education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2023

MARKS: 150

TIME: 2½ hours

12832E

X10

This question paper consists of 16 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 for each question.
6. Do 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 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 answer and write only the letter (A–D) next to the question numbers (1.1.1 to 1.1.9) in the ANSWER BOOK, for e.g. 1.1.10 D.

1.1.1 During which phase of meiosis do spindle fibres start to form?

A Prophase I
B Metaphase I
C Anaphase I
D Telophase I

1.1.2 The following list includes some features that are studied in evolution.

(i) Bipedalism
(ii) Dentition
(iii) Brow ridges
(iv) Stereoscopic vision

Which ONE the following key features separate the human line of evolution from that of the African Apes?

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

1.1.3 A small section of mRNA has the following sequence of bases that codes for different amino acids:

C C C C G U U A A

Which ONE of the following is the representation of the anticodons and number of amino acids coded for by this section?

	ANTICODONS			NUMBER OF AMINO ACIDS
A	GGG	GCA	AUU	9
B	GGG	GCA	AUU	3
C	GGG	GCA	ATT	9
D	GGG	GCA	ATT	3

1.1.4 In a family with four children, each child has a different blood group.

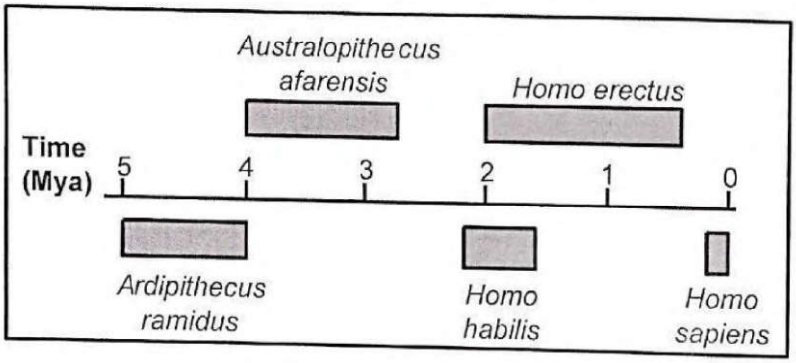
The genotypes of the parents must be ...

A $I^A i$ and $I^B i$
B $I^A I^B$ and ii
C $I^B i$ and $I^A I^B$
D $I^B i$ and ii

1.1.5 Which ONE of the following monohybrid crosses where complete dominance applies, will result in a phenotypic ratio of 3 : 1?

A Both parents are heterozygous
B One parent is heterozygous, and the other is homozygous recessive
C Both parents are homozygous for the dominant characteristic
D One parent is heterozygous, and the other is homozygous dominant

QUESTIONS 1.1.6 AND 1.1.7 ARE BASED ON THE TIMELINE BELOW SHOWING THE POSSIBLE EVOLUTION OF SOME HOMINIDS:



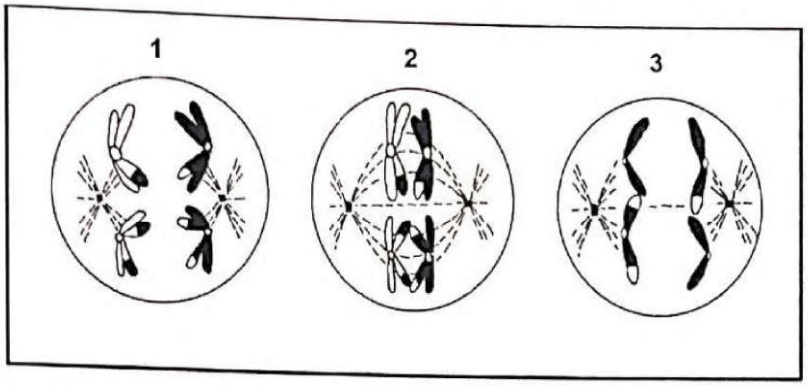
1.1.6 Which species inhabited the Earth for the longest time, and how many years ago did this species appear?

A *Australopithecus afarensis*; 4 mya
B *Homo erectus*; 2 mya
C *Homo habilis*; 2.2 mya
D *Ardipithecus ramidus*; 5mya

1.1.7 How many genera are represented on the timeline above?

A 5
B 3
C 1
D 2

1.1.8 The diagram below represents different phases of meiosis.



Identify the correct phase in diagram **2**

A Anaphase II
B Metaphase II
C Prophase I
D Metaphase I

1.1.9 If a DNA molecule contains 20 000 nitrogenous bases, of which 20% are cytosine, how many adenine molecules will be present?

A 1 000
B 2 000
C 6 000
D 8 000

(9 x 2) **(18)**

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 1.2.9) in the ANSWER BOOK.

1.2.1 The mode of locomotion where an animal uses four limbs

1.2.2 The bond formed between amino acids

1.2.3 The part of the skull that houses the brain

1.2.4 A change in the sequence of nitrogenous bases

1.2.5 A disorder due to the presence of an extra chromosome on the 21st pair of chromosomes in somatic cells of humans

1.2.6 Genetic evidence that is used to support the 'Out of Africa' hypothesis

1.2.7 The process by which genetically identical organisms are formed using biotechnology

1.2.8 Type of dominance in which both alleles are expressed in the phenotype

1.2.9 Similar structures that are inherited from a common ancestor and modified for different functions (9 x 1) **(9)**

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	The genotype of a person with haemophilia	A: X^hY B: X^hX^h
1.3.2	Variation in human height	A: Continuous variation B: Discontinuous variation
1.3.3	Involved in the discovery of DNA molecule	A: Eldredge B: Gould

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

1.4 Three ladies each gave birth to a baby boy in a hospital. The babies were accidentally swopped.

The diagram below shows a technique used in paternity testing and the results of each parent and their baby boys.

