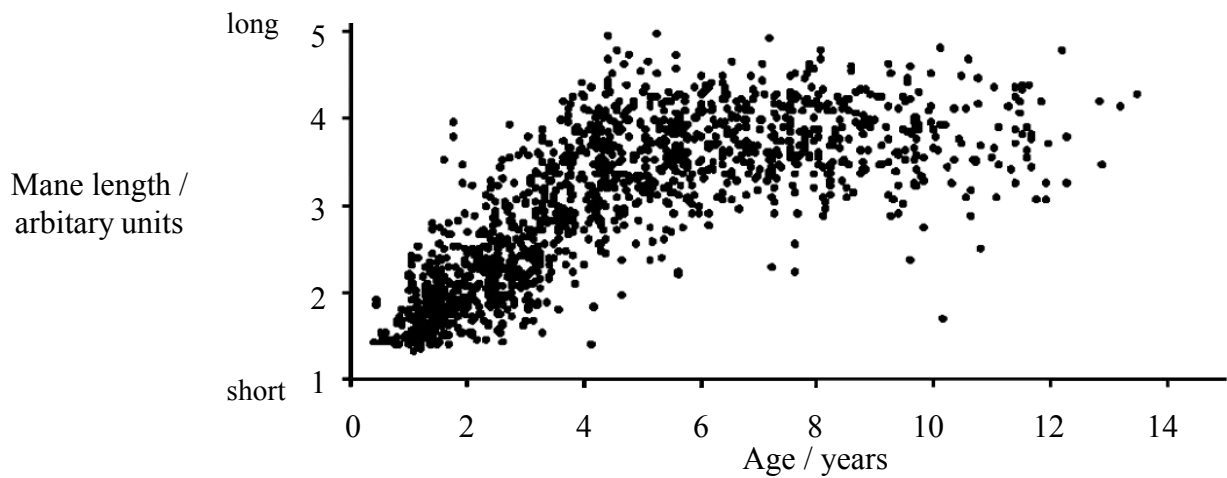
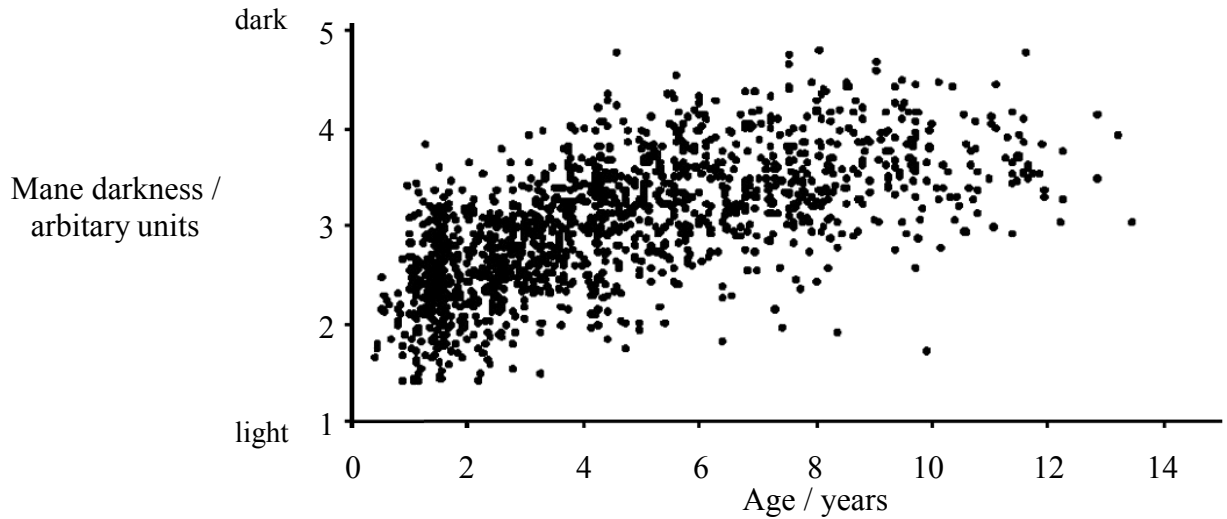
INSTRUCTIONS TO CANDIDATES

- Write your candidate number in the box 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 on answer sheets. Write your candidate 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. In the African lion (*Panthera leo*), the male grows a large mane of hair around its head. The trait is highly variable. Curiosity about the purpose of the mane prompted a long-term study of lions in the Serengeti National Park. The data obtained is shown below.



