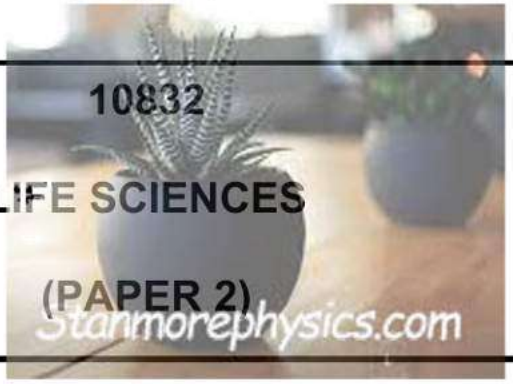
GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2024



10832

LIFE SCIENCES

(PAPER 2)

TIME: 2½ hours

MARKS: 150

LIFE SCIENCES: Paper 2

10832E

18 pages

X05

P.T.O.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

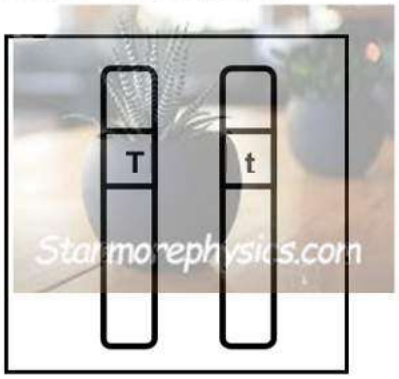
1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
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 answer and write only the letter (A – D) next to the question numbers (1.1.1 to 1.1.9) in the ANSWER BOOK, e.g. 1.1.10 D.

1.1.1 The diagram below shows the alleles for height in a flowering plant where T = tall plants and t = short plants.



The plant is …

A homozygous dominant for height.
B heterozygous for height.
C homozygous recessive for height.
D incompletely dominant for height.

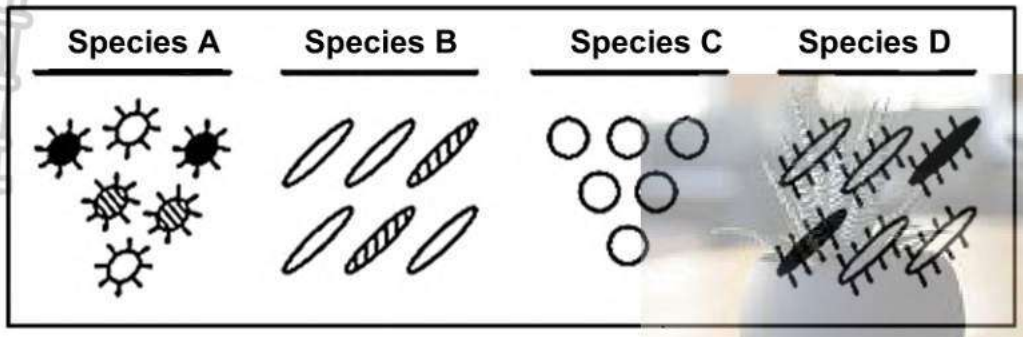
1.1.2 Which of the following is NOT applicable to crossing over?

A Genetic material is exchanged between non-identical chromatids of a homologous pair.
B Homologous chromosomes undergo crossing-over in Prophase II.
C The point at which genetic material is exchanged is the chiasma.
D The process increases genetic variation in the gametes produced by meiosis.

1.1.3 When changes occur in the genes of sex cells, these changes …

A lead to changes in the parent's phenotype.
B only affect asexually reproducing organisms.
C are always harmful to the offspring.
D can be the basis for evolutionary change.

1.1.4 The diagram below represents four different species of bacteria.



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Which statement is correct regarding the survival chances of these species if there is a change in the environment?

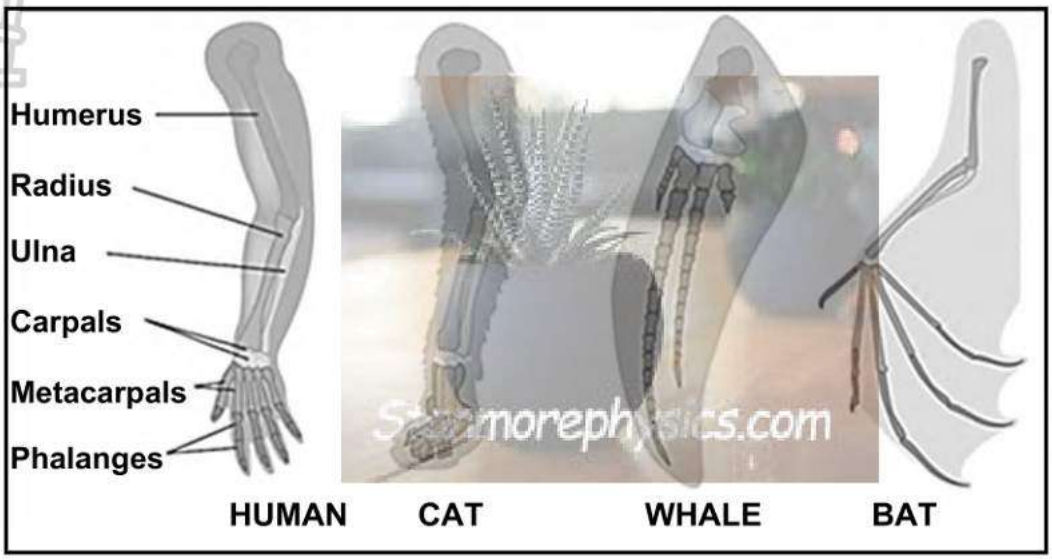
A Species **A** has the best chance of survival, because it has the most variation.
B Species **C** has the best chance of survival, because it has no gene mutations.
C Neither species **B** nor species **D** will survive, because they compete for the same resources.
D None of the species will survive, because bacteria reproduce asexually.

