

LIFE SCIENCES: PAPER I

EXAMIN

NATION NUMBER												
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ANSWER BOOKLET

QUESTION 1

There are (xii) pages in this Answer Booklet

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

COLUMN B

[]	Organisms that share a gene pool.	А	Ecological succession
[]	A limiting factor on population growth that has nothing to do with the size of the population		Climax community
			С	Species
[]	Community of organisms that first inhabit a new area.	D	Natality
[]	Kudu bulls fighting over a female for mating.	E	Ecosystem
[]		A method of estimating a fish population in which tags are used to identify sampled fish		Interspecific competition
		which tags are used to identify sampled fish.	G	Quadrat
[]	The process by which the composition of a biological community changes over time.	Н	Environmental resistance
[]	This factor slows down an increase in population	Ι	Intraspecific competition
		5120.		Mark-recapture
[]	Population parameter that increases population size.		Density-independent factor
[]	All living and non-living factors interacting with each other in a particular environment.	L	Pioneers

[] Final stage of ecological succession.

1.2 Seven 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 below.

Question	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6	1.2.7
Answer							

1.2.1 The diagram shows part of a DNA molecule. Which part is a nucleotide?



(1)

(1)

(1)

- 1.2.2 The out-of-Africa hypothesis
 - A is also called the multiregional hypothesis.
 - B proposes that mitochondrial DNA sequences only changed in African hominids.
 - C proposes that *Homo sapiens* first appeared in Africa and other continents at the same time.
 - D proposes that *Homo erectus* evolved into *Homo sapiens* in Africa before migrating to other continents.
- 1.2.3 The diagram below shows different vertebrate embryos at the same stage of development.



[Source: <https://blog.benchprep.com >]

How do the embryos provide evidence for evolution?

- A The embryos have different shaped eyes.
- B Different adults evolve from the embryos.
- C The embryos have structures that look similar.
- D Divergent evolution results in common characteristics in the embryos.

(1)

1.2.4 The following hominid fossil was NOT found in South Africa:

- A Taung child
- B Little Foot
- C Lucy
- D Mrs Ples
- 1.2.5 A wild grass, teosinte, which grew in North America about 10 000 years ago, has been changed by artificial selection to produce the maize species which is the largest grain-producing crop globally.



[Adapted from: <http://learn.genetics.utah.edu/content/variation/corn/>]

Over the years, selection for or against particular traits has been carried out. A comparison of some of the traits of teosinte and maize is given below. (Note: graph not drawn to scale.)



[Adapted from: Peabody Museum of Archaeology]

From the information above, we can assume that humans have selected against

- A large cob size
- B increased number of branches per plant
- C large size of kernels
- D increased number of kernels per cob

(2)

- 1.2.6 There are many different views on the ethics of reproductive cloning in humans. Which is a scientifically valid argument against cloning in humans?
 - A The life expectancy of children produced by reproductive cloning might be lower than normal.
 - B It is a natural process which happens when identical twins are conceived.
 - C It is 'playing God' and is just not right.
 - D It involves the use of donor sperm, which is unethical.
- 1.2.7 The following events occur after DNA is subjected to radiation. The events are listed in no specific order.
 - P: Change in protein structure
 - Q: Change in amino acid sequence
 - R: Change in cell activities
 - S: Mutation

What is the correct sequence of steps?

- A S, P, Q, R
- B S, Q, P, R
- C R, Q, S, P
- D R, S, Q, P
- 1.3 Study the following table which consists of a name/term in **COLUMN I** and two statements (numbered 1 and 2) in **COLUMN II**

Decide which statement(s) from COLUMN II relate(s) to the term in COLUMN I.

Write down your choice in the answer column, making use of the following codes:

- **A** only statement 1 relates to the term
- **B** only statement 2 relates to the term
- **C** both statements 1 and 2 relate to the term
- **D** neither statements 1 or 2 relate to the term

COLUMN I	COLUMN II	ANSWER
Guanine	1. a sugar molecule	
	2. a phosphate molecule	
Hydrogen	1. links Thymine to Adenine	
bonds	2. links deoxyribose sugar to phosphate	
Centromere	1. point at which two homologous chromosomes are joined	
	2. point at which two identical chromatids are joined	
James Watson	1. contributed to the discovery of the structure of DNA	
	2. worked together with Francis Crick	
Mitochondrial	1. inherited through the paternal line	
DNA	2. inherited through the maternal line	

(2)

(5)

(2)

1.4 Proteins are composed of long chains of amino acids joined together by peptide bonds.

The sequence of these amino acids is determined by DNA.

