GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2026

10832

LIFE SCIENCES

(PAPER 2)

LIFE SCIENCES: Paper 2

10832E

TIME: 2½ hours

MARKS: 150

18 pages

X10

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. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, flow charts or tables 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 provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, e.g. 1.1.11 D.

1.1.1 The scientist who described the Law of Segregation was:

A Darwin
B Mendel
C Eldredge
D Watson

1.1.2 The study of how traits are passed from parents to offspring is called …

A mutation.
B ecology.
C genetics.
D gene.

1.1.3 Lee Berger discovered the fossil 'Karabo', which belongs to the species …

A *Australopithecus afarensis.*
B *Australopithecus sediba.*
C *Homo naledi.*
D *Homo habilis.*

1.1.4 Study the steps of DNA replication below.

(i) Two template strands seperate.
(ii) Hydrogen bonds break.
(iii) Both strands serve as templates.
(iv) The DNA double helix unwinds.

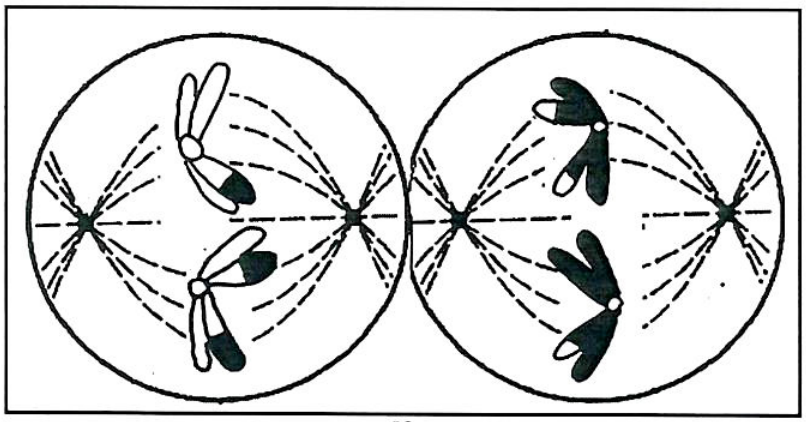
Which of the following combinations represents the correct sequence of steps?

A (i), (iv), (ii), (iii).
B (iv), (iii), (i), (ii).
C (iv), (ii), (i), (iii).
D (i), (ii), (iii), (iv).

1.1.5 Which of the following serves as evidence for the 'Out of Africa' hypothesis?

A The youngest fossils of *Australopithecus* have been found worldwide.
B The fossils of *Homo sapiens* have been found only in Africa.
C The fossils of *Homo erectus* have been found only in Africa.
D The fossils of *Homo habilis* have been found only in Africa.

1.1.6 The diagram below represents a phase in meiosis.



[Source: *https://mycourses.co.za*]

Which phase does the diagram above represent?

A Metaphase I
B Metaphase II
C Telophase I
D Telophase II

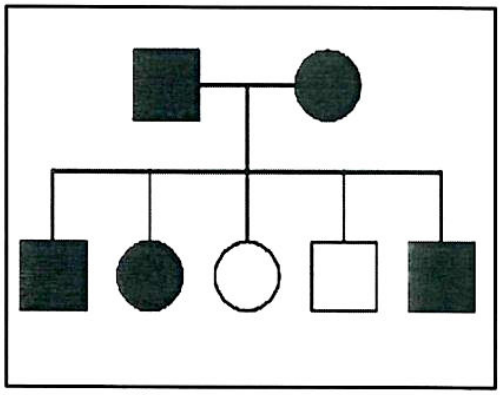
1.1.7 What will the percentage of cytosine in a DNA molecule be if 20% of the nitrogenous bases are adenine?

A 20%
B 30%
C 40%
D 80%

1.1.8 Which of the following is an example of the possible alleles in gametes?

A E and e
B EE and Ee
C Ee and Ee
D EE and ee

1.1.9 Based on the pedigree diagram below, if both parents are heterozygous for blood type B, what blood type(s) could the offspring represented by the white square and white circle have?



[Source: *msg2018.weebly.com*]

A Type A
B Type B
C Type AB
D Type O

1.1.10 A learner observes that two parents with brown eyes have a child with blue eyes.

Which explanation best describes this observation?