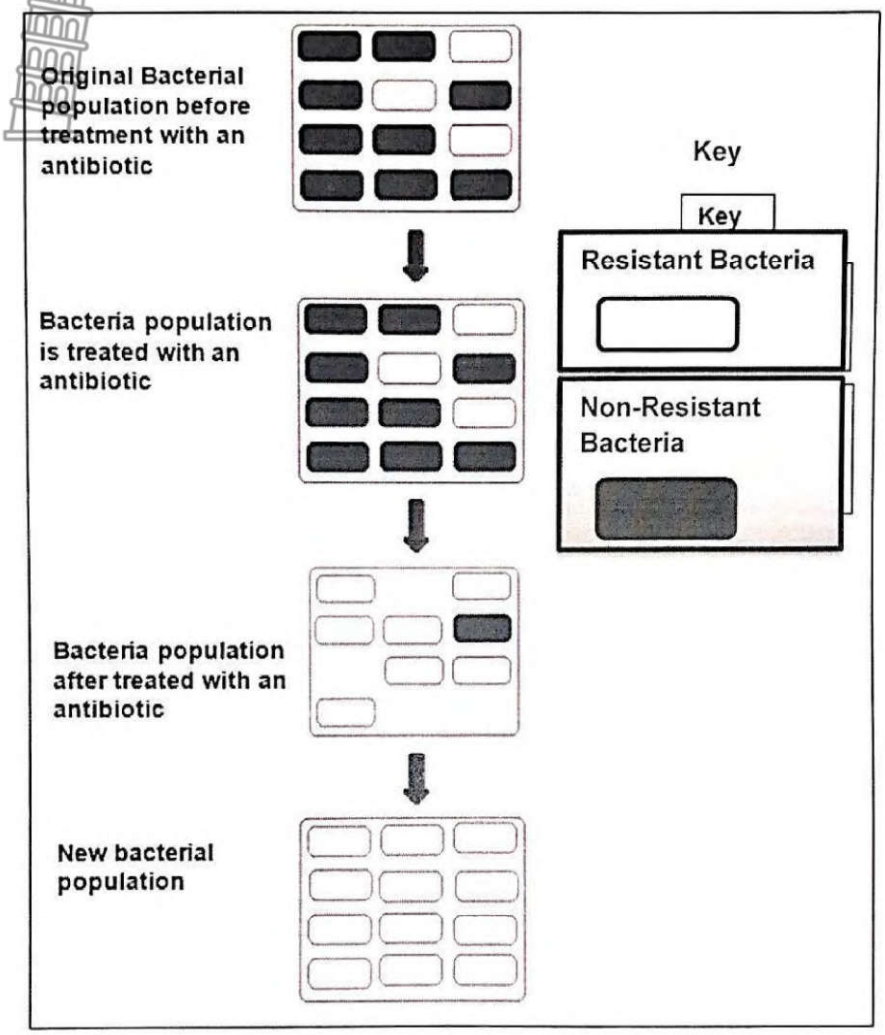
1.4.1 Identify the technique shown above. (1)

1.4.2 Which baby (**1**, **2** or **3**) belongs to the Smiths? (2)

1.4.3 State TWO other uses for the technique named in QUESTION 1.4.1. (2)
(5)

1.5 An investigation was carried out to determine the effect of an antibiotic on bacterial resistance.

The diagram below shows the effect of an antibiotic on a bacterial population.



1.5.1 Give the:

(a) Dependent variable (1)

(b) Independent variable (1)

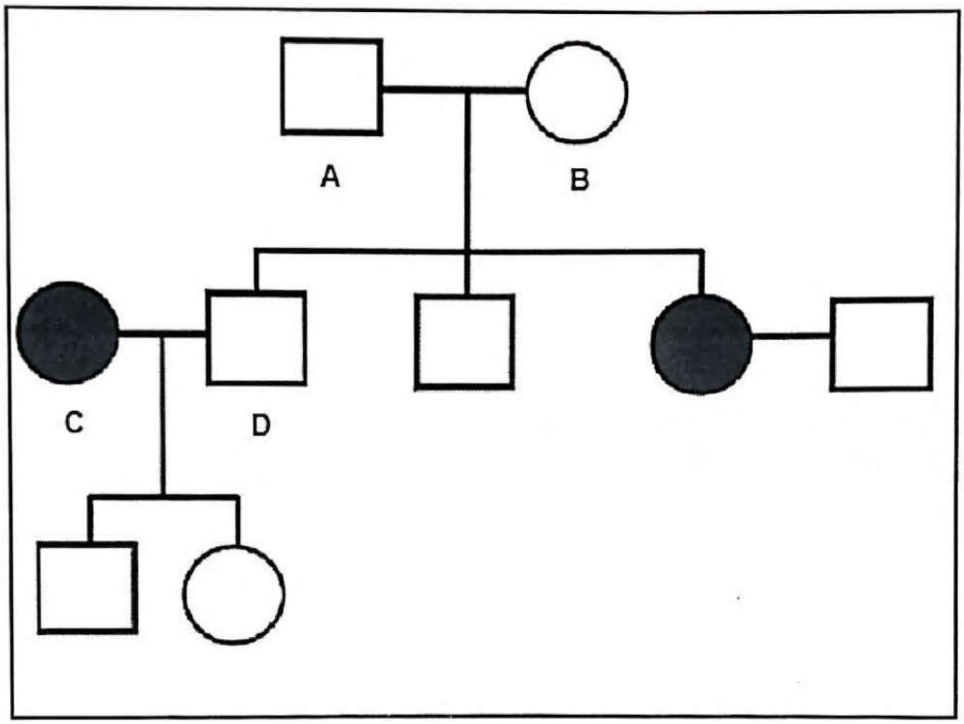
1.5.2 Name the type of evolution that occurs in this bacterial population. (1)

1.5.3 What is the change in the environment that brings about the change in the bacteria population? (1)

1.5.4 Which variation can be found in greater proportion in the final population? (1)

1.5.5 What percentage of the bacteria in the original population was resistant to antibiotics? (1)
(6)

1.6 A genetic disorder is caused by a recessive allele **(a)**.
An individual with the disorder is described as affected, and an individual without it is described as unaffected. The affected individual is indicated by a black circle or square.
The pedigree diagram below shows the inheritance of this disorder in a family.



