NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY EXAMINATION MARCH 2016

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

ANSWER BOOKLET

There are (ix) pages in this Answer Booklet.

QUESTION 1

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 A		**COLUMN B**
[ ]	Organisms that share a gene pool.	A	Charles Darwin
[ ]	This results from an inability to adapt to environmental change.	B	Micro-evolution
[ ]	The transferring of acquired characteristics to the next generation.	C	Artificial selection
[ ]	Inability to breed with another species due to differing breeding mechanisms.	D	Inbreeding
[ ]	Small changes that occur within a species over time.	E	Neutral mutation
[ ]	The wings of birds and insects develop in this way.	F	Extinction
[ ]	A farmer chooses the seeds from the biggest, strongest tomato plant for his next crop.	G	Lamarck
[ ]	A change in DNA structure which has no effect on phenotype.	H	Divergent evolution
[ ]	Type of reproductive behaviour displayed by small isolated populations.	I	Variation
[ ]	The appearance of many different phenotypes in a population.	J	Convergent evolution
		K	Reproductive isolation
		L	Species

(10)

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 Which type of molecule is the end product of translation?

A an amino acid
B mRNA
C a polypeptide
D tRNA (1)

1.2.2 The direction of transfer of genetic information in most living things is …

A protein → DNA → mRNA
B DNA → mRNA → protein
C DNA → protein → tRNA
D protein → tRNA → DNA (1)

1.2.3 If a polypeptide consists of 240 amino acids, what is the minimum number of nucleotides needed on the coding strand of a gene to code for it?

A 240
B 80
C 480
D 720 (1)

1.2.4 Which of the following age sequences (most recent to oldest) is correct?

A *A. sediba* → *H. habilis* → *A. afarensis* → *H. erectus*
B *H. sapiens* → *H. erectus* → *A. sediba* → *A. afarensis*
C *A. africanus* → *A. sediba* → *A. afarensis* → *H. erectus*
D *H. sapiens* → *H. habilis* → *A. africanus* → *H. erectus* (1)

1.2.5 An autosomal gene in Hereford cattle has the alleles **H**, having horns, and **h**, having no horns. Some farmers choose to humanely remove the horns, as horns can be used to injure other cattle. Stanley, a hornless bull, was mated with Iris, a cow which had had her horns removed when she was young. The mother of Iris was homozygous recessive for the trait. All calves from a cross Iris × Stanley will:

A be born with horns.
B carry at least one 'h' allele.
C have a one-in-four chance of being hornless.
D have a one-in-two chance of being homozygous dominant for horns. (2)

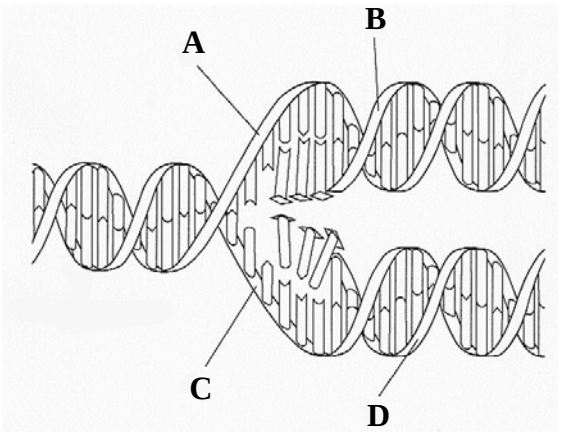
1.2.6 Meiosis is essential to the process of sexual reproduction, because …

A it ensures that genetic information remains unchanged from one generation to the next.
B it halves the chromosome number to negate the doubling effect of fertilisation.
C it ensures that mutation does not occur during gamete formation.
D it allows haploid individuals to reproduce. (2)

1.2.7 While excavating in 8-million-year-old geological beds in southern Kenya, Professor Eric Snyman unearthed a primate fossil unlike any seen before. After detailed examination, he classified it as a new species of *Australopithecus* and announced this discovery to the world. His archrival, Dr Pierre Cloete, disagreed, stating that this was an ape skull. He demanded evidence in support of Professor Snyman's claim. Which of the following pieces of evidence would be most likely to persuade Dr Cloete that Professor Snyman's claim is valid?