1.1.5 The relationship between genes and alleles is that …

A genes are different forms of the same allele.
B each person contains two alleles for the gene of one characteristic.
C genes can only have two possible alleles.
D alleles are the phenotypic expression of a gene.

1.1.6 The diagrams below represent the forelimbs of four animals that all contain similar bones.

Study the diagrams and statements below.



(i) The structures are homologous.
(ii) The animals do not share a common ancestor.
(iii) The forelimbs of all these animals have the same function.
(iv) The structures arose due to modification by descent.

Which statements above apply to the diagrams?

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

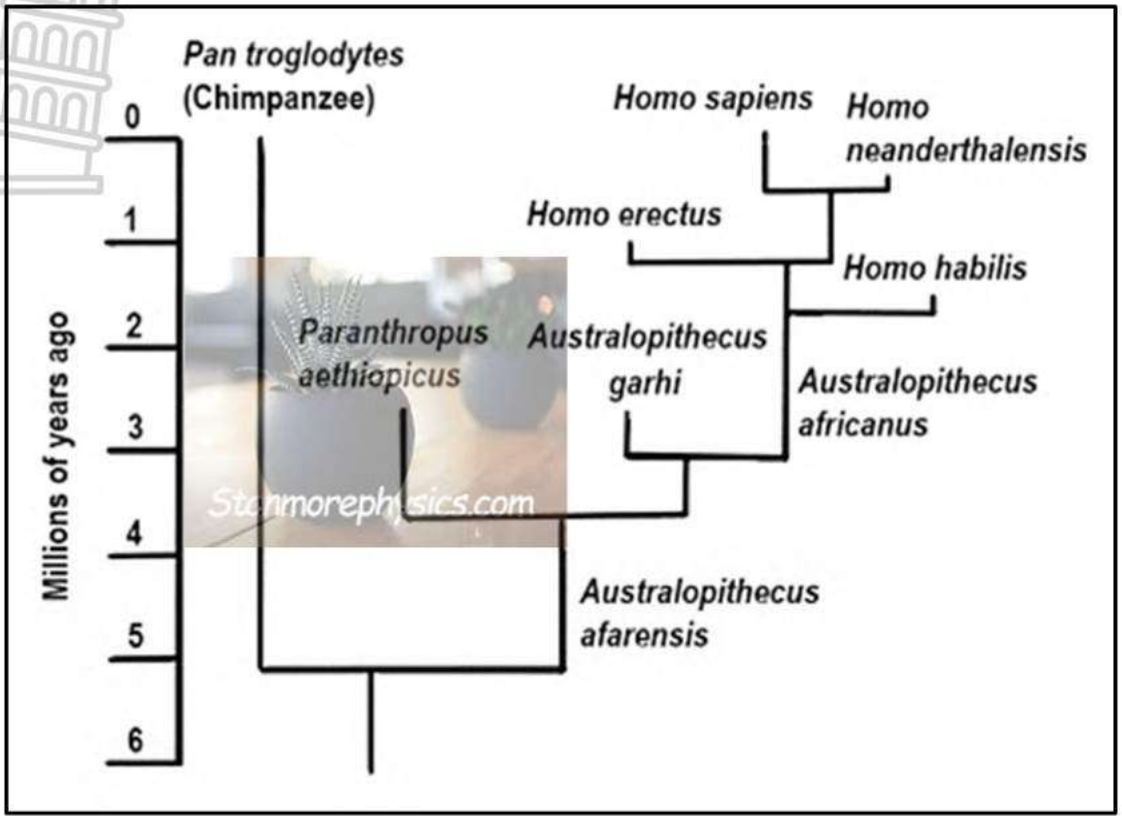
1.1.7 A certain disorder is caused by the dominant allele F.
The following combinations should be considered:

(i) ff x Ff
(ii) ff x FF
(iii) Ff x Ff
(iv) Ff x FF

Which of the following combinations of crosses can result in some offspring without the disorder?