1.6.1 How many of each of the following are present in the diagram?

(a) Males (1)

(b) Generations (1)

(c) Children of individuals **A** and **B** (1)

1.6.2 Give the:

(a) Possible genotype of individual **D** (2)

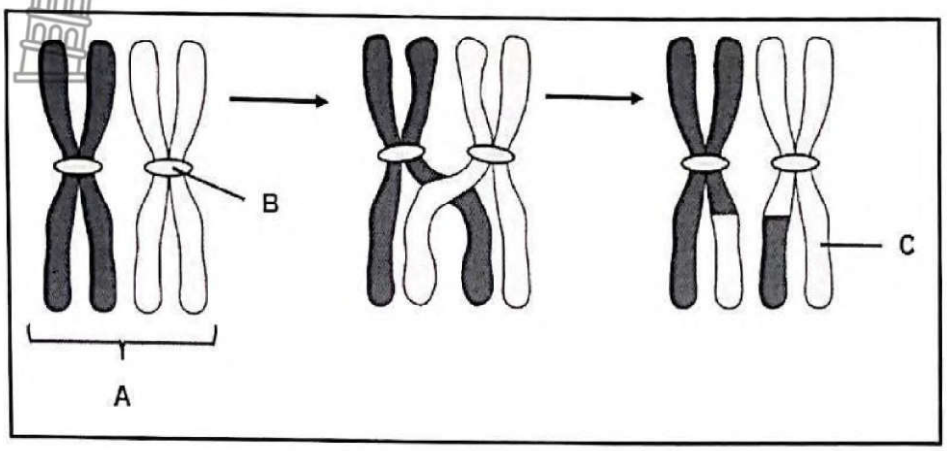
(b) Phenotype of individual **C** (1)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents chromosomes in a cell that is undergoing meiosis.



2.1.1 Identify:

(a) Chromosome pair **A** (1)

(b) Structure **B** (1)

(c) Part **C** (1)

2.1.2 Which process is illustrated in the diagram? (1)

2.1.3 During which phase of meiosis does the process named in QUESTION 2.1.2 take place? (1)

2.1.4 What is the importance of the process named in QUESTION 2.1.2? (1)

2.1.5 Describe ONE other process in meiosis which will ensure the same outcome as the one stated in QUESTION 2.1.4. (3)
(9)

2.2 Tabulate THREE differences between meiosis I and meiosis II. (7)
(7)

2.3 Lamarckism refers to the theory of evolution suggested by Jean Baptiste de Lamarck.

Answer the following questions on Lamarck's theory.

2.3.1 State the TWO principles (laws) that Lamarck used to explain evolution. (2)

2.3.2 Explain ONE reason why most scientists reject this theory. (2)
(4)

2.4 Human blood types are determined by multiple alleles. Each person has only two alleles in their DNA that code for their blood type.

Explain how an analysis of blood groups can be used to determine paternity. (5)
(5)

2.5 Scientists wanted to determine which type of inheritance accounted for most of the selected genetic disorders in dogs.

To do this they sequenced the genomes of many dogs of the same breed that suffered from the genetic disorders.

The table below represents the type of inheritance for genetic disorders in dogs.

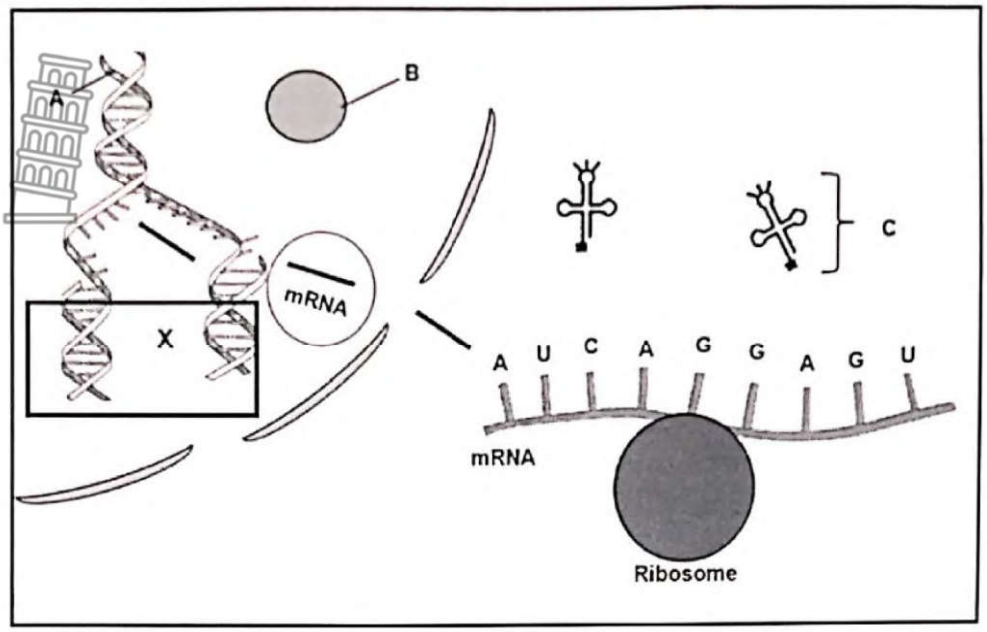
TYPE OF INHERITANCE	PERCENTAGE OF GENETIC DISORDERS (%)
Autosomal recessive	71
Autosomal dominant	11
Sex-linked	10
Other	8

2.5.1 Define the term *genome*. (2)

2.5.2 State ONE factor that was kept constant in this investigation. (1)

2.5.3 Draw a pie graph to represent the information provided in the table. (6)
(9)

2.6 The diagram below shows parts of two different processes that take place in the nucleus and a process taking place at the ribosome.



