

Education and Sport Development

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NORTH WEST PROVINCE

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2017

MARKS: 150

TIME: 2½ hours

This question paper consists of 15 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. Make ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, tables or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

SECTION A**QUESTION 1**

- 1.1 Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK, for example 1.1.11 E.

1.1.1 During DNA replication ...

- A adenine links with uracil.
- B one DNA strand only serves as a template.
- C base triplets attach to complementary codons.
- D two identical DNA strands form.

1.1.2 The modern pig was derived from crossing the smaller Chinese pig that reproduced faster, with the larger European pig that produces less offspring. This is an example of ...

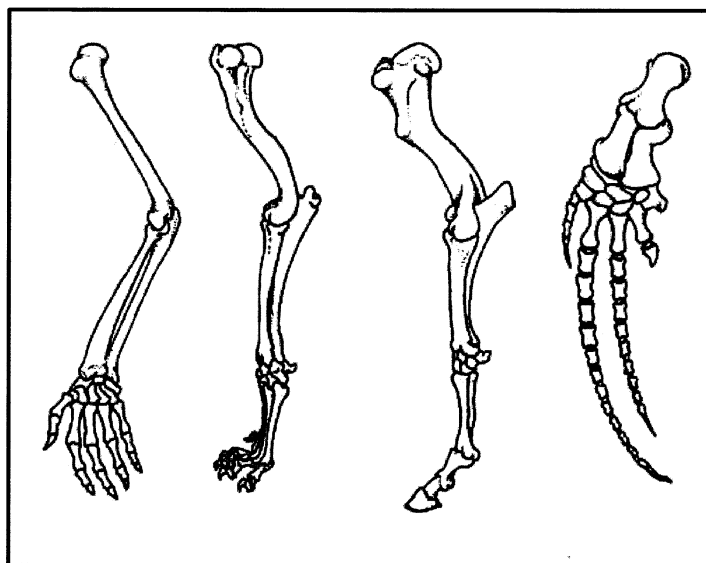
- A artificial selection.
- B natural selection.
- C dihybrid crossing.
- D genetic engineering.

1.1.3 Flower colour in geraniums is an example of incomplete dominance. If a florist wants to grow plants with pink flowers only, he will have to do the following cross:

- A Pink geraniums x white geraniums
- B Pink geraniums x pink geraniums
- C Pink geraniums x red geraniums
- D White geranium x red geraniums

1.1.4 Which ONE of the following may cause the lack of fossil evidence to support evolution?

- A Punctuated equilibrium
- B Discontinuous variation
- C Natural selection
- D Biogeographic distribution

QUESTIONS 1.1.5 AND 1.1.6 ARE BASED ON THE FOLLOWING DIAGRAM.

1.1.5 From which field of study does the diagram provide evidence of evolution?

- A Genetics
- B Biochemistry
- C Modification by decent
- D Biogeography

1.1.6 Study the following list of conclusions before answering the question.

- (i) The organisms share a common ancestor
- (ii) The organisms change to adapt to their specific environments
- (iii) The organisms evolved through punctuated equilibrium
- (iv) The organisms display discontinuous variation

The conclusion(s) that can be drawn from the diagram is/are:

- A (i), (ii), (iii) and (iv)
- B Only (i), (ii) and (iii)
- C Only (i) and (ii)
- D Only (i)

1.1.7 Give the expected genotypic ratio of the following cross:

$$FfGg \times ffgg$$

- A 1 : 3 : 1
- B 1 : 1 : 1 : 1
- C 1 : 3 : 3 : 1
- D 9 : 3 : 3 : 1

- 1.1.8 Scientists who won the Nobel prize for discovering the structure of the DNA molecule are ...
- A Watson, Crick, Wilkens and Franklin.
 - B only Watson, Crick and Wilkens.
 - C only Watson, Crick and Franklin.
 - D only Watson and Crick.
- 1.1.9 A scientist wanted to determine the variation in neck length of adult male ostriches. Which ONE of the following steps was done to ensure the validity of the investigation?
- A Permission was obtained to conduct the investigation
 - B A random sample of adult male ostriches was selected
 - C He measured the neck lengths of 65 adult male ostriches
 - D The average neck length of the 65 ostriches were calculated
- 1.1.10 Choose the row from the table below with the correct answer.