A The child inherited blue eyes because eye colour changes after birth.
B Both parents carried the recessive allele for blue eyes, which was expressed in the child.
C One parent was homozygous for brown eye colour.
D The child's eye colour was caused solely by environmental factors.

(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 numbers (1.2.1 to 1.2.7) in the ANSWER BOOK.

1.2.1 The type of sugar found in RNA

1.2.2 An arrangement of black bars representing the DNA fragments of a person

1.2.3 The organ in human females where meiosis occurs

1.2.4 A phase of meiosis II in which the nuclear membrane reforms

1.2.5 The presence of different alleles at a given locus

1.2.6 The 22 pairs of chromosomes that are not responsible for sex determination

1.2.7 A sex-linked disorder that affects the photoreceptors in the eye

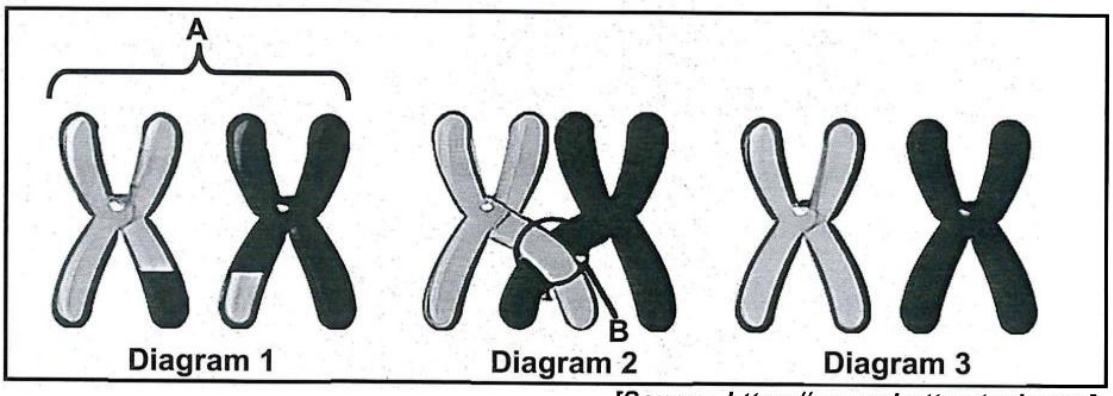
(7 x 1) **(7)**

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 numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	A possible location of DNA in a human cell	A: Mitochondrion B: Chloroplast
1.3.2	An advantage of genetic modification	A: Improved food quality B: Increases resistance to disease
1.3.3	The normal chromosome composition of the nucleus of a human sperm cell	A: 44 autosomes + XY B: 22 autosomes + XY

(3 x 2) **(6)**

1.4 The diagrams below show a process taking place during a phase of meiosis.



[Source: ***https://www.shutterstock.com***]

1.4.1 Name the phase of meiosis represented by the diagrams above. (1)

1.4.2 State the process taking place in diagram **2**. (1)

1.4.3 Identify part **B**. (1)

1.4.4 Arrange the diagrams (**1, 2** and **3**) in the correct sequence in which the process named in QUESTION 1.4.2 occurs. (2)

1.4.5 Name TWO characteristics that are the same between the two chromosomes labelled **A**. (2)
(7)

1.5 In maize plants, the allele for yellow kernels (**G**) is dominant over white kernels (**g**), and the allele for smooth texture (**T**) is dominant over wrinkled texture (**t**). A farmer crosses two maize plants that are heterozygous for both characteristics to study the inheritance of these traits. Below are the results of the cross that he performed.

