education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2022

MARKS: 150

TIME: 2½ HOURS

This question paper consists of 16 pages

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in your 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. ALL drawings should be done in pencil and labelled in blue or black ink.
7. Draw diagrams 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 may use a non-programmable calculator, protractor and a compass.
11. Write neatly and legibly.

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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 to D) next to the question number (1.1.1 to 1.1.10) in your ANSWER BOOK, for example 1.1.11 D.

1.1.1 The process where one DNA molecule produces two identical DNA molecules is called …

A reproduction.
B replication.
C translation.
D transcription.

1.1.2 If half of a population mates in January and the other half mates in June, they will eventually become different species.

Which ONE of the following correctly describes the reproductive isolation mechanism given above?

A Different courtship patterns
B Species-specific courtship behaviour
C Prevention of fertilisation
D Breeding at different times of the year

1.1.3 When a DNA template strand that contains 22% adenine bases is transcribed, the mRNA produced will have …

A 22% thymine bases.
B 22% cytosine bases.
C 22% uracil bases.
D 22% guanine bases.

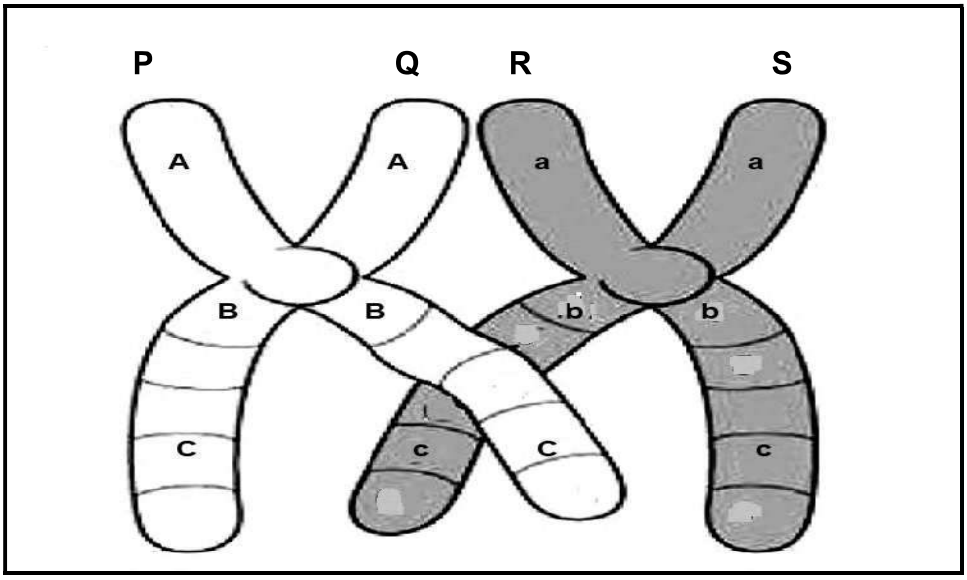
1.1.4 In an investigation, a chemical was used to prevent spindle fibres from forming in cells. This chemical was added to cells in the anthers of the flowers of rice plants. Each cell in the anther has 24 chromosomes.

What is the expected number of chromosomes in each daughter cell at the end of meiosis?

A 12 replicated chromosomes
B 24 replicated chromosomes
C 24 unreplicated chromosomes
D 48 unreplicated chromosomes

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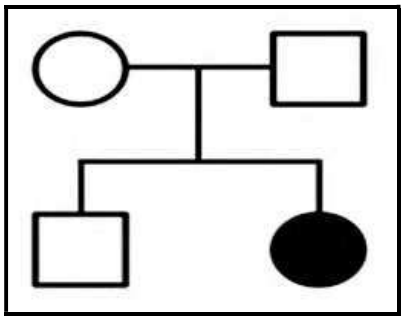
1.1.5 The diagram below represents one pair of homologous chromosomes during crossing over.