	NAME OF FOSSIL	COUNTRY WHERE FOUND	SCIENTIST
A	Lucy	Ethiopia	Robert Broom
B	Taung Child	Tanzania	Raymond Dart
C	Karabo	South Africa	Matthew and Lee Berger
D	Ardi	Ethiopia	Mary and Louis Leaky

(10 x 2) (20)

- 1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.8) in the ANSWER BOOK.

1.2.1 The type of DNA used to trace maternal ancestors

1.2.2 A diagram used to show the evolutionary relationships between organisms

1.2.3 It refers to organisms that no longer exist on earth

1.2.4 A large opening at the base of the skull

1.2.5 The type of bond found between nitrogen bases in a DNA molecule

1.2.6 A scientist that proposed the law of use and disuse

1.2.7 The characteristic of primates that enables them to have precision grip

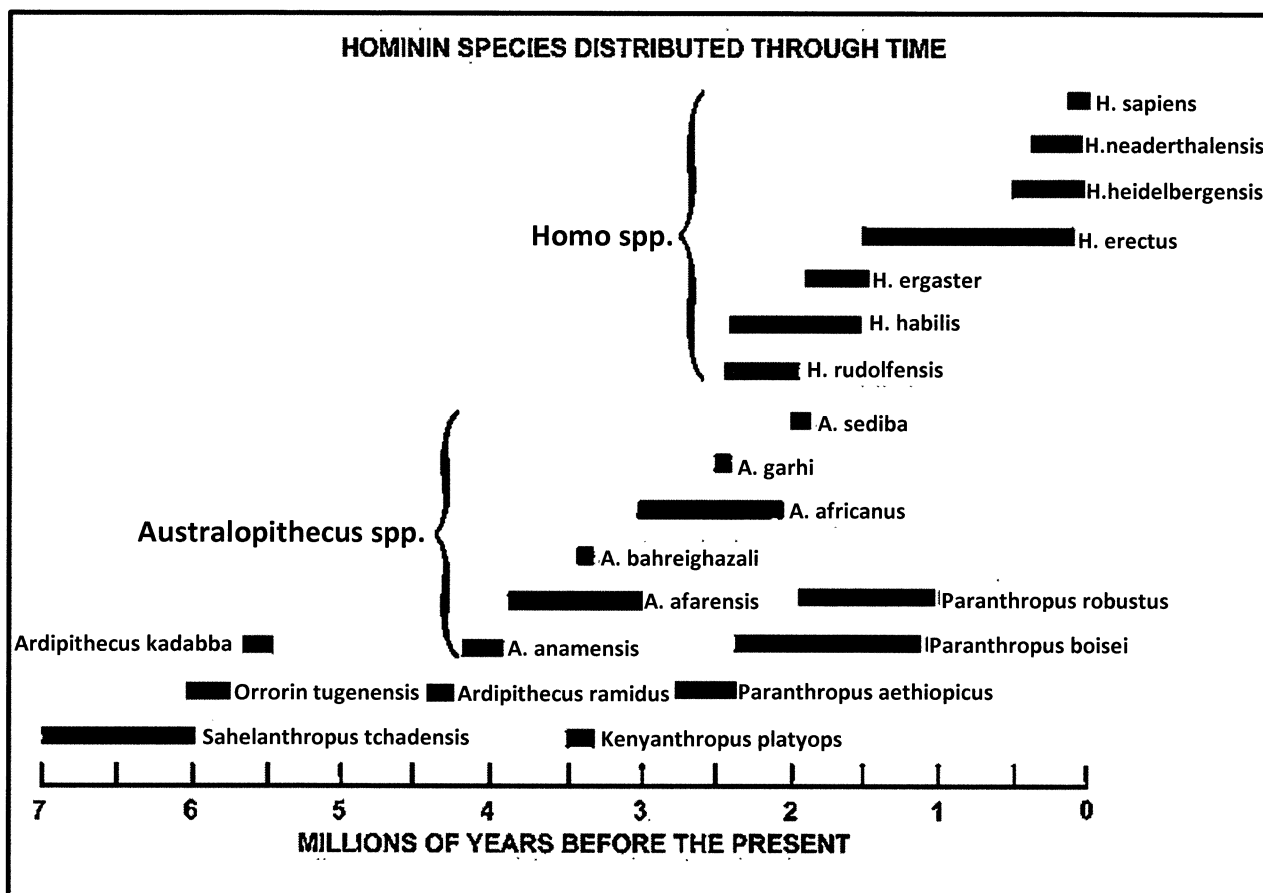
1.2.8 Walking on two limbs (8 x 1) (8)