Gamete	GT	Gt	gT	gt
GT	GGTT	GGTt	GgTT	GgTt
Gt	GGTt	GGtt	GgTt	Ggtt
gT	GgTT	GgTt	ggTT	ggTt
gt	GgTt	**A**	ggTt	ggtt

1.5.1 Give the:

(a) Genotype of the parent plants (1)

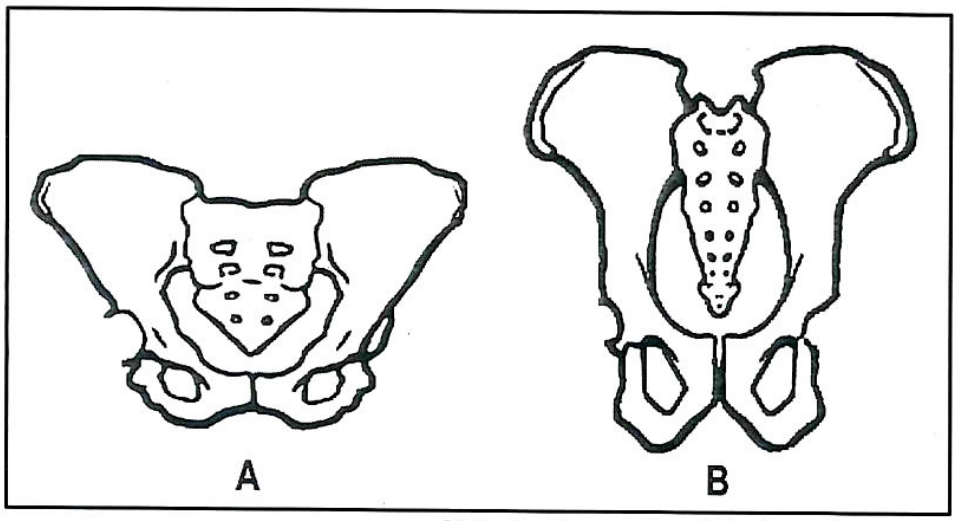
(b) Phenotype of plant **A** (2)

(c) Genotype of the gametes that resulted in an offspring with the genotype GGtt (1)

1.5.2 Based on the Punnett square, determine the simplified fraction of the F_1 maize plants that have yellow kernels with a wrinkled texture. (1)
(5)

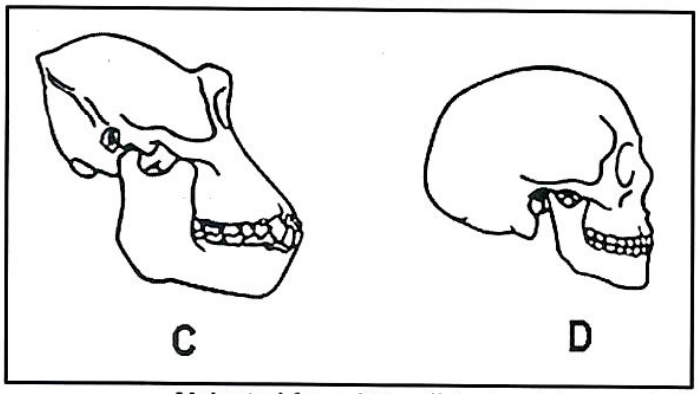
1.6 The diagrams below show both the pelvis and skull of a human and a gorilla.

The pelvis of a human and a gorilla



[Adapted from *https://stock.adobe.com/za*]

The skull of a human and a gorilla



[Adapted from *https://stock.adobe.com/za*]

1.6.1 Give the LETTER of the:

(a) Pelvis that belongs to a gorilla (1)

(b) Skull that belongs to a human (1)