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

QUESTIONS 1.1.8 AND 1.1.9 ARE BASED ON THE DIAGRAM BELOW.



1.1.8 Approximately how much longer did *Pan troglodytes* exist compared to its closest relative?

A 2,5 my
B 3,6 my
C 4,0 my
D 5,0 my

1.1.9 How many genera are represented in this diagram?

A 2
B 3
C 4
D 9

(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 1.2.7) in the ANSWER BOOK.

1.2.1 The allele that does not influence the phenotype in the heterozygous condition

1.2.2 The bond that forms between amino acid molecules in a protein

1.2.3 A portion of a chromosome that codes for a particular characteristic

1.2.4 The biotechnological process that produces a genetically identical organism

1.2.5 The type of variation where there is a range of intermediate phenotypes

1.2.6 The study of the past and present-day distribution of living organisms across the continents

1.2.7 The scientist who argued that acquired characteristics obtained by the parents, could be passed on to their offspring (7 x 1) **(7)**

1.3 Indicate whether each of the descriptions in COLUMN I apply 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	Characteristic of an African ape skull	A: Prognathous B: Less pronounced brow ridges
1.3.2	Characteristics of blood group inheritance	A: Multiple alleles B: Co-dominance
1.3.3	In a cross between a bull that is heterozygous for long eyelashes and brown coat colour and a cow that has short eyelashes and white coat colour, the gametes of the cow will be …	A: EB; Eb; eB and eb B: eb; Eb

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

1.4 The 'Out-of-Africa' hypothesis states that modern humans originated in Africa and then migrated to other continents. Some fossils of the genus *Australopithecus* have been discovered in South Africa.

1.4.1 Give the name of the scientist who discovered:

(a) Mrs Ples (1)

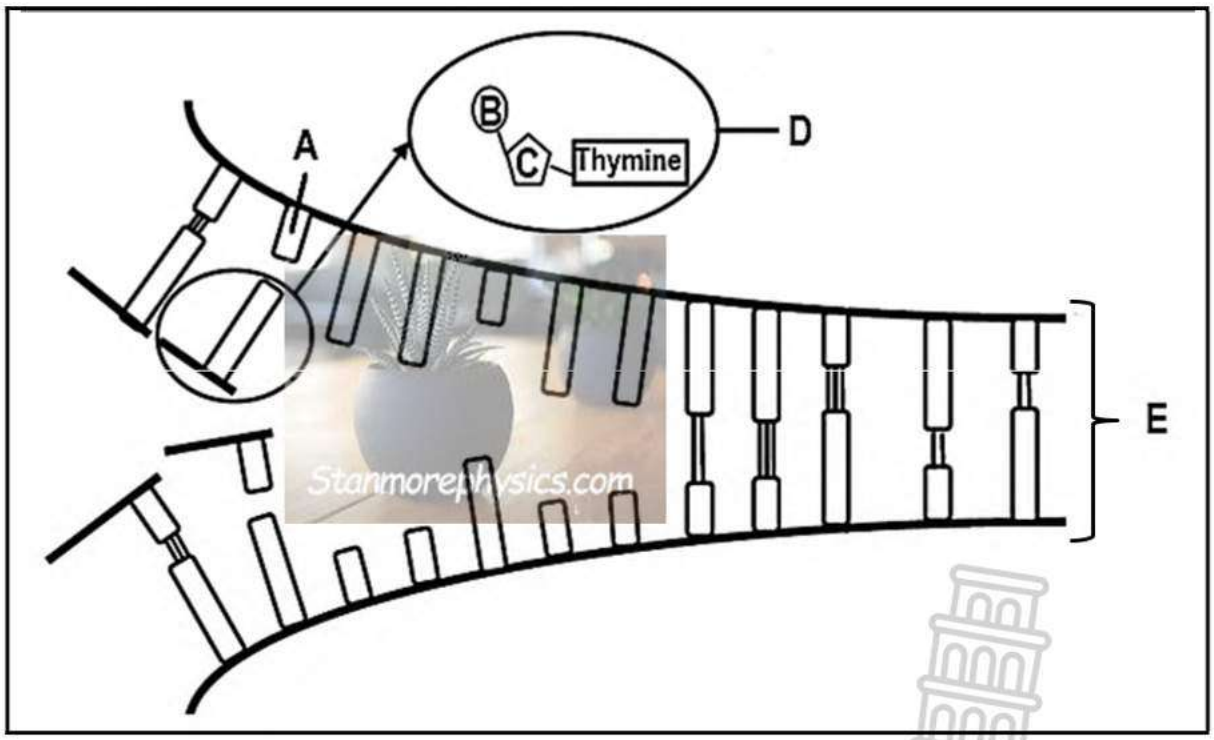
(b) Little foot (1)