- 1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **Both A and B** or **none** next to the question number (1.3.1 to 1.3.2) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 African apes	A: Pelvis wide and short B: Spine S-shaped
1.3.2 Genetic evidence for evolution	A: Identical DNA structure B: Homologous structures

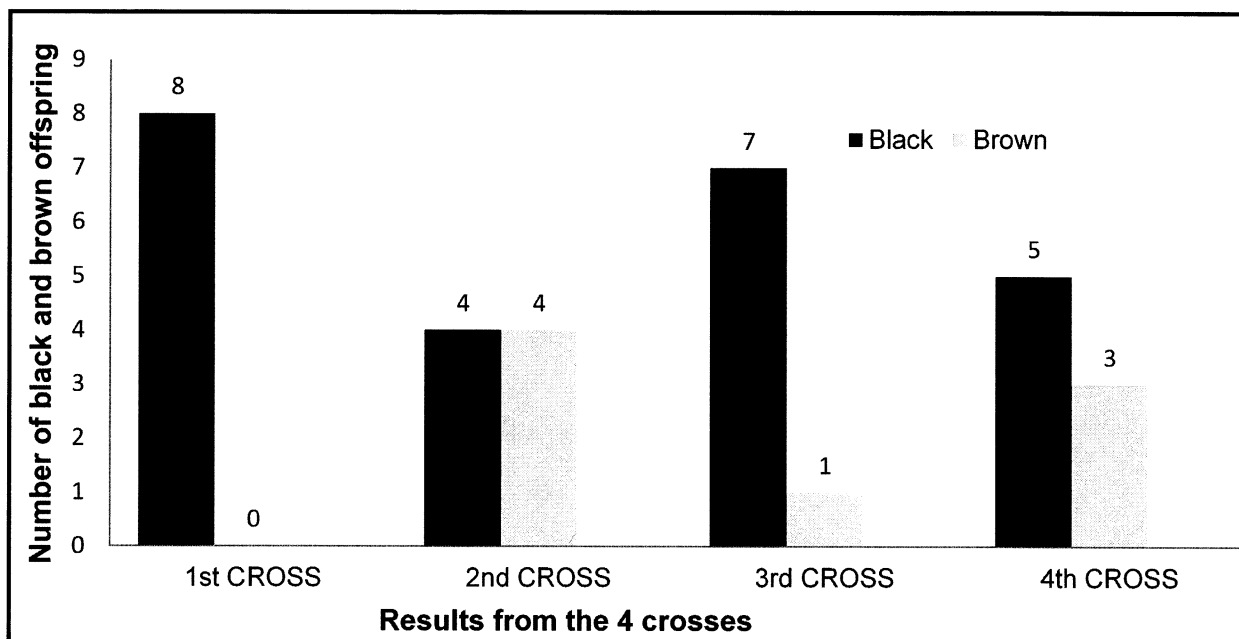
(2 x 2) (4)