1.6.2 Describe the visible characteristics of the size of pelvis **A** that make it suited for bipedalism. (1)

1.6.3 State ONE visible characteristic of the jaw of skull **C**. (1)

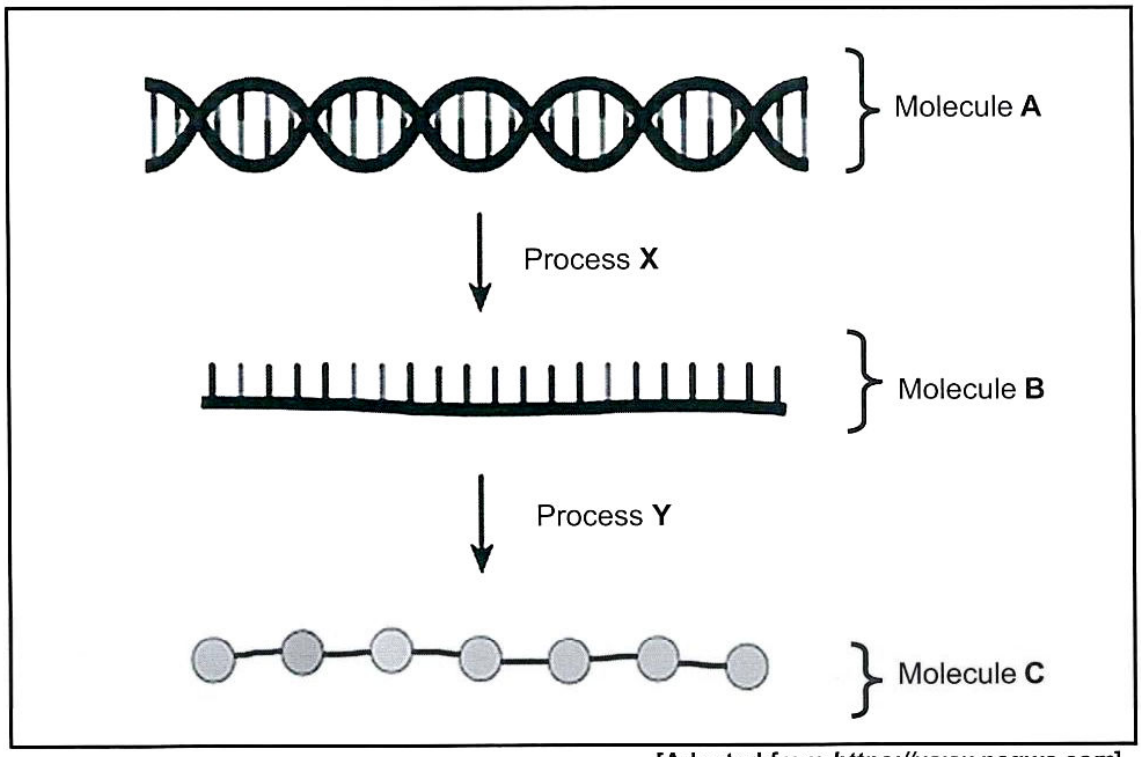
1.6.4 State ONE similarity between the hand of a gorilla and that of a human, that allows them to have a power grip. (1)
(5)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents protein synthesis.



[Adapted from *https://www.nagwa.com*]

2.1.1 Identify the final product formed by molecule **C**. (1)

2.1.2 Name the part of the cell in which process **X** takes place. (1)

2.1.3 Describe ONE visible difference between molecules **A** and **B**. (2)

2.1.4 Draw a labelled stick diagram of a monomer that contains the nitrogenous base that is only found in molecule **A**. (4)

2.1.5 Describe the process of translation represented by process **Y**. (5)
(13)

2.2 Use tables **1** and **2** below to answer the questions that follow.

Table **1** shows some of the codons that can occur in mRNA (with and without a mutation).

mRNA (normal)	UGA	UUC	UGC	ACA
mRNA (mutated)	UGA	UUC	AGC	ACA

Table **2** shows the anticodons and amino acids that correspond to mRNA.

Anticodon	**Amino acid**
ACU	Threonine
AAG	Lysine
ACG	Threonine
UCG	Serine
UGU	Cysteine

[Adapted from The Answer Series, Grade 12 Life Sciences, 3-in-1, Part 1, IEB]