2.6.1 Identify:

(a) Molecule **A** (1)

(b) Organelle **B** (1)

(c) Molecule **C** (1)

(d) The number of codons shown in the diagram on the mRNA (1)

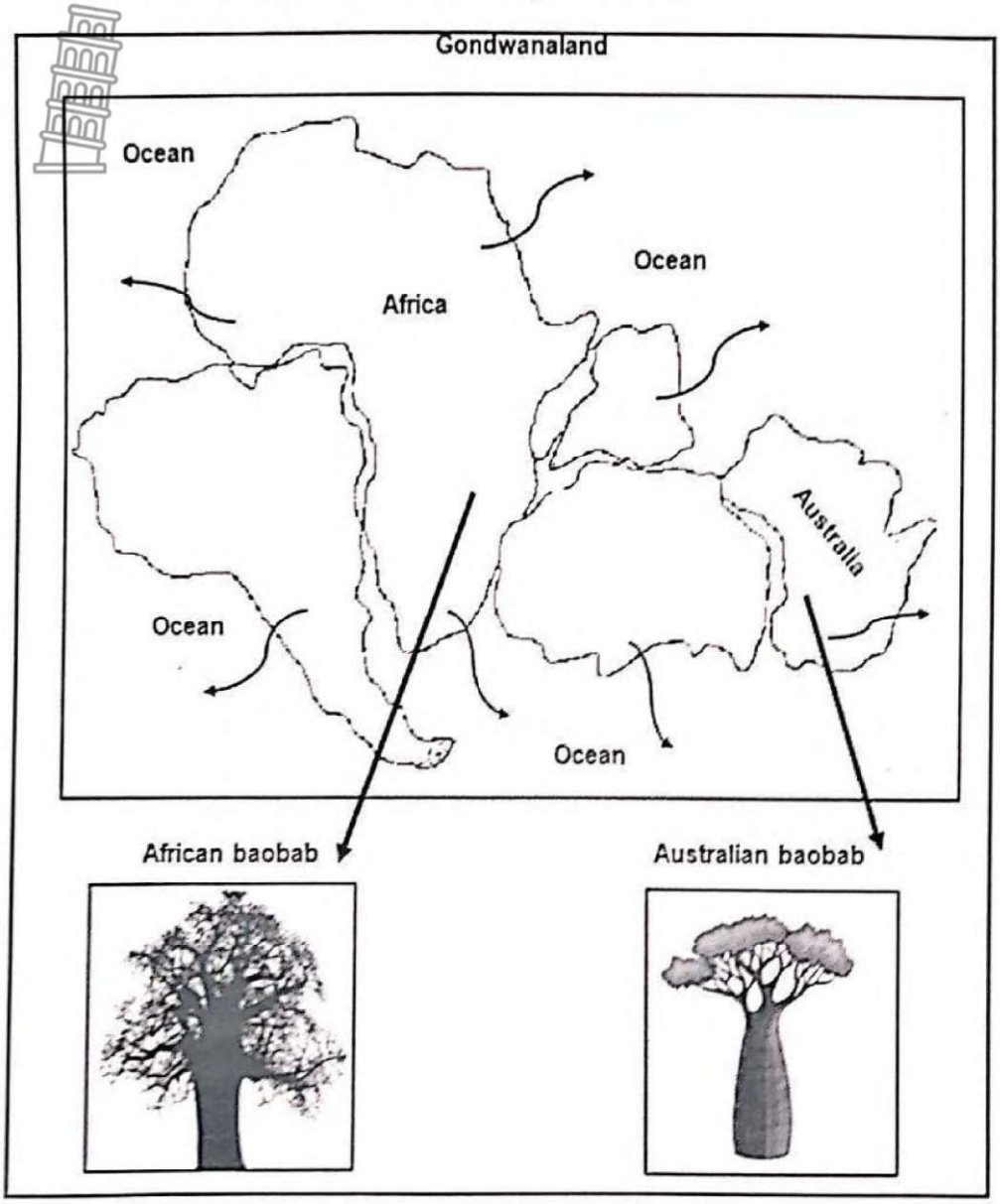
2.6.2 Give the anticodon for the second codon from left to right. (2)

2.6.3 Name AND describe the process that is taking place at **X.** (6)

2.6.4 Describe the role of mRNA in protein synthesis. (4)
(16)
[50]

QUESTION 3

3.1 The baobab tree belongs to the genus *Adansonia*. Different species are found in Africa and Australia. Originally these two continents formed part of Gondwanaland, as shown in the diagram below.