1.4.2 State the fossil site where Little Foot was discovered. (1)

1.4.3 Give the species name of the fossil Karabo. (1)

1.4.4 Name the genetic evidence that supports the 'Out-of-Africa' hypothesis. (1)
(5)

1.5 The diagram below represents DNA replication.



1.5.1 During which phase in the cell cycle does DNA replication take place. (1)

1.5.2 State the natural shape of molecule **E**. (1)

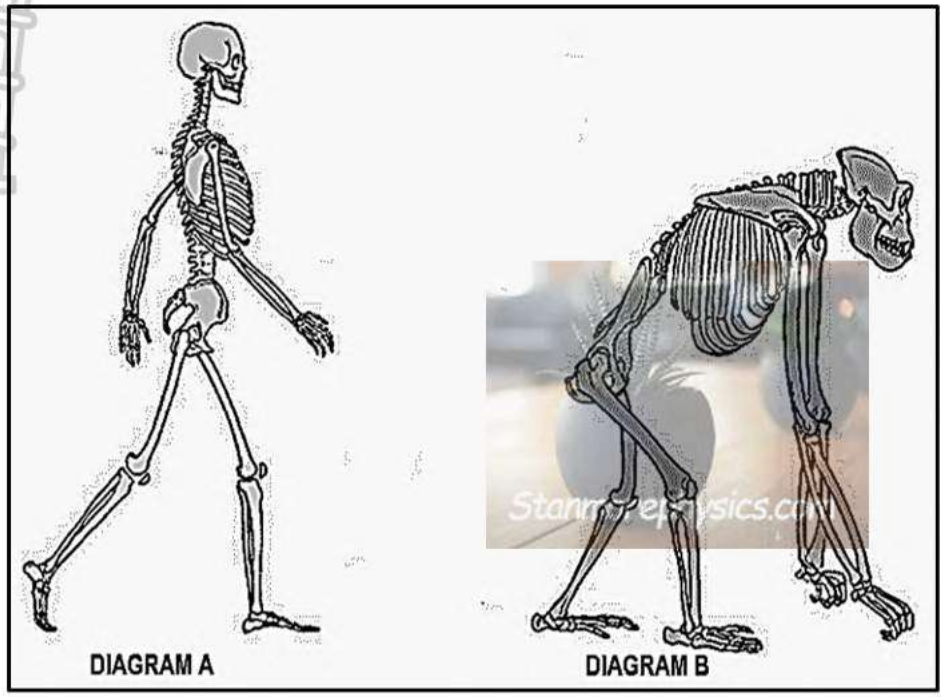
1.5.3 Give the LETTER and NAME for each of the following:

(a) A monomer (building block) of DNA (2)

(b) A sugar in DNA (2)

(c) The complimentary base for the nitrogenous base in molecule **D** (2)
(8)

1.6 The diagrams below show two skeletons.



1.6.1 Identify which of the diagrams (**A, B** or **Both A and B**) belongs to:

(a) Homo sapiens (1)

(b) Hominids (1)

1.6.2 Describe THREE characteristics of an organism's skeleton that allows for bipedalism. (3)

1.6.3 State the characteristic of the skull that allows for binocular vision. (1)

(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Table 1 below shows a partial DNA sequence of a human, and Table 2 shows the amino acids coded for by different mRNA codons.

Table 1				
Base triplet number	1	2	3	4
Human DNA sequence	TGT	ACG	TGC	ACA

Table 2	
mRNA codons	**Amino acid**
GUU, GUG, GUA	Valien
UGU, UGC	Cysteine
CCA, CCU	Proline
UUG, CUC, CUG, UUA	Leucine
ACG, ACA	Threonine
UAC, UAU	Tyrosine

2.1.1 Name and describe the process in protein synthesis that is responsible for the formation of mRNA. (5)

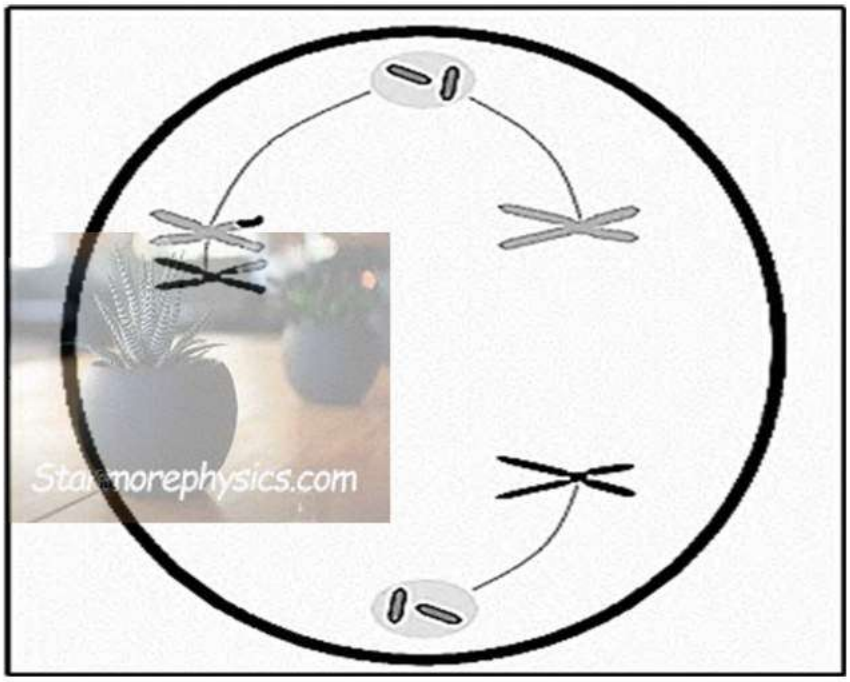
2.1.2 Give the mRNA codon that is formed from base triplet number **4** on the DNA sequence. (1)