2.2.1 Name the type of mutation that caused the change in the mRNA. (1)

2.2.2 Define the mutation named in QUESTION 2.2.1. (1)

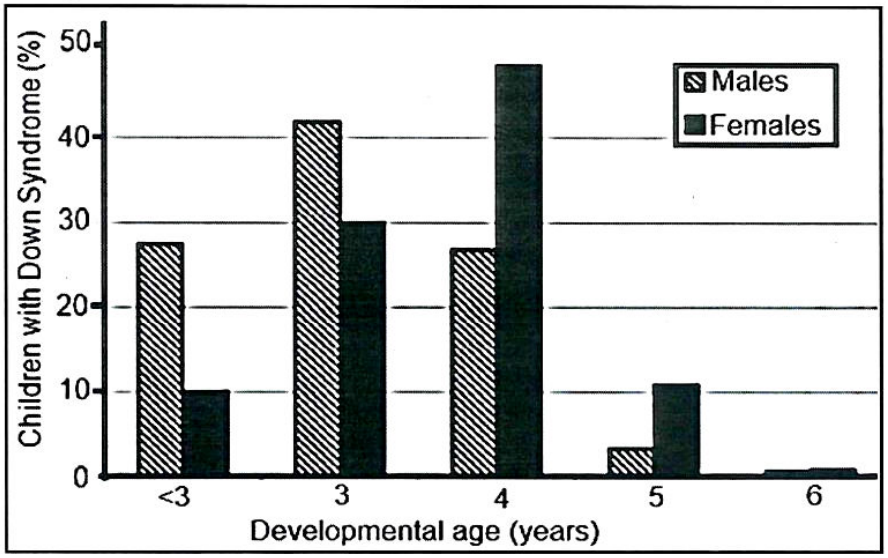
2.2.3 Explain the effect of the mutation that occurred in the mRNA on the protein formed. (4)
(6)

2.3 Study the extract and graph below.

During meiosis, a failure of chromosomes to separate may lead to Down syndrome. Down syndrome is associated with intellectual disability, such as a lower developmental age and difficulties with language. Developmental age refers to a person's level of maturity in physical, mental, social, and emotional skills, measured against average milestones (achievements). In 2011, scientists from the Netherlands investigated the percentage of children with Down syndrome who were of different developmental ages. All the children with Down syndrome were eight years old when assessed for developmental age.

The results of the investigation are shown in the graph below.

Percentage of children with Down syndrome at different developmental ages



[Adapted from *https://journals.plos.org*]

2.3.1 With reference to the extract, identify TWO intellectual disabilities found in children with Down syndrome. (2)

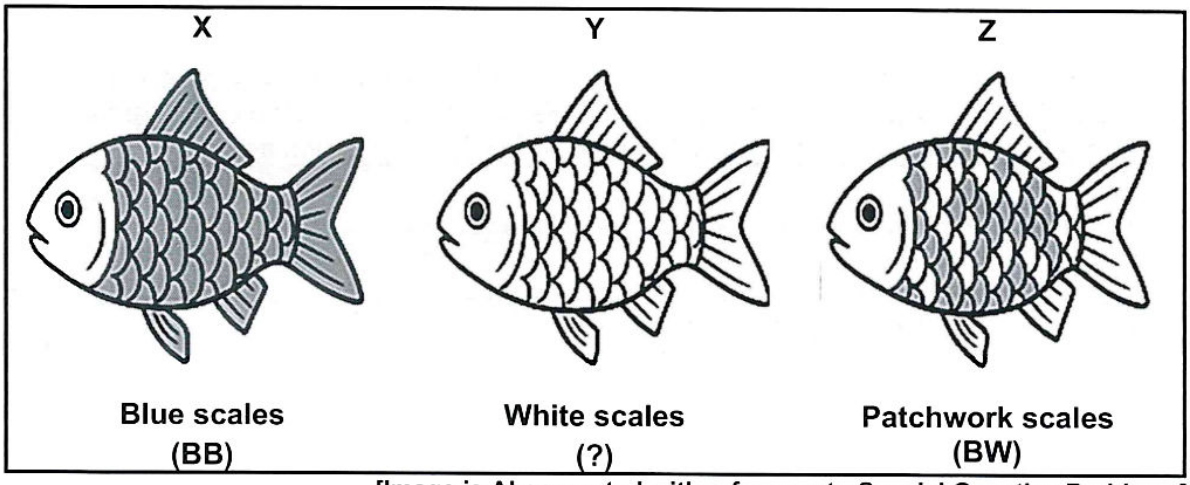
2.3.2 From the graph, determine the percentage of female children with Down syndrome who are at the developmental age of 3 years. (1)

2.3.3 Name the process where chromosomes fail to separate during meiosis. (1)

2.3.4 Describe how the process named in QUESTION 2.3.3 may lead to a child having Down syndrome. (4)
(8)

2.4 In a particular fish species, when a fish with blue scales **(BB)** and a fish with white scales **(WW)** interbreed, their offspring are all born with patchwork scales.