Explain how the different species of baobab could have evolved on the different continents. (6)

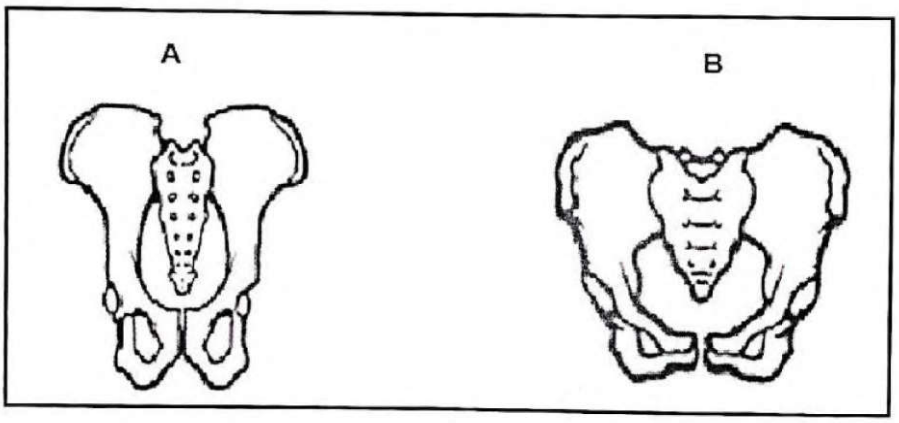
3.2 Read the extract below.

> Warblers/songbirds belong to a large group of birds grouped together in the same bird family. In Siberia, Russia, two distinct species of greenish warblers coexist, one in the west and one in the east. A large region of desert, where they cannot survive, separates the two groups of warblers. Their distributions only narrowly overlap in central Siberia, where they do not interbreed. The two species differ, in the songs that males sing to attract females. Also, females of each species do not recognise the song of the other species but respond strongly to the song of the males from their own species.

3.2.1 Name AND describe the reproductive isolation mechanism described in the extract. (3)

3.2.2 Mention TWO other reproductive isolation mechanisms that keep species separated. (2)
(5)

3.3 The diagrams below show the pelvic structure of two species not drawn to scale.

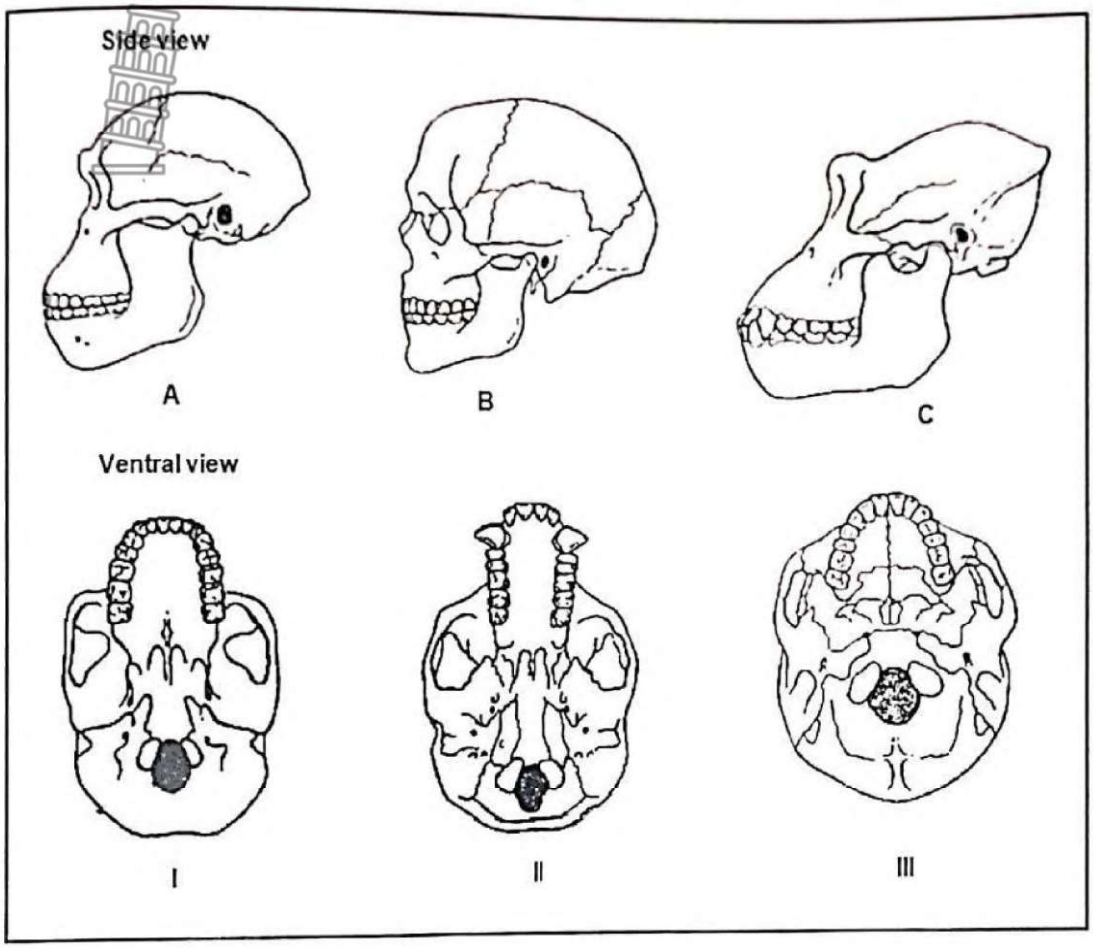


3.3.1 Which diagram represents the pelvis of a hominid? (1)

3.3.2 Explain ONE reason why Diagram **B** is better suited for a bipedal mode of locomotion. (2)

3.3.3 Explain TWO advantages of bipedalism. (4)
(7)

3.4 The diagrams below represent the side and ventral views of the skulls of three primates: A gorilla, *Australopithecus africanus* and *Homo sapiens*. The diagrams showing the side views are not necessarily in the same order as the diagrams showing the ventral views.