2.1.3 Name the amino acid coded for by base triplet **2**. (1)

2.1.4 A mutation caused base triplet **1** to change so that it looks the same as base triplet **3**.

Explain what effect this mutation has on the protein formed. (4)
(11)

2.2 The diagram below shows a cell during a phase of Meiosis I and a phenomenon that can occur during this phase of meiosis, which may lead to chromosomal mutations.



2.2.1 At the end of meiosis gametes are produced.

Explain ONE other biological importance of meiosis. (3)

2.2.2 Tabulate TWO differences between Meiosis I and Meiosis II. (5)

2.2.3 Draw a labelled diagram of this cell in the phase before the one shown above. (5)

2.2.4 Name and describe the phenomenon that occurred in the cell above. (3)

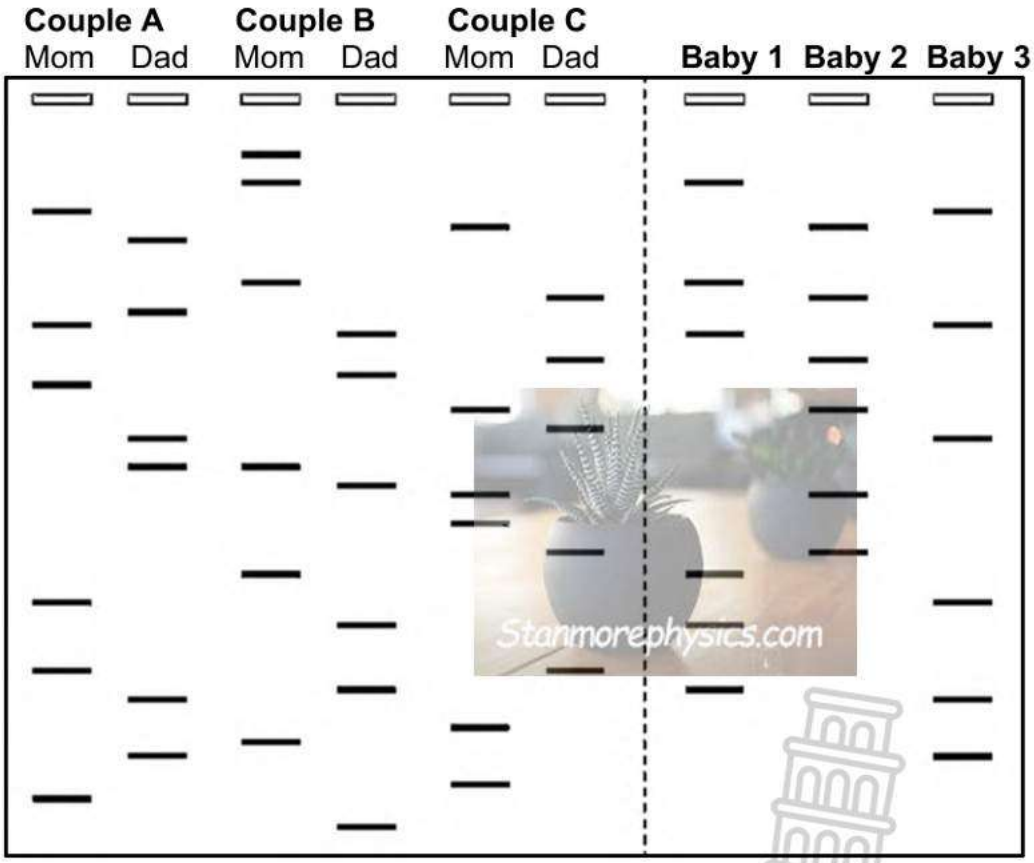
2.2.5 At the end of meiosis in this cell, if one gamete containing three chromosomes fertilises a gamete containing two chromosomes, would this lead to Down syndrome? (1)

2.2.6 Give a reason for your answer to QUESTION 2.2.5. (2)
(19)

2.3 Although a rare occurrence, cases of babies being switched at birth in a hospital have made the news in the past. Since an individual's DNA sequence is unique, with the exception of identical twins, DNA profiling is a reliable way of determining the parents of a given baby. Restriction fragment-length polymorphism (RFLP) or using the polymerase chain reaction (PCR) are two methods used in analysing DNA profiles.