The diagram below shows the three possible phenotypes of the fish species.



[Image is AI-generated with reference to Special Genetics Problems]

2.4.1 State the genotype of fish **Y**. (1)

2.4.2 Name the type of dominance displayed in fish **Z**. (1)

2.4.3 Describe the dominance of fish **Z**'s scales as identified in QUESTION 2.4.2. (2)

2.4.4 Use a genetic cross to determine the expected number of offspring of each colour in the F_1 phenotype, if fish **X** and **Y** were crossed to produce 200 offspring. (6)
(10)

2.5 Ocular albinism in humans is caused by a recessive allele on the X chromosome **(X^a)**. Individuals with ocular albinism have normal pigment in their skin and hair but less pigment in their eye tissue. A father with unaffected eyes and a mother who is a carrier of the ocular albinism allele could produce any one of the children represented in the table below.

CHILD	PHENOTYPE	GENOTYPE
1	Ocular albinism Male	
2	Unaffected Female	Heterozygous
3	Unaffected Male	
4	Unaffected Female	Homozygous

[Adapted from *https://www.mayoclinic.org*]

2.5.1 Explain, with reference to Mendel's Law of Segregation, how child **1** could have inherited his phenotype. (5)

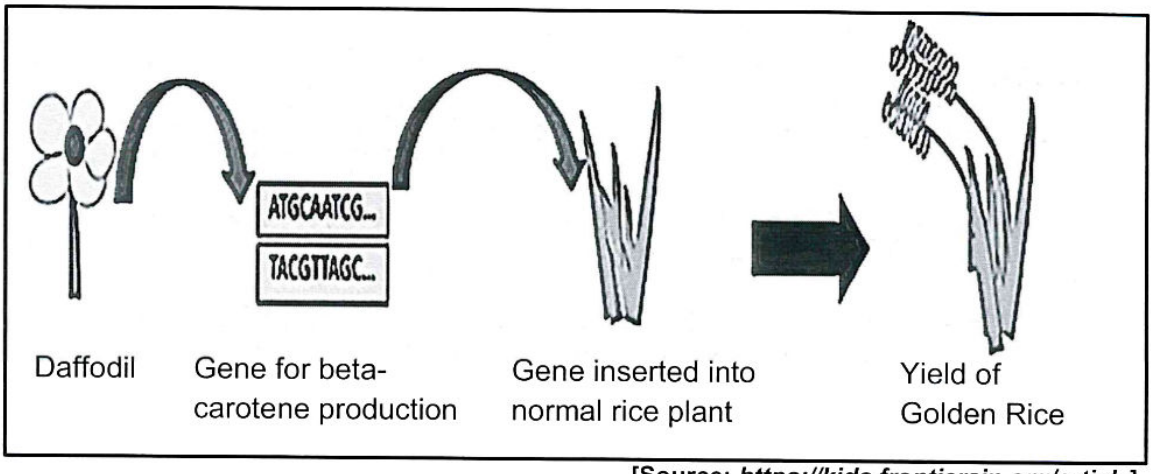
2.5.2 The wife is expecting a female child. Calculate the percentage chance of their daughter being heterozygous for ocular albinism. Show ALL calculations. (3)

2.5.3 Tabulate TWO differences between the genotype of Child **3** and Child **4** in relation to the sex-linked disorder in the family. (5)
(13)
[50]

QUESTION 3

3.1 Read the extract below and study the diagram.

In some countries, people suffer from vitamin A deficiency, which can lead to blindness. Beta-carotene is a red-orange pigment found in plants that the human body converts into vitamin A. Scientists have genetically modified rice by inserting a gene from a daffodil plant. This enables the rice (now called Golden Rice) to produce beta-carotene.