1.4 The questions that follow are based on the following diagram.



- 1.4.1 Which *Homo* species survived for the longest period of time? (1)
 - 1.4.2 List all the species that lived along with *Homo sapiens*. (3)
 - 1.4.3 How long ago did all the *Australopithecine* species become extinct? (2)
 - 1.4.4 List TWO *Australopithecine* species indicated on the diagram, of which fossils were found in South Africa. (2)
 - 1.4.5 From the diagram, list TWO hominin genera other than *Homo*, which are on the direct line of human evolution. (2)
- (10)**

- 1.5 A learner wanted to determine the genotypes of his breeding pair of mice. Black fur colour is dominant to brown fur colour in mice. His black male was crossed four times with his brown female. The results of the crosses are shown in the following graph.



- 1.5.1 Supply the graph with a suitable heading. (2)
- 1.5.2 Give the dependent variable in this investigation. (1)
- 1.5.3 From the graph, determine the ratio between all the black and brown offspring. Show all calculations. (2)
- 1.5.4 What conclusion can be made from this investigation? (2)
- 1.5.5 Why did the learner do four crosses? (1)
- (8)**

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

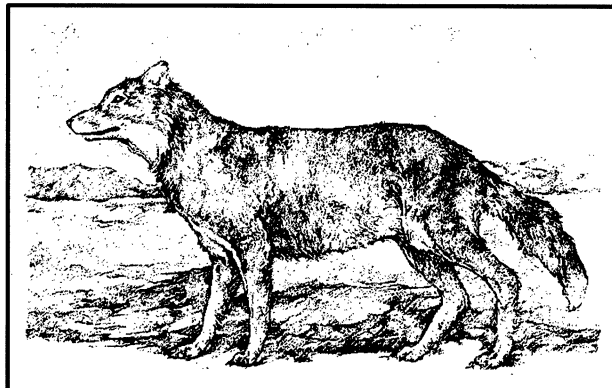
2.1 Read the following extract.

Charles Darwin came across the Falkland wolf on his journey around the world. He was puzzled about the fact that the Falkland wolf was the only mammal inhabiting the Falkland Islands. He couldn't explain how they got to the islands as the islands are too far for swimming and the islands have never been connected to the continent. The Falkland wolf split from its closest relative *Dusicyon avus* 16 000 years ago during the last ice age.

The mystery of how the wolf got to the island was solved. Recent evidence suggests that there was a shallow channel as narrow as 20 km, which may have frozen completely at times. It seems likely that the founding population of wolves crossed on this ice bridge during the last Ice Age. This would explain the absence of other mainland mammals on the islands; an ice crossing is much more difficult than crossing a land bridge.

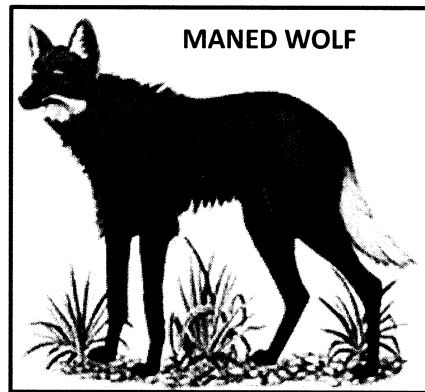


FALKLAND WOLF



- 2.1.1 Name the ship on which Charles Darwin undertook his voyage around the world. (1)
- 2.1.2 Explain how the Falkland wolf could have evolved by speciation from the wolf species that lived on the mainland of Argentina. (5)

- 2.1.3 The maned wolf (*Chrysocyon brachyurus*) is the closest living relative of the now extinct Falklands wolf. The maned wolf lives in a habitat of very tall grass in South America. The wolf has a reddish fur with black legs and rotating ears. The maned wolf has exceptionally long legs which are believed to be an adaptation to see over the tall grass on the lookout for prey.