Below are the results of DNA profiling conducted on three babies and three sets of parents, when a hospital suspected that babies may have been switched.

The hospital allocated the babies as follows:
Baby 1 was given to **Couple A**, **Baby 2** to **Couple C** and **Baby 3** to **Couple B.**



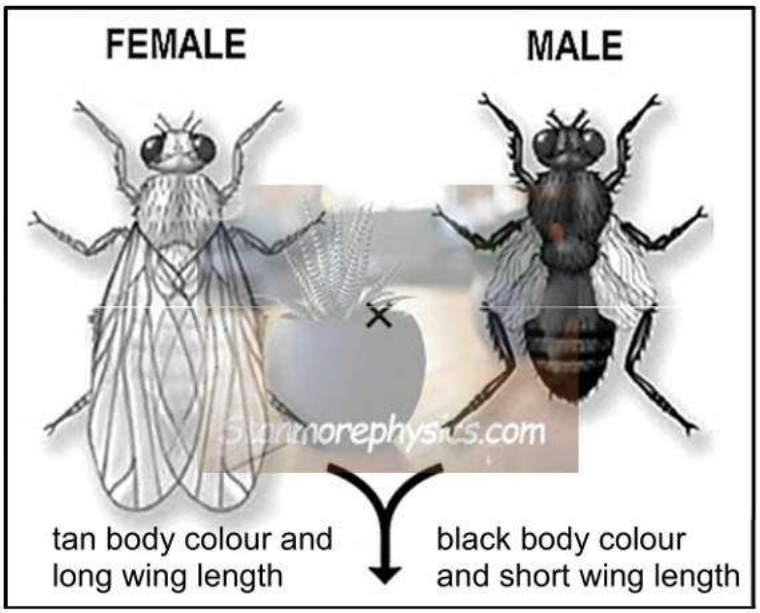
2.3.1 From the text above, state TWO methods used to analyse DNA profiles. (2)

2.3.2 Based on the DNA profiles provided, which baby/babies was/were correctly allocated by the hospital? (1)

2.3.3 Explain your answer to QUESTION 2.3.2. (2)

2.3.4 Provide ONE other use of DNA profiling. (1)
(6)

2.4 In a species of fly, *Drosophila melanogaster*, tan (light brown) body colour (**T**) is dominant over black body colour (**t**) and long wing length (**L**) is dominant over short wing length (**l**).



The punnet diagram below shows the cross between the female and male *Drosophila melanogaster* fly as shown above.

Possible gametes	TL	tL
A	TtLl	**B**

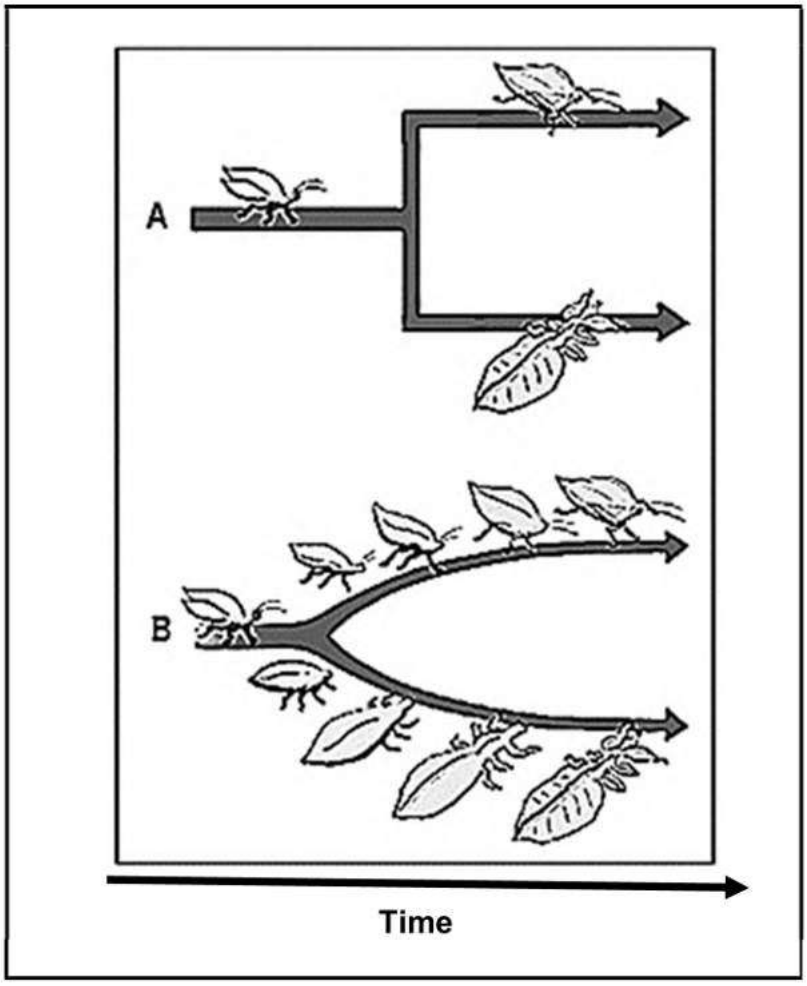
2.4.1 State why the type of cross involved in the above scenario is referred to as a dihybrid cross. (2)