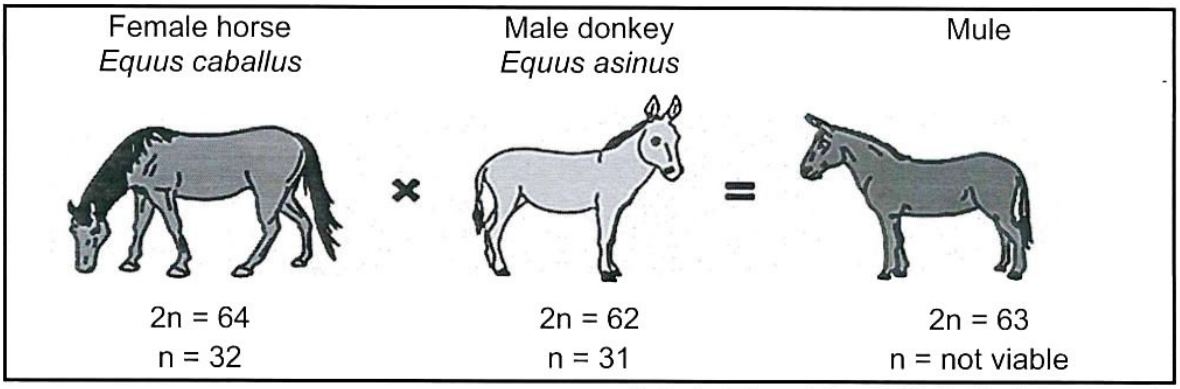
[Source: *https://kids.frontiersin.org/article*]

3.1.1 Genetic modification is a form of biotechnology. Define the term *biotechnology*. (2)

3.1.2 With reference to the image above, identify the source of the gene that is inserted into normal rice. (1)

3.1.3 Using the information provided, explain how Golden Rice can help reduce blindness in humans. (2)
(5)

3.2 The image below shows an example of artificial selection between a female horse and a male donkey to produce a mule. Horses and donkeys share similar characteristics, although they are different species. Mules eat less and live longer than horses; they are also more intelligent and easier to ride than donkeys. In the diagram, **2n** represents the diploid number of chromosomes, and **n** represents the haploid number. The gametes of a mule are not viable.



[Adapted from *https://old-ib.bioninja.com.au*]

3.2.1 Identify the:

(a) Chromosome number in a gamete of a donkey (1)

(b) Genus name of a horse (1)

3.2.2 Name the mechanism of reproductive isolation represented in the image above. (1)

3.2.3 Use the information provided to justify your answer to QUESTION 3.2.2. (1)

3.2.4 Aside from reproductive isolation, use the information provided in the image to name ONE factor that causes horses and donkeys to be two different species. (1)

3.2.5 Describe how and why the process of artificial selection was used to produce the mule above. (4)

3.2.6 Use the information provided to explain TWO financial benefits of owning a mule rather than a horse. (4)
(13)

3.3 The Potchefstroom Koekoek is a breed of chicken unique to South Africa. Chicken eggs are graded into small, medium, large, extra-large, and jumbo sizes based on their weight.

Researchers wanted to determine what percentage of the eggs produced by the Potchefstroom Koekoek, fall into the different weight ranges.

The investigation was conducted as follows:

- 100 hens were selected.
- The hens were raised from day 1 to week 16 in an environmentally controlled cage and given the same diet as well as sufficient water.
- At 16 weeks old, the hens were placed in laying houses, where their environment, diet and water supply were kept the same.
- All the eggs produced in a year were collected, sorted and recorded according to their weight range.

The percentage of eggs in different weight ranges is shown in the table below.

Egg grade	Weight range (g)	Percentage of eggs produced (%)
Small	33 – 42,9	4,5
Medium	43 – 50,9	22
Large	51 – 58,9	61,5
Extra-large	59 – 65,9	2
Jumbo	66 – 71	1,5
Unusable	n/a	8,5

[Adapted from *https://scispace.com* and *https://southafrica.co.za*]