By referring to the information above:

- (a) Explain the long legs of the maned wolf using the theory of evolution by natural selection (7)
- (b) Explain ONE adaptation, other than the long legs, of the maned wolf to its specific habitat (2)
- (15)

- 2.2 Tay-Sachs disease is a disorder caused by a recessive mutation on the HEXA-allele on chromosome 15. This disorder causes brain damage and death between the ages of 2 to 5 in children.

The following diagram shows a part of the DNA structure of a normal HEXA-allele as well as a part of the structure of the DNA with the Tay-Sachs mutation.

<u>NORMAL HEXA-allele:</u>
... ATA – TCC – TAT – GCC ...
<u>TAY-SACHS allele:</u>
... ATA – TCT – ATG – CCC ...

- 2.2.1 Is Tay-Sachs a gene mutation or a chromosome mutation? (1)
- 2.2.2 Explain your answer in QUESTION 2.2.1 by referring to the differences between a gene mutation and a chromosome mutation. (3)
- 2.2.3 Give the DNA triplet AND the corresponding Tay-Sachs triplet where the mutation occurred. (2)
- 2.2.4 Use the following table to determine the amino acid sequence of the four triplets of Tay-Sachs allele shown in the diagram above. (2)

ANTI-CODON	AMINO ACID
AGA	Valine
AUA	Isoleucine
AUG	Methionine
CCC	Proline
GGG	Glycine
UAU	Tyrocine
UCU	Serine
UAC	Tyrocine

- 2.2.5 Use the symbols **T** for the normal allele and **t** for the recessive Tay-Sachs allele.

Do a genetic cross to determine the percentage chance of a couple who are both heterozygous for Tay-Sachs, to have a child with this disorder. (6)

- 2.2.6 Tay-Sachs disorder has a high incidence among a certain population group in Europe. One in every 27 people in this population group has at least one allele for this disorder.

If a sample of 360 000 people in this population group is tested, how many of them do you expect to have the allele for Tay-Sachs? Show all workings.

(3)

(17)

- 2.3 Read the passage below.

Traditionally the insecticide DDT has been used to kill mosquitoes. A single gene mutation causes resistance to DDT in mosquitoes. The Zika virus, like malaria, is also spread by mosquitoes. The Zika virus has spread with alarming speed throughout South and Central America.

The Zika virus has been linked to microcephaly, a rare neurological condition which leads to abnormal brain development in human babies. The World Health Organization has declared the situation an international public health emergency.

The U.S. Food and Drug Administration's Centre for Veterinary Medicine (FDA-CVM) has cleared the experimental release of genetically modified (GMO) mosquitoes for field trials in Key Haven, a small island off the coast of Florida in the USA.

The idea is that genetically modified male mosquitoes will be produced and released to mate with the disease spreading female mosquitoes. The modified gene will then cause early death in the offspring of these mosquitoes.

- 2.3.1 What is meant by *genetically modified organisms (GMOs)*? (2)

- 2.3.2 Explain TWO possible objections that the people from Key Haven Island may have against the release of GMO mosquitoes. (4)

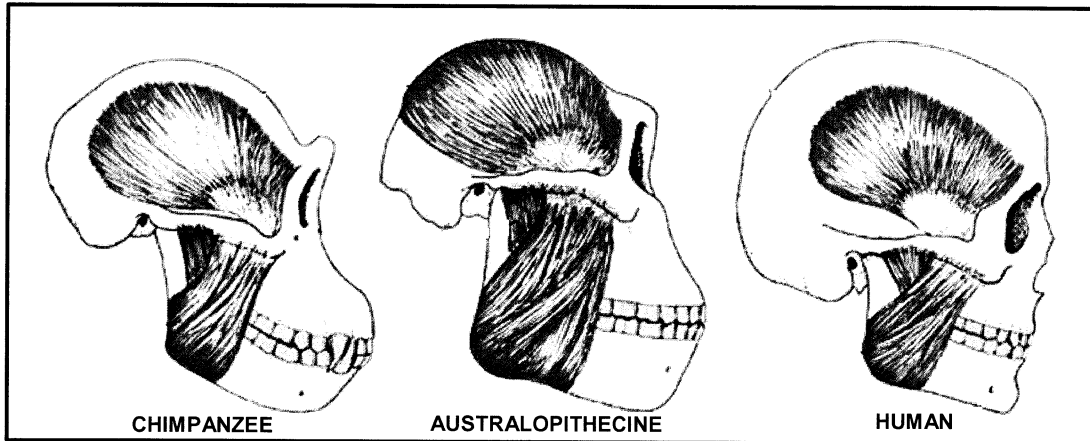
- 2.3.3 Explain why the field trials are planned to take place on a small island, rather than on the mainland of Florida. (2)