[Source: West and Parker, *Science* (2002), 297, page 1340]

- (a) State the relationship between mane darkness and age. [1]

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(Question 1 continued)

- (b) Compare the changes in mane length with mane darkness as the lion ages. [2]

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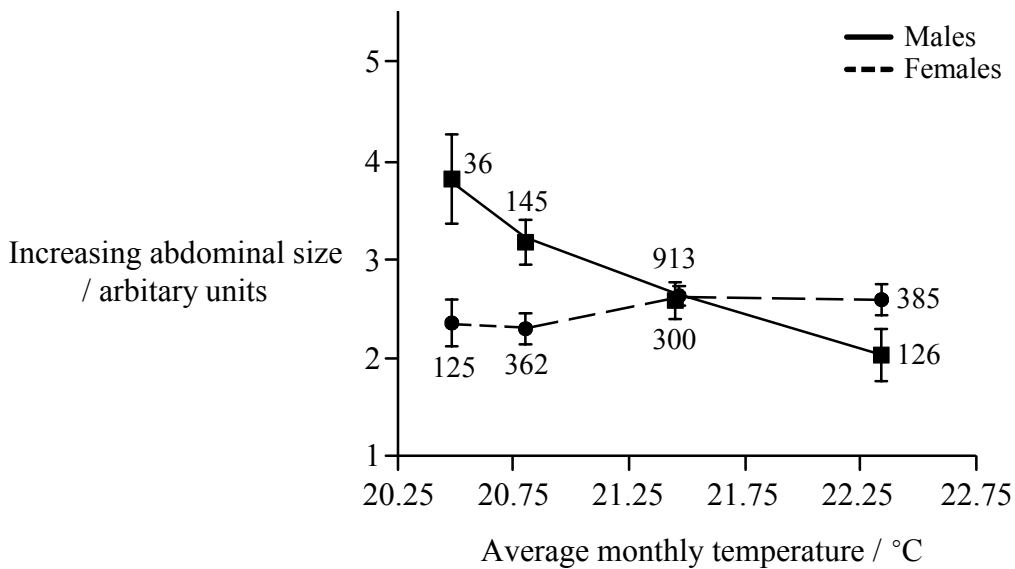
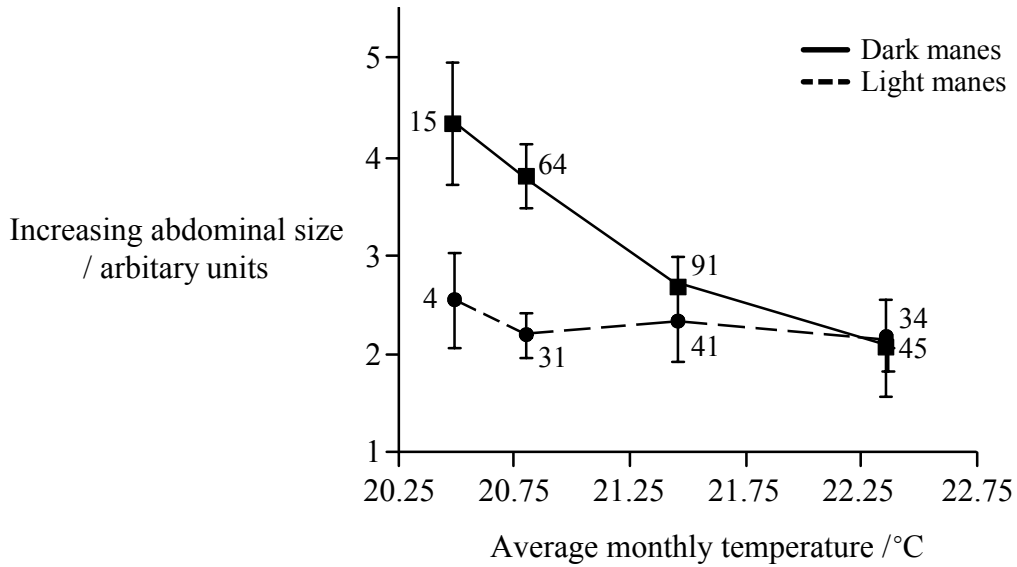
- (c) Suggest a reason why the data in the graphs is difficult to interpret. [1]