3.3.1 Is egg weight in chickens an example of CONTINUOUS or DISCONTINUOUS variation? (1)

3.3.2 Use the information in the table to justify your answer to QUESTION 3.3.1. (1)

3.3.3 State TWO ways in which the researchers ensured the reliability of their results. (2)

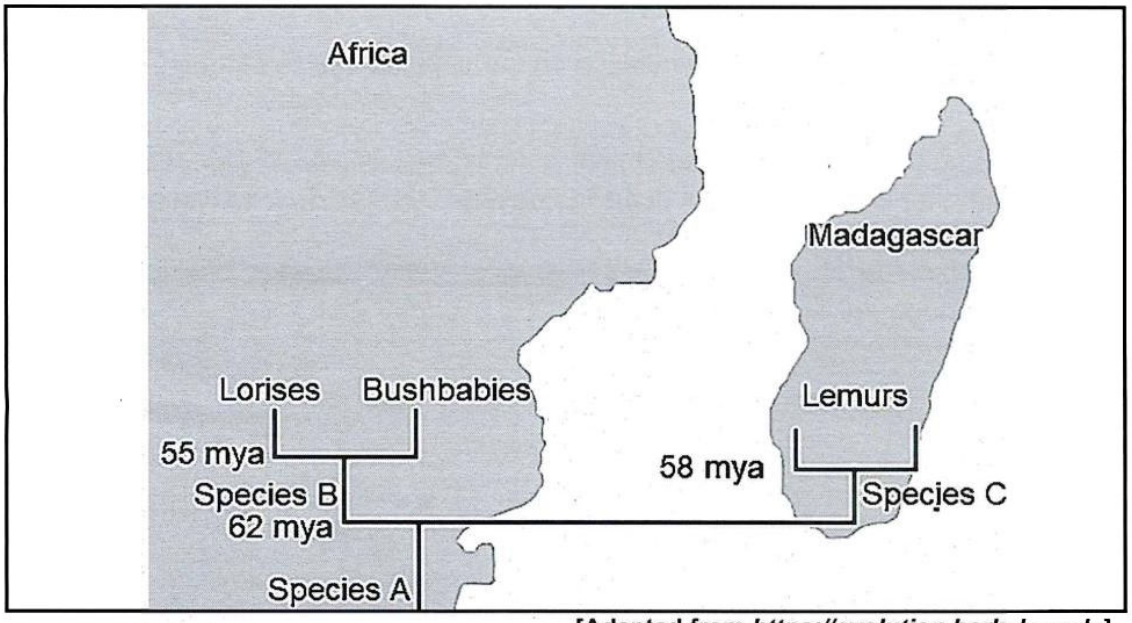
3.3.4 State TWO planning steps that the researchers took before conducting their investigation. (2)

3.3.5 During sorting, some eggs are rejected as being unusable. Suggest ONE reason why some eggs may be considered unusable by the farmers. (1)

3.3.6 Explain why the researchers needed to keep factors such as the age of the chickens, the environment, the food and water controlled. (2)

3.3.7 Draw a histogram of the percentage of usable eggs in the different weight ranges produced by the Potchefstroom Koekoek. (6)
(15)

3.4 Lemurs, lorises, and bushbabies are all types of primates that evolved from an ancestral population of species **A**. Species **A** split into two around 62 million years ago when Madagascar broke away from Africa. One group evolved into the ancestor of the lorises and bushbabies (species **B**). The other group evolved into the ancestor of the lemurs (species **C**).



[Adapted from *https://evolution.berkeley.edu*]

3.4.1 How long ago did the lorises and bushbabies evolve from their ancestor species **B**? (1)

3.4.2 Define a *population*. (2)

3.4.3 Use the information provided to describe how species **B** and **C** were formed through geographic isolation. (6)
(9)

3.5 Read the text below and answer the questions that follow.

In Gorongosa National Park, a previously rare genetic condition which causes elephants to be tuskless has become more common. Approximately 90% of Mozambique's elephant population were slaughtered by poachers during the civil war (1977 to 1992). Elephants without tusks were of no value to poachers and were not killed. Before the war, about 18,5% of females were naturally tuskless. But that figure increased to 33% after the war. Researchers have long suspected that the tuskless characteristic, only seen in females, was caused by a sex-linked mutation. This mutation is fatal to males, who do not develop properly in the womb, leading to fewer elephants being born.

[Adapted from *https://www.bbc.com*]

3.5.1 According to the text, state ONE reason why no tuskless male elephants are seen in Gorongosa National Park. (1)

3.5.2 Explain the effect of the mutation on the population size of these elephants. (2)

3.5.3 Using your understanding of evolution, explain why the proportion of female elephants without tusks increased in the Gorongosa National Park. (5

(8

[50]

TOTAL SECTION B: 100

TOTAL: 150

END