A Foramen magnum centred directly underneath the braincase.
B Body size larger than apes found in that era.
C The presence of long arms in relation to the body.
D The presence of opposable thumbs. (2)

1.3 Study the diagram below and answer the questions that follow:



1.3.1 What process is illustrated in the diagram above?

_____ (1)

1.3.2 Where in the cell would this process occur?

_____ (1)

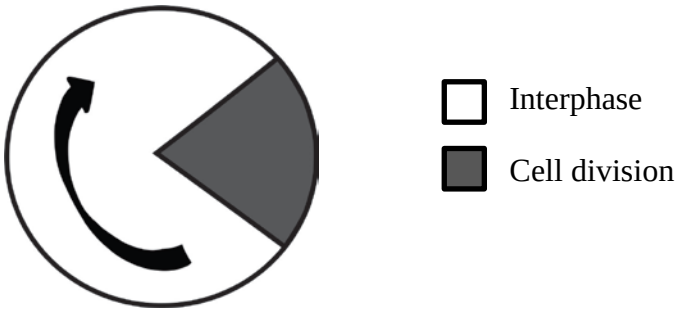
1.3.3 Identify whether strands B and C are new or original strands:

B: _____

C: _____ (2)

1.3.4 By means of a flow diagram, outline the process named in Question 1.3.1. Use the space provided below: (6)

1.3.5 The pie chart below represents the cell cycle. ON THE PIE CHART, use your pen to draw an X in the region of the cell cycle where the process illustrated in the diagram would occur. (1)



1.3.6 The total length of a bacterium's DNA may be 1 000 times the length of the cell within which it is contained. Suggest an explanation for how this is possible.

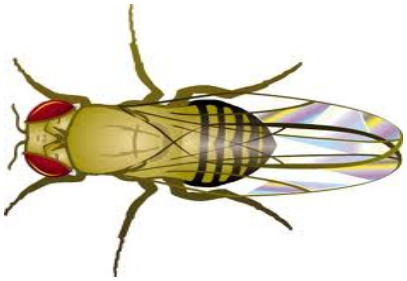
_____

_____

_____ (2)

1.4 The fruit fly, *Drosophila melanogaster*, feeds on sugars found in damaged fruits. A fly with normal features is called the wild type. Its wings are longer than its abdomen. There are mutant variations such as flies with vestigial wings. Wing size is coded for by autosomes, with the allele for normal wing size being dominant over the allele for vestigial wings.

Mutant type with vestigial wings



Wild type

1.4.1 Explain what is meant by:

(a) allele _____

_____

(b) dominant _____

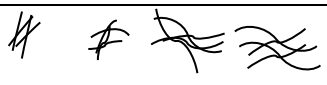
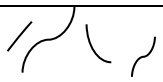
_____

(c) autosome _____

_____ (6)

1.4.2 The diploid number of chromosomes for *Drosophila* is 8.

Study the table below showing chromosomes from a cell of *Drosophila* at different stages in the meiotic process. Identify the phases of meiosis I and II shown below:

	Appearance of chromosomes	**Phase of meiosis**
(a)		
(b)		
(c)		

(3)

1.4.3 How many chromosomes would be in …

(a) a cell from the eye of *Drosophila*? _____

(b) a *Drosophila* sperm cell? _____

(c) a cell of a *Drosophila* embryo? _____ (3)

1.4.4 A heterozygous *Drosophila* fly mates with a vestigial winged variety.

(a) Provide a genetic key for Normal and Vestigial wings.

_____

_____ (1)

(b) Fill in the Punnet Square below to show the possible outcomes of the cross.

(4)

(c) What is the ratio of possible phenotypes resulting from the above cross?