3.4.1 Name the family that all these primates belong to. (1)

3.4.2 Which diagram (**I, II** or **III**) represents the ventral view of skull **B**? (1)

3.4.3 Give TWO visible reasons for your answer to QUESTION 3.4.2. (2)

3.4.4 Describe THREE visible differences between the jaws in diagrams **II** and **III**, which show trends in human evolution. (6)

3.4.5 Based on the differences in dentition, what conclusion can be made about the difference in the diet of the organisms in diagrams **II** and **III**? (2)
(12)

3.5 In guinea pigs, black fur **(B)**, is due to a dominant gene and white fur **(b)** is due to a recessive gene. Short fur **(H)** is due to a dominant gene and long fur **(h)** is due to a recessive gene.

A breeder made the following cross: **BbHh x bbhh**

3.5.1 State the phenotypes of the parents that the breeder crossed. (2)

3.5.2 Give the genotypes of ALL the possible gametes of the parents. (2)

Give :

3.5.3

a) All the possible phenotypes of the offspring (2)

b) The dominant allele for fur colour (1)

3.5.4 Explain Mendel's law of independent assortment. (3)
(10)

3.6 Study the extract below.

Female fruit flies are approximately 2,5 mm long. Males are smaller and possess a distinct black patch on their bodies. Females lay up to 400 eggs, which develop into adults in 7 to 14 days. Fruit flies can survive and breed in small flasks containing a simple nutrient medium consisting mainly of sugar. The gonosomes of fruit flies are similar to that of humans (XX and XY).

3.6.1 Explain TWO reasons why the fruit fly is a useful organism for studying genetic crosses. (4)

3.6.2 In fruit flies, the gene for eye colour is sex-linked and is carried on the X chromosome.

The allele for red eyes **R** is dominant to the allele for white eyes **r**.
A male with white eyes is crossed with a homozygous female with red eyes.

Use a genetic cross to show the phenotypic ratio of the F_1 offspring. (6)
(10)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2
SEPTEMBER 2023
MARKING GUIDELINES

MARKS: 150

These marking guidelines consists of 12 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. **If more information than marks allocated is given**
   Stop marking when maximum marks are reached and put a wavy line and 'max' in the right-hand margin.

2. **If, for example, three reasons are required and five are given**
   Mark the first three irrespective of whether all or some are correct/incorrect.

3. **If the whole process is given when only a part of it is required**
   Read all and credit the relevant part.

4. **If comparisons are asked for, but descriptions are given**
   Accept if the differences/similarities are clear.

5. **If tabulation is required, but paragraphs are given**
   Candidates will lose marks for not tabulating.

6. **If diagrams are given with annotations when descriptions are required**
   Candidates will lose marks.

7. **If flow charts are given instead of descriptions**
   Candidates will lose marks.

8. **If the sequence is muddled and links do not make sense**
   Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If the sequence and links become correct again, resume credit.

9. **Non-recognised abbreviations**
   Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation, but credit the rest of the answer if correct.

10. **Wrong numbering**
    If the answer fits into the correct sequence of questions, but the wrong number is given, it is acceptable.

11. **If the language used changes the intended meaning**
    Do not accept.

12. **Spelling errors**
    If recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.

13. **If common names are given in terminology**
    Accept, provided it was accepted at the national memo discussion meeting.

14. **If only the letter is asked for, but only the name is given (and vice versa)**
    Do not credit.

15. **If units are not given in measurements**
Candidates will lose marks. Marking guidelines will allocate marks for units separately.

16. **Be sensitive to the sense of an answer, which may be stated differently.**

17. **Caption**
All illustrations (diagrams, graphs, tables, etc.) must have a caption.

18. **Code-switching of official languages (terms and concepts)**
A single word or two that appear(s) in any official language other than the learner's assessment language used to the greatest extent in his/her answers should be credited if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.

19. **Changes to the memorandum**
No changes must be made to the memorandum. The provincial internal moderator must be consulted.

SECTION A
QUESTION 1

1.1	1.1.1	A ✓✓		
	1.1.2	D ✓✓		
	1.1.3	B ✓✓		
	1.1.4	A ✓✓		
	1.1.5	A ✓✓		
	1.1.6	B ✓✓		
	1.1.7	B ✓✓		
	1.1.8	D ✓✓		
	1.1.9	C ✓✓	(9 x 2)	**(18)**
1.2	1.2.1	Quadrupedalism✓		
	1.2.2	Peptide✓		
	1.2.3	Cranium✓		
	1.2.4	Gene mutation✓		
	1.2.5	Trisomy 21✓/Down Syndrome		
	1.2.6	Mitochondrial DNA✓/mt-DNA		
	1.2.7	Cloning✓		
	1.2.8	Co-Dominance✓		
	1.2.9	Homologous structures✓	(9 x 1)	**(9)**
1.3	1.3.1	Both A and B✓✓		
	1.3.2	A only✓✓		
	1.3.3	None✓✓	(3 x 2)	**(6)**
1.4	1.4.1	DNA profiling✓		(1)
	1.4.2	Baby 3✓✓		(2)
	1.4.3	– Identifying suspects in a crime✓ – Tracing missing persons✓ – Identifying genetic disorders✓ – Matching tissues for organ transplants✓ – Identifying dead persons✓ **(Mark first TWO only)**	Any	(2) **(5)**
1.5.	1.5.1	(a) Bacterial resistance✓ (b) Effect of antibiotics✓		(1) (1)
	1.5.2	Natural Selection✓/Punctuated Equilibrium		(1)
	1.5.3	Antibiotics✓		(1)
	1.5.4	Resistant Bacteria✓		(1)
	1.5.5	25%✓		(1) **(6)**

1.6 1.6.1 (a) 5✓ (1)
(b) 3✓ (1)
(c) 3✓ (1)