(8)

[40]

QUESTION 3

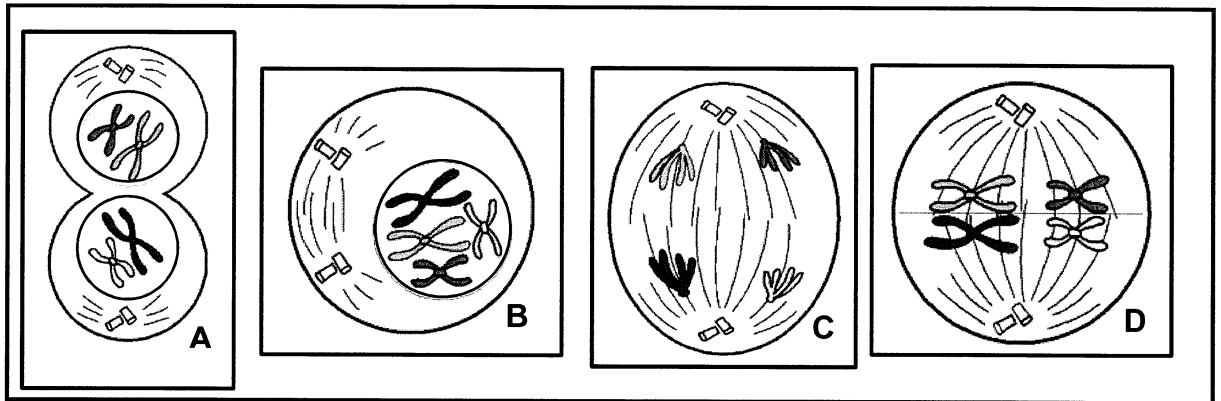
- 3.1 Study the following diagrams of the skulls of a chimpanzee, an *Australopithecine* and a modern human.



- 3.1.1 Compare the difference between the size of the teeth of the human and the chimpanzee AND explain the reason for this development. (4)
- 3.1.2 Apart from the difference in teeth size, tabulate THREE other differences between the skull of the chimpanzee and the skull of the human that are visible in the diagram. (7)
- 3.1.3 In all three skulls the eyes are facing forward. Explain the significance of this characteristic. (3)

(14)

3.2 Study the following diagrams of different phases during meiosis.



3.2.1 Arrange phases **A** to **D** in the correct sequence. (1)

3.2.2 Give TWO visible reasons why the diagrams represent Meiosis I. (2)

3.2.3 How many chromosomes will be present in each gamete of this species? (1)

3.2.4 Describe the process that will take place during phase **B** that will lead to genetic variation in the offspring. (5)

3.2.5 Name AND describe the error in meiosis that may lead to Down syndrome in humans. (5)
(14)

3.3 Describe the role of mRNA and tRNA during protein synthesis. (8)

3.4 List FOUR reproductive isolating mechanisms that help to keep different species apart. (4)

[40]

TOTAL SECTION B: 80

SECTION C**QUESTION 4**

Describe how blood groups in humans are determined by different alleles and explain how blood typing can be used to solve paternity cases. Also explain why and how DNA profiling is sometimes required to solve paternity cases.

Content: (17)
Synthesis: (3)
(20)

NOTE: NO marks will be awarded for answers in the form of tables, flow charts or diagrams.

TOTAL SECTION C: 20

GRAND TOTAL: 150