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(Question 1 continued)

Among lions, abdominal size can be correlated to food intake. In an area where food supply was constant throughout the year, abdominal sizes were assessed visually at different months of the year. The following graphs show food intake data for many different lions. The values adjacent to the data points indicate the numbers of individuals assessed.



[Source: West and Parker, *Science*, (2002), 297, page 1341]

(d) Identify the temperature at which dark-maned males have the largest abdominal size. [1]

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(Question 1 continued)

- (e) Suggest why males with dark manes have less food intake during warmer months. [1]

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- (f) Analyse the data for feeding activity among females and males. [2]

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- (g) Using the data, outline which type of lions are relatively well-nourished during cooler months. [3]

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(Question 1 continued)

Field research included placing in the Serengeti, life-size models of male lions, differing in **either** mane darkness **or** mane length. The number of male and female lions which approached the models for closer inspection, after seeing them at a distance, were recorded in the table below.

Number of approaches for closer inspection

	Number of trials	Dark-maned model	Light-maned model
Females	10	9	1
Males	5	0	5

	Number of trials	Long-maned	Short-maned
Females	10	7	3
Males	10	1	9

[Source: West and Parker, *Science* (2002), 297 Supporting Online Material, Table S1]

- (h) Using the data in the table, deduce the appearance of a male lion that would be most attractive to a female lion. [1]

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- (i) Explain the male response to the different models. [3]

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- (j) Some researchers have hypothesized that manes in lions represent an evolutionary balance between advantages and disadvantages. Suggest **one** advantage and **one** disadvantage for a male lion having a mane. [2]

Advantage:

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Disadvantage:

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2. (a) Explain how the surface area to volume ratio influences cell sizes. [3]

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(b) State **one** function for each of the following organelles. [3]

(i) Ribosomes

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(ii) Rough endoplasmic reticulum

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(iii) Golgi apparatus

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(c) Compare prokaryotic and eukaryotic cells in regards to **three** different features. [3]

	Prokaryotic	Eukaryotic
1.
2.
3.

3. (a) Define the term *degenerate* as it relates to the genetic code. [1]

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(b) Apart from international cooperation, outline **two** positive outcomes of the Human Genome Project. [2]

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(c) State the catalytic activity of reverse transcriptase. [1]

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(d) State **one** use of monoclonal antibodies in diagnosis and **one** use in treatment. [2]

Diagnosis:
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Treatment:
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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 on the answer sheets provided. Write your candidate number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.

4. (a) Outline enzyme-substrate specificity. [5]
- (b) Explain how allosteric control of metabolic pathways by end-product inhibition includes negative feedback and non-competitive inhibition. [8]
- (c) Distinguish between fibrous and globular proteins, giving **one** example of each. [5]
5. (a) State a role for each of **four** different named enzymes in DNA replication. [6]
- (b) Outline the differentiation of cells in a multicellular organism. [4]
- (c) Explain how meiosis results in great genetic variety among gametes. [8]
6. (a) Outline locomotion in each of the following: [5]
- swimming in a bony fish
 - flying in a bird.
- (b) Draw a labelled diagram of the human elbow joint. [4]
- (c) Explain how skeletal muscle contracts. [9]
7. (a) Explain how the light-independent reactions of photosynthesis rely on light-dependent reactions. [8]
- (b) Outline the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis. [6]
- (c) Distinguish between xerophytes and hydrophytes, giving **one** structural adaptation for each type of plant. [4]
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