



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2011

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

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ANSWER BOOKLET

There are (vii) pages in this booklet.

QUESTION 1

Answer the questions in the spaces provided. Place this yellow booklet inside the Answer Book in which you answer the rest of the examination paper.

- 1.1 Select the term in column B which best matches a description in column A. Write the letter of the term in the corresponding space provided between the brackets. Each letter may only be used once.

Column A

- [] Picture of homologous chromosomes arranged in pairs to see their number, size and shape
- [] A dramatic genetic change due to the isolation of a small group of humans
- [] Somatic cell nuclear transfer
- [] Slow changes in a species over time that can cause extinction, or the production of a new species
- [] The scientist who first worked with X-ray crystallography leading to the discovery that DNA is a double helix
- [] A chromosome that is not a sex chromosome
- [] A way to remedy a genetic disease by replacing a faulty gene
- [] Theory explaining how the major land masses of earth have moved over time
- [] A process by which a chromatid breaks off during meiosis and joins to a different chromatid

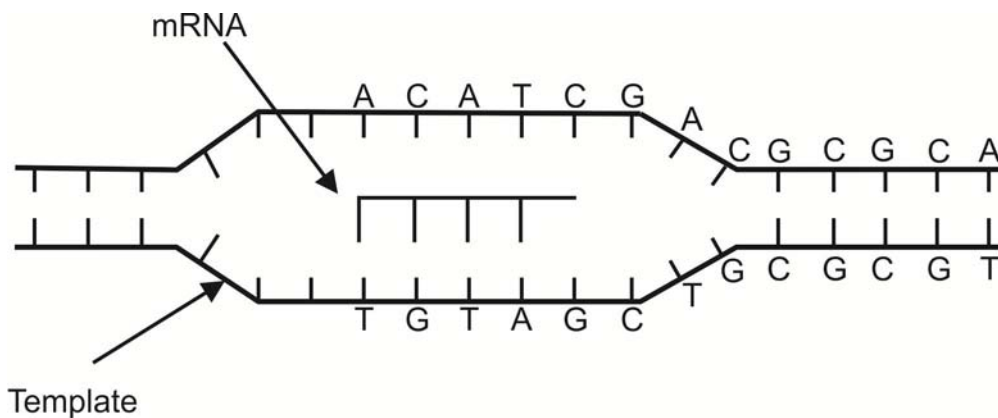
Column B

- A Rosalind Franklin
- B Crossing over
- C Autosome
- D Gene therapy
- E Continental drift
- F Founder effect
- G Karyotype
- H James Watson and Francis Crick
- I Gondwanaland
- J Macroevolution
- K SCNT

- 1.2 Four multiple choice questions are given below. Choose the most correct option in each question and write the letter of your choice in the space provided in the table.

1.2.1	1.2.2	1.2.3	1.2.4

- 1.2.1 The following diagram shows a section of a DNA molecule during transcription. Which of the following options shows the correct sequence of the first four nucleotides in the mRNA?



- A A C A T
- B A C A U
- C T G T A
- D U G U A





(1)

- 1.2.2 Which of the following is an example of artificial selection by humans?

- A Increased darkness in colouration of peppered moths in England
- B DDT resistance in mosquitoes
- C Increased milk yield in dairy cattle
- D Loss of effectiveness of antibiotics on bacteria

(1)

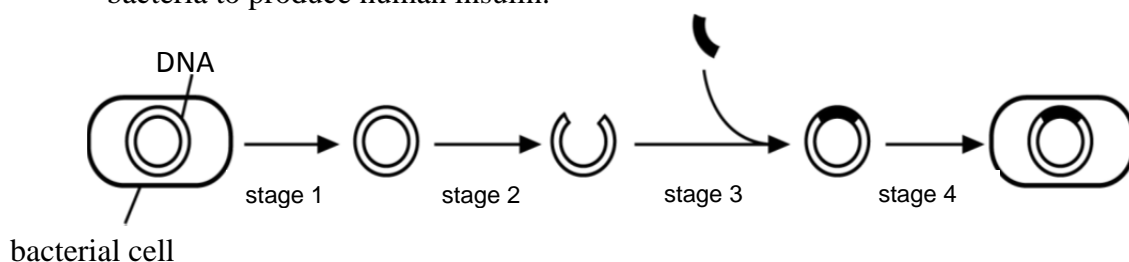
- 1.2.3 The result of profiling various DNA samples in a criminal investigation is shown below.

Results of part of DNA profile:	KEY:
	1. Blood sample of victim
	2. Blood sample of suspect X
	3. Blood sample of suspect Y
	4. Blood sample from forensic evidence

Which one of the following options could the DNA analyst conclude about the crime?

- A Only suspect X was involved
 B Only suspect Y was involved
 C Suspects X and Y were both involved
 D Neither suspect X nor Y was involved (1)

- 1.2.4 The diagram below shows stages involved in the genetic engineering of bacteria to produce human insulin.



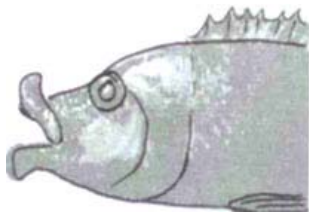
Which line in the table below shows the stages of this process in which a restriction enzyme and DNA ligase are involved?

