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NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2020
FORMERLY MAY/JUNE

LIFE SCIENCES: PAPER II

Time: 2 hours

100 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 6 pages and a Source Material Booklet of 16 pages (i–xvi). Please check that your question paper is complete. Remove the Source Material Booklet from the middle of the question paper.
 2. The question paper consists of three questions. Question 1 and Question 2 are case studies and Question 3 is an essay. Read the sources provided in the Source Material Booklet and use this information and your own knowledge to answer Questions 1 and 2.
 3. Source material is also provided in the Source Material Booklet for the essay. Use this information and your own knowledge to first plan and then write your response.
 4. Read the questions carefully.
 5. All questions must be answered in the Answer Book provided.
 6. Please start **each question** on a **new** page and leave lines open between each sub-question (e.g. 1.1 and 1.2).
 7. Number the answers exactly as the questions are numbered.
 8. Use the total number of marks that can be awarded for each part of the questions in Question 1 and 2 as an indication of the detail required.
 9. It is in your own interest to write legibly and to present your work neatly.
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SECTION A**QUESTION 1**

The questions below refer to the sources on pages ii–v in the Source Material Booklet.

- 1.1 Write the numbers 1.1.1–1.1.5 in your Answer Book. Column A contains statements taken from the text and Column B contains terms that match these statements. Match the term in Column B with the correct statement in Column A (e.g. 1.1.1 B; 1.1.2 F, etc.).

COLUMN A	COLUMN B
1.1.1 "... small genetic changes"	A Evolution
1.1.2 "changes in the characteristics of a population occurs over time"	B Genetic variation
1.1.3 "nine mutations within the Agouti gene"	C Microevolution
1.1.4 "coat colour"	D Punctuated equilibrium
1.1.5 "huge leaps that result in dramatic change"	E Phenotype

(5)

- 1.2 There have been many evolutionary biologists who have put forward ideas as to how evolution occurs. Explain how the following biologists would have described the evolution of light coat colour in these mice.

1.2.1 Charles Darwin (4)

1.2.2 Jean Baptiste Lamarck (2)

- 1.3 Answer TRUE or FALSE to the following statements:

1.3.1 Coat colour is polygenic in deer mice. (1)

1.3.2 The presence of the *Agouti* gene in mammals is an example of divergent evolution. (1)

1.3.3 The presence of the pale colour coat in deer mice is an example of allopatric speciation. (1)

- 1.4 Two scientific investigations are described in this article.

1.4.1 What is the importance of publishing the results of the investigations in a scientific journal? (3)

1.4.2 What is the selection pressure for a change in coat colour in the enclosure experiment? (1)

1.4.3 What was the reason for taking DNA samples from each mouse in the enclosure experiment? (3)

- 1.5 Sketch a bar graph to illustrate the relative numbers of pale- and dark-coloured deer mice in the enclosure situated on dark soil at the end of the enclosure investigation. No actual numbers are required. (6)
- 1.6 In a school text book it states that "Natural selection results in perfection." Do you agree with the validity of this statement? Justify your answer. (3)
- [30]**

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QUESTION 2

The questions below refer to the sources on pages vi–viii in the Source Material Booklet.

- 2.1 State ONE piece of evidence FROM THE TEXT that indicates that:
- 2.1.1 both cave and surface fish are the same species. (1)
 - 2.1.2 blindness arose by convergent evolution in the different cave populations. (1)
 - 2.1.3 natural selection acted on the cave populations. (1)
 - 2.1.4 the Mexican tetra cave populations arose from a founder effect. (1)
 - 2.1.5 eyes in the cave fish are vestigial structures. (1)
 - 2.1.6 artificial selection has occurred in the aquarium specimens of tetra. (1)
- 2.2 The populations of cave fish are often very small and isolated. Genetic diversity in these populations is probably also low.
- 2.2.1 What is the geographical barrier that prevents mating between the different populations of cave fish? (1)
 - 2.2.2 Explain the possible effects of a reduced level of genetic diversity on these populations. (4)
 - 2.2.3 Give ONE example of a founder effect in humans. (1)
- 2.3 The text states that the isolation and evolution of cave fish populations is similar to that of the appearance of Darwin's finches in the Galápagos Islands. Use information from the text and your own knowledge to explain this similarity. (3)
- 2.4 DNA analysis was used in various ways in the research in this article. How does the use of DNA provide evidence for evolution? (4)
- 2.5 Use the scale on the map on page vii of the Source Material Booklet to calculate the distance between caves 1 and 2. Show all working. (2)

- 2.6 Scientists came up with three hypotheses (I to III) for the evolution of blindness in the three cave fish populations (Textbox A; page viii of the Source Material Booklet). Copy the following table into your Answer Book and complete it by filling in the correct information in each column.

Population of cave fish	Hypothesis to explain evolution of blindness	Explanation
1		
2		
3		

- For EACH population 1–3 (Textbox B; pg viii of Source Material Booklet), write down the number of the hypothesis (I to III), which best explains the evolution of blindness in the population, in Column 2.
- Explain your choice of answer in each case in Column 3.

(6)

- 2.7 In what way could the knowledge gained from studying the genetics of the eyesight in Mexican tetras be useful in understanding human sight problems?

(3)
[30]**60 marks**

SECTION B

The sources for the essay are on pages ix–xvi of the Source Material Booklet.

QUESTION 3

Consider the following statement:

***Homo sapiens* (humans) are responsible for the extinction of *Homo neanderthalensis* (Neanderthals).**

Using the source material provided as well as your own knowledge, discuss your opinion on the statement in the form of an essay of 2½–3 pages.

In your response you are expected to:

- Read the source material carefully.
- Take a definite stand on the statement.
- Plan your essay before you start writing. Your plan will be marked.
- Present a debated argument, using relevant information from sources A to H as well as your own knowledge of biology, to support your point of view.
- Arrange the information to best develop your argument.
- Write in a scientifically appropriate way.

40 marks

Total: 100 marks