1.6.2 (a) Aa✓/AA✓ (2)
(b) Affected female✓ (1)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 2.1.1 (a) Homologous✓ chromosomes/bivalent (1)

(b) Centromere✓ (1)

(c) Chromatid✓ (1)

2.1.2 Crossing over✓ (1)

2.1.3 Prophase I✓ (1)

2.1.4 Ensures genetic variation✓ (1)

2.1.5 – Chromosomes/chromatids arrange themselves randomly✓
– on either side of the equator✓
– during metaphase I✓/II (3)
(9)

2.2

Meiosis I	Meiosis II
Crossing over takes place✓	No crossing over takes place✓
In metaphase, the chromosomes align on the equator in homologous pairs✓	(In metaphase) chromosomes align singly✓ on the equator
During anaphase, chromosomes✓ move towards the poles	During anaphase, chromatids✓ move towards the poles
Homologous chromosomes in prophase I ✓	Chromosomes occur singly in prophase II ✓
The chromosome number is halved✓/changes from diploid to haploid	The chromosome number remains the same✓
Results in two daughter cells✓	Results in four daughter cells✓

(Mark first THREE only) Any 3 x 2 + 1 for table **(7)**

2.3 2.3.1 'Law' of use and disuse✓
'Law' of the inheritance of acquired characteristics✓ (2)

2.3.2 – Acquired characteristics✓
– are not inherited✓/do not cause any change to the DNA of an organism's gametes (2)
(4)

2.4 – The blood the of mother, possible father and the child must be compared✓
– If this shows that it is not possible that these parents can produce a child with his/her blood group✓
– then this man is not the father✓
– If this shows that it is possible that these parents can produce a child with his/her blood group✓
– then he may/ may not be the father✓
– because other males have the same blood group✓ (5)
Any **(5)**

2.5 2.5.1 The mapping of the exact position of all the genes in all the chromosomes of an organism/human✓✓ (2)

2.5.2 The breed of the dogs✓
(Mark first ONE only) (1)

2.5.3 **Calculations**

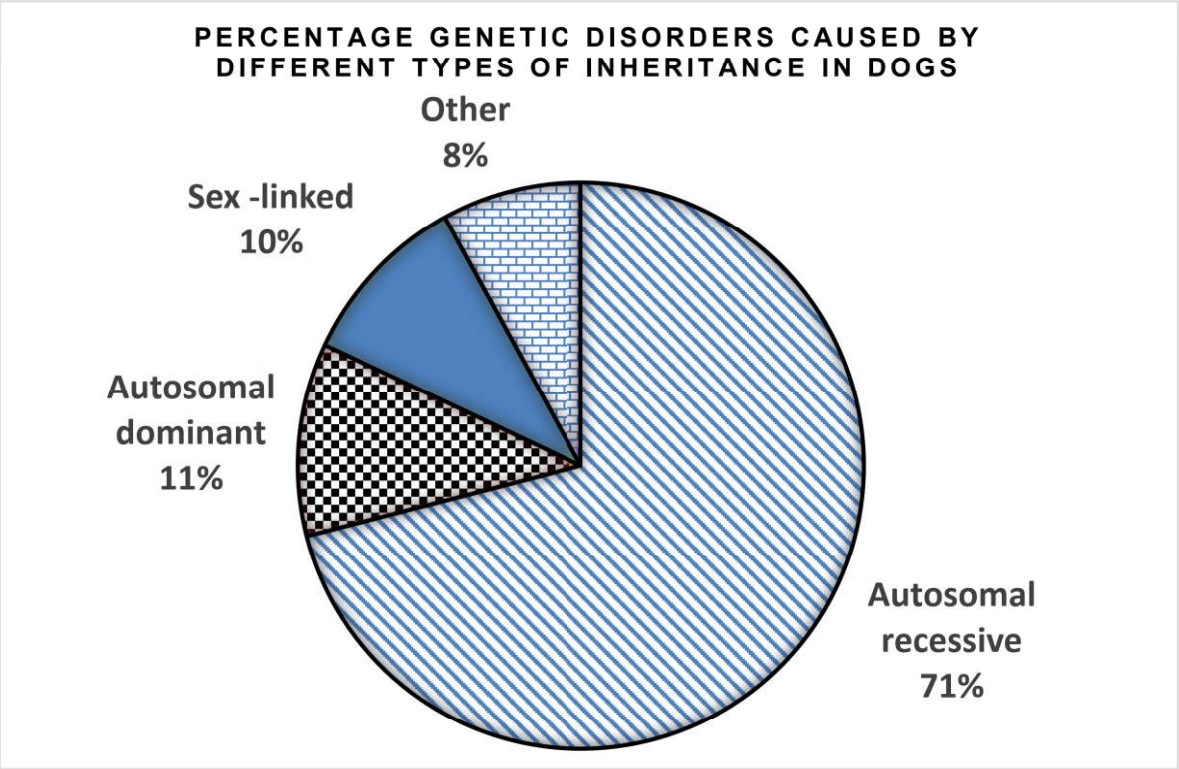
Total: 71 + 11 + 10 + 8 = 100

Autosomal recessive: 71/100 x 360 = 255,6°

Autosomal dominant: 11/100 x 360 = 39,6°

Sex-linked: 10/100 x 360 = 36°

Other: 8/100 x 360 = 28,8°



Criteria for marking graph

CRITERIA	MARK
Pie chart drawn **(T)**	1
Caption **showing the relationship between the two variables(H)**	1
Correct calculation **(C)** to determine the proportions for the labelled sectors	2
Plotting of Sectors **(P)** Correct proportions for labelled sectors 1–3 sectors drawn and labelled correctly All 4 sectors of the graph are drawn and labelled correctly	 1 2