	Stage involving restriction enzyme	Stage involving ligase
A	2	4
B	2	3
C	3	4
D	1	3

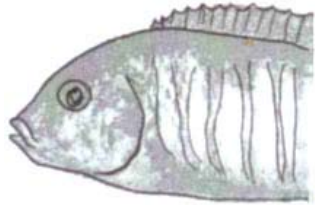
(2)

- 1.3 Many species of **cichlid** fish are found in Lake Malawi in Africa. The lake provides a large range of habitats and few other competing organisms. The cichlids evolved from a single common ancestor.

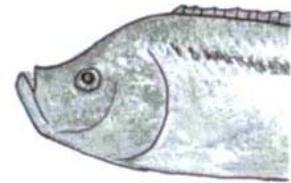
The diagrams below show the heads of three different species of cichlid fish and provide information about their feeding methods.



Sucks in organisms from the water and between rocks



Scrapes algae from the surfaces of rocks



Crushes snail shells and swallows snail flesh

- 1.3.1 Describe how the information given about these fish illustrates adaptive radiation.

(3)

- 1.3.2 The evolution of these cichlid fish has involved an isolating mechanism.

- (a) State the importance of isolating mechanisms in the evolution of new species.

(1)

- (b) Do you think these cichlid fish in Lake Malawi are an example of sympatric or allopatric speciation?

(1)

Give a reason for your answer.

(1)

- 1.4 1.4.1 Decide if each of the following statements about DNA replication is **True** or **False** and tick (✓) the appropriate box.

If the statement is **False**, write the correct word in the correction box to replace the word **underlined** in the statement.

STATEMENT	TRUE	FALSE	CORRECTION
DNA replication happens just before <u>protein synthesis</u> .			
During DNA replication, weak <u>hydrogen</u> bonds between nitrogenous bases break.			
The base pairing to form two new strands of DNA occurs in the following way: cytosine with guanine, <u>thymine</u> with adenine.			
As a result of DNA replication, the DNA content of a cell is <u>halved</u> .			

(7)

- 1.4.2 Free DNA nucleotides are needed for DNA replication. Draw a simple labelled diagram of a nucleotide in the space below.

(2)

- 1.4.3 A single DNA molecule has 6000 nucleotides of which 34% are adenine and 16% are cytosine.

Calculate the number of guanine bases that would be present on this DNA molecule. Show your calculation.

(2)

- 1.5 The Meadow Brown butterfly is very interesting to geneticists. Individuals show a lot of variation in the number of spots on their wings. The spotting pattern varies in different regions in which they live. This has led to it being studied extensively.

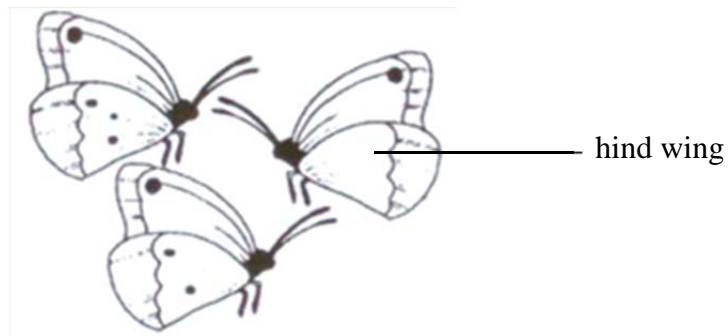


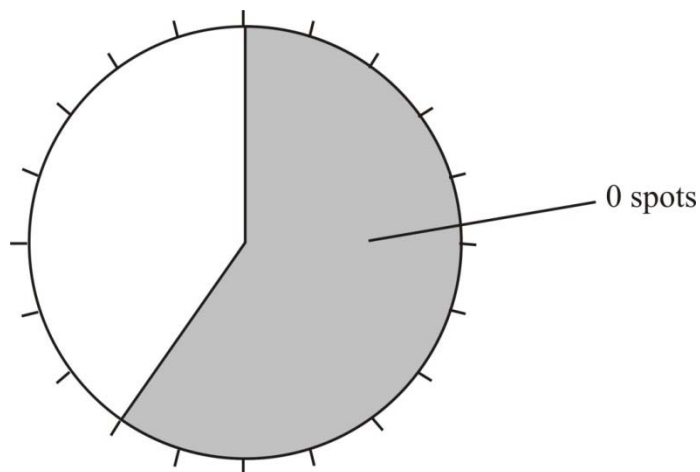
Table 1: Variety in the number of wing spots in a sample of Meadow Brown butterflies.

Number of spots on hind wing	0	1	2	3	4
Percentage of population (%)	60	5	20	10	5

- 1.5.1 What advantage could this spot variation give to certain butterflies? Explain your answer.

(2)

- 1.5.2 Using Table 1 above, complete the pie chart below.



(2)

- 1.5.3 It has been suggested by some geneticists that the variations in the Meadow Brown butterflies could mean that they come from different species.

Write a hypothesis for an investigation that scientists might carry out to explore this idea.

(3)

- 1.5.4 Scientists would collect evidence to test their hypothesis.

List TWO observations or types of investigative data that scientists could collect to show that the butterflies belong to the **same** species.

(2)
[40]