2.4.2 The formation of gametes with different allele combinations can be explained by Mendel's Laws. Name the TWO laws that apply. (2)

2.4.3 Identify the:

(a) Genotype of the gamete of the male parent at **A** (1)
(b) Phenotype of offspring labelled **B** (2)
(c) Genotype of the female parent (1)
(8)

2.5 The diagram below shows two models of evolution based on the rate at which it occurs.



2.5.1 Give the LETTER (**A** or **B**) that would best represent:

(a) Gradualism (1)

(b) Eldrige and Gould's explanation of evolution (1)

2.5.2 Name and describe the model of evolution shown in **A**. (3)

2.5.3 Name the type of fossils that supports the model of evolution represented by **B**. (1)

(6)

[50]

QUESTION 3

3.1 Domesticated crops have been transformed over thousands of years and now look vastly different in comparison to their relatives in the wild.

Maize belongs to the genus *Zea* which includes wild teosinte (*Z. mays parviglumis*) and domesticated maize (*Z. mays mays*).

Teosinte produces a cob with only 6 – 12 kernels in 2 rows protected by a hard outer covering. Modern maize produced by farmers have a cob consisting of 500 or more exposed kernels in as many as 20 rows.

The diagram below shows the wild teosinte and domesticated maize cob.



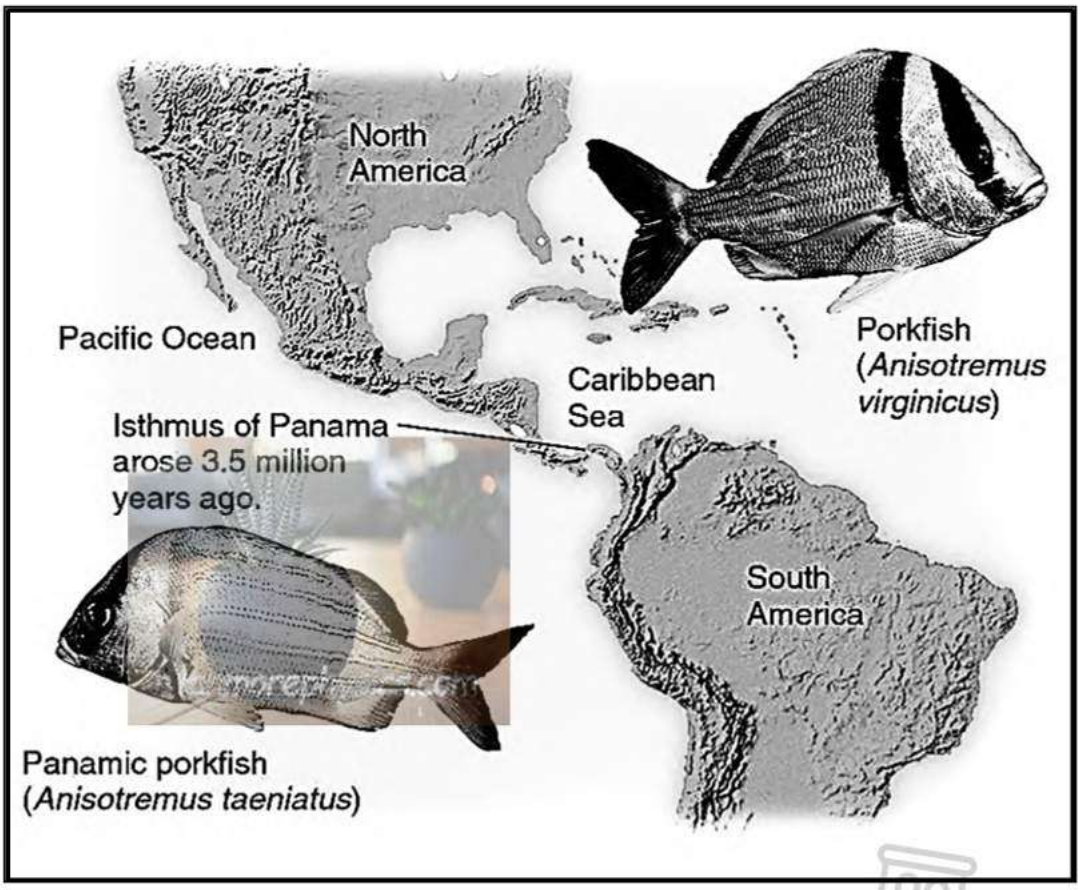
3.1.1 Name the process through which humans produced the modern maize. (1)