(6)
(9)

2.6 2.6.1 (a) DNA✓ (1)

(b) Nucleolus✓ (1)

(c) tRNA✓ (1)

(d) 3✓ (1)

2.6.2 UCC✓✓ (2)

2.6.3 DNA Replication✓*
- The DNA (double helix) unwinds✓ and
- unzips✓/hydrogen bonds break
- to form two separate strands✓
- Both DNA strands serve as the templates✓
- to build a complementary DNA✓/(A to T and C to G)
- using free (DNA) nucleotides✓ from the nucleoplasm
- This results in two identical (DNA) molecules✓
- Each molecule consists of one original strand and one new strand✓ ***1 Compulsory** + Any 5 (6)

2.6.4
- mRNA forms during transcription✓
- by copying the coded message from DNA✓
- and moves out of the nucleus✓
- and attaches to the ribosome✓
- the anticodons on the tRNA match the codons on the mRNA✓

Any (4)
(16)
[50]

QUESTION 3

3.1
- The common ancestor of the original baobab population/the baobab population of Gondwanaland was separated into two populations✓
- by the **ocean/sea✓***
- There was no gene flow between the African baobab and Australian baobab✓/two baobab populations.
- Each baobab population were exposed to different environmental conditions✓/other selection pressures.
- Natural selections occur independently✓ in each of the two baobab populations.
- Such that the individuals of the two baobab populations become very different✓ from each other.
- genotypically and phenotypically✓
- even if the two baobab populations were to mix again✓
- they will not be able to interbreed.✓

The two baobab populations are now different baobab species (in the question) (No marks for this statement)

***1 Compulsory** + Any 5 **(6)**

3.2 3.2.1
- They use species-specific courtship behaviour✓*
- Males sing songs to attract female mates✓
- and females do not respond/recognise songs from other males✓

***1 Compulsory** + 2 (3)

3.2.2
- Breeding at different times of the year✓
- Plant adaptations to different pollinators✓
- Producing infertile offspring✓
- Prevention of fertilisation✓

(Mark first TWO only) Any (2)
(5)

3.3 3.3.1 B✓ (1)

3.3.2
- The pelvis is short and wide✓
- to support the body weight of the upper body✓

(Mark first ONE only) (2)

3.3.3 – Frees the arms✓
so that they could carry offspring✓/tools/food/manipulate things
– Allows the ability to see further✓
to spot danger✓/food
– Reduces the surface area exposed to the sun,✓
so, less heat is absorbed✓/less heat lost/improved thermoregulation
– Expose the genitals✓
to attract the opposite sex✓
– Efficient locomotion✓
allows travelling longer distances✓
(Mark first TWO only) Any 2 x 2 (4)
(7)

3.4 3.4.1 Hominidae✓ (1)

3.4.2 Diagram III✓ (1)

3.4.3 – The foramen magnum is in a more forward position✓
– The palate is more rounded✓
(Mark first TWO only) (2)

3.4.4 – The jaw/palate is rectangular in Diagram II✓ and rounded in Diagram III✓
– Large spaces between the teeth in Diagram II✓ and small/ no spaces between the teeth in Diagram III✓
– Large canines/teeth in Diagram II ✓ and small canines/ teeth in Diagram III ✓
(Mark first THREE only) Any 3 x 2 (6)

3.4.5 – This organism in Diagram II had a diet of hard, raw food✓
– and the organism in Diagram III has a diet of softer✓/ cooked food (2)
(12)

3.5 3.5.1 Phenotype Black short fur✓ x White long fur✓ (2)

3.5.2 Gametes BH, Bh, bH, bh✓✓ (2)

3.5.3 (a) Black Short fur; Black Long fur; White Short fur; White Long fur✓✓ (2)

(b) Black fur✓ (1)

3.5.4 – Because of the random arrangement of chromosomes at the equator during meiosis✓/any one of two alleles of a characteristic can sort with any two of another characteristic
– the alleles of different genes move independently of each other into the gametes✓
– They can therefore appear in the gametes in different combinations✓ (3)
(10)

3.6 3.6.1 – Females lay many eggs✓ which will ensure that the ratios obtained will be reliable✓
– The eggs develop very quickly✓/7 to 14 days therefore, results will be obtained fast✓
– Can clearly differentiate between male and female✓ making it easy to breed✓
– Fruit flies survive and breed in small flasks✓ making it easy to observe and work with✓
– The food medium required is simple✓/cheap making it easy/cheap to conduct the investigation✓
(Mark first TWO only) (Any 2 x 2) (4)

3.6.2

P_1 Phenotype: White-eyed male x red-eyed female✓

Genotype: X^rY x X^RX^R ✓

Meiosis

G/gametes X^r , Y X^R , X^R ✓

Fertilisation

F_1 Genotype X^RX^r X^RX^r X^RY X^RY ✓

Phenotype: 2 red-eyed males : 2 red-eyed females
1 red eyed male : 1 red-eyed female✓*

P_1 and F_1 ✓
Meiosis and fertilisation ✓

(***1 Compulsory** + Any 5)

OR

P_1 Phenotype: White-eyed male x Red-eyed female✓
Genotype: X^rY x X^RX^R ✓

Meiosis

Fertilisation

Gametes	X^R	X^R
X^r	X^RX^r	X^RX^r
Y	X^RY	X^RY

1 mark for correct gametes✓
1 mark for correct genotypes✓

F_1 Phenotype: 2 red-eyed males: 2 red-eyed females
1 red-eyed male: 1 red-eyed female✓*

P_1 and F_1 ✓
Meiosis and fertilisation ✓ (6)

(***1 Compulsory** + Any 5) **(10)**
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150