The allele sequence for chromatid **S** after the completion of crossing over will be…

A A, B, c
B A, b, C
C a, b, c
D a, b, C

1.1.6 The diagram below shows the pattern of inheritance of a disorder.



One can conclude that the disorder is caused by a …

A recessive allele, with both parents homozygous recessive.
B recessive allele, with both parents heterozygous.
C dominant allele, with one parent heterozygous while the other is homozygous dominant.
D dominant allele, with both parents homozygous recessive.

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1.1.7 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

1.1.8 Which of the following indicates that Darwin's and Lamarck's theories are similar?

A Acquired characteristics of organisms are passed from parents to offspring.
B Population as a whole changes.
C Evolution depends on changes in the environment.
D Evolution happens very rapidly

1.1.9 Some genes from the bacterium *E. coli* have sequences that are similar to genes found in humans.

This statement is an example of which type of evidence?

A Biogeography
B Fossil
C Genetic
D Modification by descent

1.1.10 The table below compares the rate of extinction of mammal species over two different time periods.

TIME PERIOD (YEARS	RATE OF EXTINCTION (PER 100 YEARS)
1500–1900	**4,5**
1900–2000	**90**

What is the ratio between the rate of extinction from 1500 to 1900 compared to the rate of extinction from 1900 to 2000?

A 1: 20
B 1: 2
C 2: 1
D 20: 1

(10 x 2) **(20)**

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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 1.2.10) in your ANSWER BOOK.

1.2.1 The monomers of DNA

1.2.2 The bond formed between two monomers of a protein

1.2.3 Structures formed when the centrosome divides into two

1.2.4 Chromosomes involved in sex determination

1.2.5 An arrangement of black bars representing DNA fragments that can be used to determine whether people are related

1.2.6 The number, size and shape of chromosomes in a body cell

1.2.7 The period between two consecutive cell divisions

1.2.8 The family to which humans belong

1.2.9 Specific parts of DNA that carry the codes for characteristics of organisms

1.2.10 The different characteristics that occur naturally from one individual to another in a population (10 x 1) **(10)**

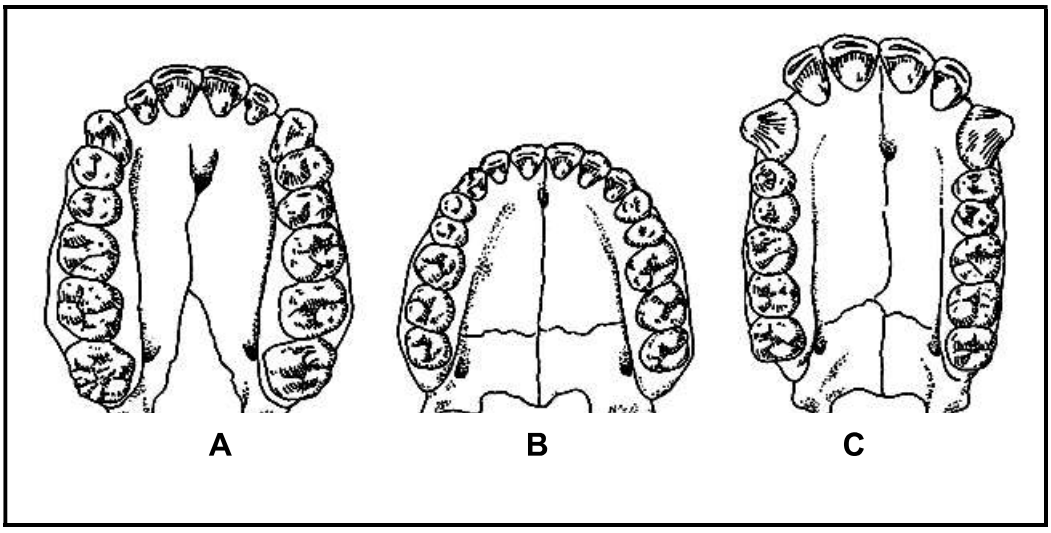
1.3 Indicate whether each of the statements in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.4) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	The significance of RNA	A: B:	Replicates DNA Reduces the number of chromosomes
1.3.2	The site of protein synthesis	A: B:	Mitochondrion Ribosomes
1.3.3	The pairing of chromosomes	A: B:	Mutation Non-disjunction
1.3.4	Capable of bipedal locomotion	A: B:	*Homo erectus* *Australopithecus africanus*

(4 x 2) **(8)**

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1.4 The diagram below shows the dentition of three genera.