3.1.2 State ONE negative effect the process named in QUESTION 3.1.1 may have on a species. (1)

3.1.3 Describe how the process mentioned in QUESTION 3.1.1 was carried out on maize. (3)

3.1.4 Explain ONE economic benefit that producing the modern maize cob has to farmers. (2)
(7)

3.2 An isthmus is a narrow strip of land that connects two larger landmasses and separates two bodies of water. The Isthmus of Panama is a narrow strip of land that joins North and South America. Scientists believe that this strip of land formed 3,5 million years ago. The Caribbean Sea is warm, while the Pacific Ocean is cooler. Porkfish, genus *Anisotremus*, can be found on either side of the narrow strip of land. However, when scientists placed male porkfish from the Caribbean Sea and female Panamic porkfish from the Pacific Ocean into the same fish tank, they would not copulate. They are now considered to be two different species.



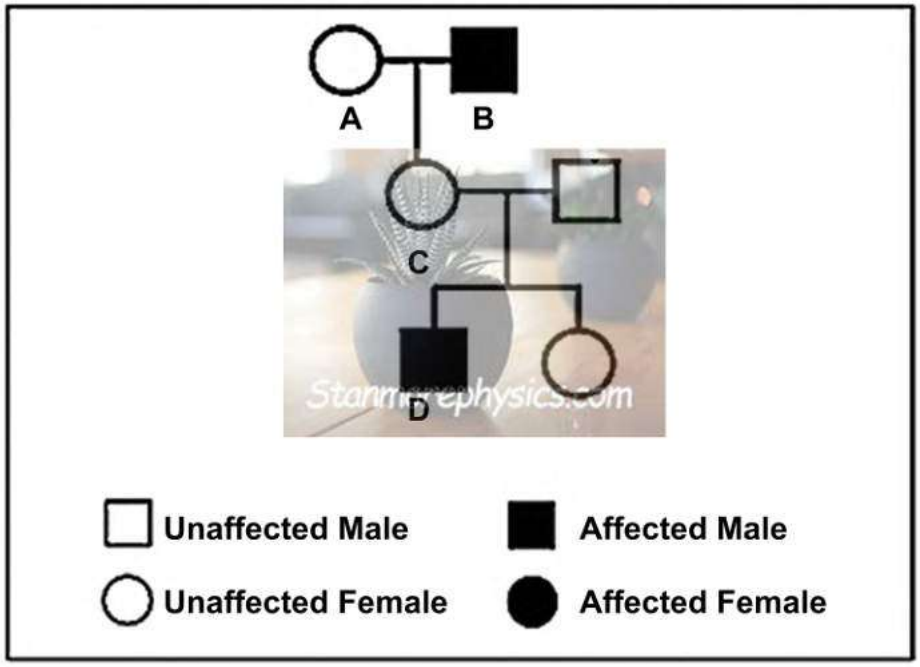
3.2.1 Define the term *species*. (2)

3.2.2 Name TWO reproductive isolating mechanisms that may have prevented the two species of porkfish from copulating. (2)

3.2.3 Based on the scenario above, describe the speciation of the porkfish through geographic isolation. (7)
(11)

3.3 Ichthyosis is a skin disorder caused by a mutation of a gene carried on the X-chromosome.

The disorder results in dry, scaly skin due to a deficiency of an enzyme. Individual **B** has a genotype X^tY.



3.3.1 Name the type of diagram shown above. (1)

3.3.2 Provide the possible genotype/s of individual **A**. (2)

3.3.3 Explain the relationship between the inherited genotype and phenotype of individual **C** and Mendel's Law of Dominance. (4)

3.3.4 Explain why males are more likely to be affected by this disorder than females. (2)

3.3.5 Using a genetic cross, show how individual **D** inherited the genotype which caused this individual to be affected by the disorder. CIRCLE the genotype in the correct position on the cross. (6)
(15)

3.4 Nala and Luke are farmers of the same species of small fish. Nala breeds homozygous yellow fish while Luke breeds homozygous blue fish.

In an investigation to determine the dominant colour in this species of fish, they allowed for the yellow fish to breed only with the blue fish over five years and collected 100 offspring each year to observe.

The table below shows the average results of the offspring.

Phenotype	Average number of fish over five years
Yellow	20
Green	65
Blue	15

3.4.1 Name the type of dominance shown in this investigation. (1)

3.4.2 Provide a reason for your answer to QUESTION 3.4.1. (1)

3.4.3 State:

(a) TWO ways in which the reliability of this investigation was ensured (2)

(b) ONE way in which the results of the investigation were made more valid (1)

3.4.4 Give TWO planning steps that would have been taken for this investigation. (2)

3.4.5 Draw a bar graph to represent the results of this investigation. (6)
(13)

3.5 According to Darwin's theory of evolution, there is a great deal of variation in offspring.

Using natural selection, describe how variations in the offspring increases the number of individuals with favourable characteristics in the next generation. **(4)**
[50]

TOTAL SECTION B: 100

TOTAL: 150

END