_____

_____ (2)

1.5 The table below lists some of the amino acids. Alongside is an mRNA codon for each amino acid. The strand of DNA against which mRNA is transcribed is called the coding strand. **Use Table 1 to answer the following questions.**

Table 1: Amino Acids and mRNA Codons

Amino Acid	**mRNA Codon**
Serine	AGU
Aspartic Acid	GAC
Glutamine	GAG
Histidine	CAU
Leucine	CUA
Alanine	GCA
Lysine	AAA
Proline	CCU
Glycine	GGC

1.5.1 State the:

(a) tRNA anticodon for proline: _____

(b) proline triplet on the DNA coding strand: _____

(c) amino acid carried by the tRNA anticodon GAU: _____ (3)

1.5.2 A sequence of bases on the coding strand of DNA is shown below.

C T C C G T T C A

List the sequence of amino acids that would appear in a polypeptide coded for by this DNA.

(3)

1.5.3 What would be the significance of a deletion mutation during transcription?

_____

_____ (2)

1.5.4 If this deletion, referred to in Question 1.5.3, took place in a skin cell of a woman, would her future babies be affected by the mutation? Explain.

_____

_____ (2)

1.6 Choose the correct term from the two options given in bold. Indicate your selection by clearly **circling** the CORRECT term:

1.6.1 The points at which crossing over occurs during the meiotic process are known as **chiasmata/centromeres**.

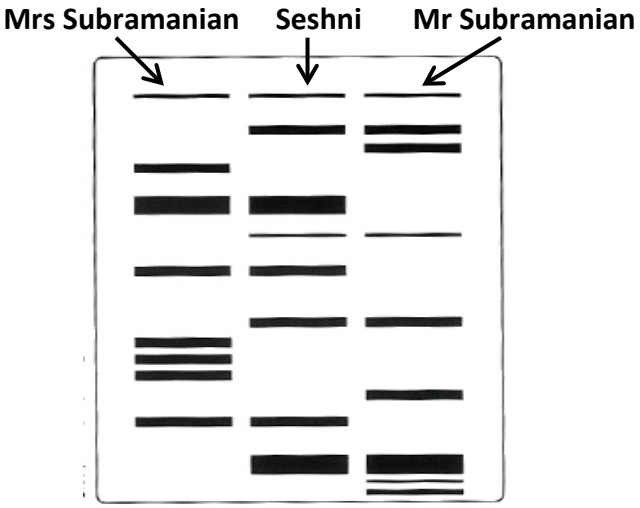
1.6.2 The number and appearance of all the chromosomes in a particular cell is known as a **genotype/karyotype**.

1.6.3 Cells formed at the end of meiosis will always be **haploid/diploid**.

1.6.4 Centromeres only ever split during **Anaphase I/Anaphase II**.

1.6.5 Down Syndrome is an example of a **point/chromosomal** mutation. (5)

1.7 In order to establish paternity, a DNA profile of the mother and the child must be compared to the DNA profile of the 'father' in question. Study the DNA profiles below and answer the questions that follow:



1.7.1 What is meant by the term 'DNA profile'?

_____ (1)

1.7.2 From the evidence in the DNA profiles above, do you think that Mr Subramanian is Seshni's father? Explain your answer.

_____

_____

_____

_____ (3)

1.8 Crested barbets are small birds that are commonly found in suburban gardens in South Africa. An ecologist estimated the size of the crested barbet population visiting gardens in a small suburb in April.

- She trapped 18 crested barbets. She marked all of these birds with small metal rings on their legs.
- Two weeks later, she trapped another sample of crested barbets. Of these birds, 6 were marked and 10 were not marked.

1.8.1 Use the data given above to estimate the size of the crested barbet population in the suburb. Show your working in the space below. (4)

1.8.2 State THREE aspects that the ecologist would have to consider with regard to the metal rings she used, in order to make the estimation valid and reliable.

_____

_____

_____

_____ (3)

1.8.3 The method of population estimation described above is not suitable for all organisms. What method would be suitable to calculate:

(a) The number of alien plant species in a field?

_____ (1)

(b) The number of people in a country?

_____ (1)

[80]