In a portion of a particular protein, the sequence of three amino acids is as follows:

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Portion of protein: CYS – HIS – SER
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The diagrams below show tRNA molecules in the cytoplasm, which carry amino acids to the ribosomes.



Using all the information provided, as well as your knowledge of mRNA structure, **draw** and **label** only the section of mRNA that acts as a template for the portion of the protein shown above.



(1)

1.5 A genetic disorder occurs when a mutation occurs within a gene. A mother (individual 4) and three of her sons who suffer from a genetic disorder visit a geneticist to find out more about their genetic disorder. The geneticist draws up a family pedigree before she answers their questions. Study the family pedigree below and answer the questions that follow:



1.5.1 Is this mutation dominant or recessive? Explain your answer.

(3) 1.5.2 State whether individual 1 and individual 2 are homozygous or heterozygous for gene in question. (1)1.5.3 What percentage of the offspring of individuals 3 and 4 do not have the

disorder?

1.6 An ecologist uses a random quadrat method to estimate the abundance of a species of wattle trees in an open forest community near Cape Town as shown in the diagram. Each quadrat is 100 m² and the total area of the community is 12 000 m².



[Adapted from: <http://www.oup.com.au>]

1.6.1 Why is a forest described as a community?

1.6.2 Use the information given above to **calculate** the approximate number of wattle trees in the area shown above. Show all working.

1.6.3 The accuracy of this method relies on a number of precautions. List any THREE precautions that the ecologist doing this study should have taken.

(3)

(4)

(2)

1.6.4 What ecological concept operates in this forest community to ensure that a variety of plant populations can survive in the same area of the forest? Explain the concept.

- 1.6.5 If a fire were to sweep through this forest, it would take a number of years to re-establish this community. What name is given to this process of forest re-establishment after the fire?
- (2)

(3)

1.6.6 The ecologist was also recording the animal life in the forest after the fire. A few months after the fire, animals started to return to the forest. Of particular interest to him was the Grey Squirrel *Sciurus carolinensis*, a common yet alien species of squirrel introduced to the Cape by Cecil John Rhodes in the late 19th century.



[Source: <http://upload.wikimedia.org/>]

Date	Number of Grey
(2005 - 2006)	Squirrels observed
01 June	2
01 July	2
01 Aug	5
01 Sept	8
01 Oct	15
01 Nov	28
01 Dec	64
01 Jan	78
01 Feb	80
01 March	76
01 April	79
01 May	78
	[Examiner's own data]

He performed a direct census of the Grey Squirrel population in the forest. He recorded his data in the table below:

(a) Plot this data accurately as **a line graph** on the graph paper below:

Heading:



Explain t	he slope of the graph from October to December.
	what is meant by the term carrying capacity.

1.7 Read the following article (text and graph) and then answer the questions that follow:

South Africa has by far the largest population of rhino in the world. However, rhino poaching has reached a crisis point. If the killing continues at this rate, we could see rhino deaths overtaking rhino births in 2016 – 2018, meaning rhino could become extinct in the very near future. Figures compiled by the South African Department of Environmental Affairs show the dramatic increase in poaching over recent years – see graph below.



[Adapted from: <http://www.savetherhino.org/rhino_info/poaching_statistics>]

The five statements in the table below refer to the text and graph above. For each statement decide whether:

- **A** the statement is supported by the information in the article.
- **B** the statement is contradicted by the information in the article.
- **C** the statement is neither supported nor contradicted by the information in the article.

	STATEMENT	A, B OR C
1.7.1	There are 1 215 rhino left in South Africa.	
1.7.2	The number of poached rhino has shown a sharp upward trend in the past five years.	
1.7.3	After 2016 we should see living rhino numbers levelling off.	
1.7.4	Rhino poaching is a crime punishable by law.	
1.7.5	From 2012 – 2013, the number of rhino poached increased by 336.	

(5)

1.7.6 Make TWO of your own suggestions as to how this rhino crisis could be solved.

(2)

1.8 Study the following diagrams showing a cell from the anther of a flowering plant in various stages of MEIOSIS I and II:



[Adapted from: <http://www.vcbio.science.ru.nl>]

1.8.1 Using the letters associated with each stage, place the diagrams in the correct sequence.

1.8.2 Below is a diagram of a pair of homologous chromosomes from cell C.



(a) Name the process occurring in the diagram above.

(1)

(b) Explain the significance of this process (Question 1.8.2 (a)) to the plant.

(3) [**80**]