1.4.1 Give only the LETTER(S) (**A, B or C**) of the organisms that is/are:

(a) Most likely to eat raw food only. (2)

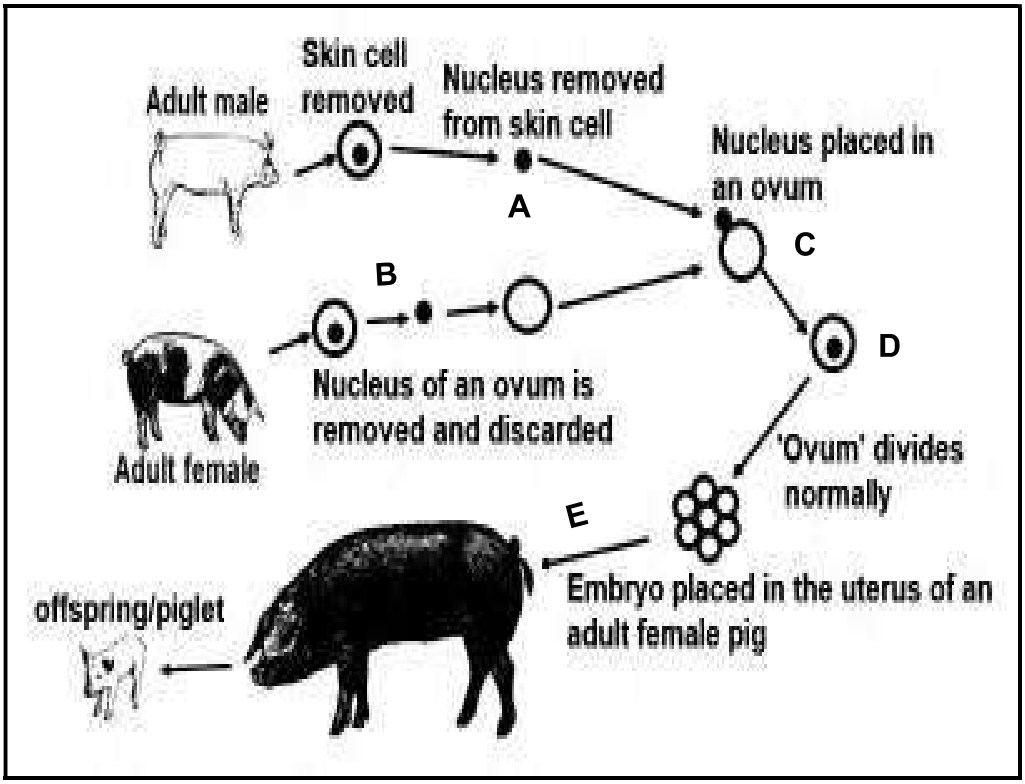
(b) Most likely to eat soft, cooked food. (1)

1.4.2 Which diagram (**A**, **B** or **C**) represents the dentition of *Australopithecus afarensis*? (1)

1.4.3 Give ONE observable reason for your answer to QUESTION 1.4.2 (1)

1.4.4 Give the correct sequence of the organisms (**A, B** and **C**) from most primitive to most evolved. (2)
(7)

1.5 The diagram below shows a genetic engineering process. A donor cell was taken from the skin cell of a male pig to create a new offspring.



1.5.1 Name the genetic engineering process shown in the diagram above. (1)

1.5.2 Name the type of cell division through which:

(a) Cell **D** divides. (1)

(b) Ovum **B** is produced. (1)

1.5.3 A somatic cell in a pig contains **38** chromosomes.

How many chromosomes would there be in:

(a) Structure **A** (1)

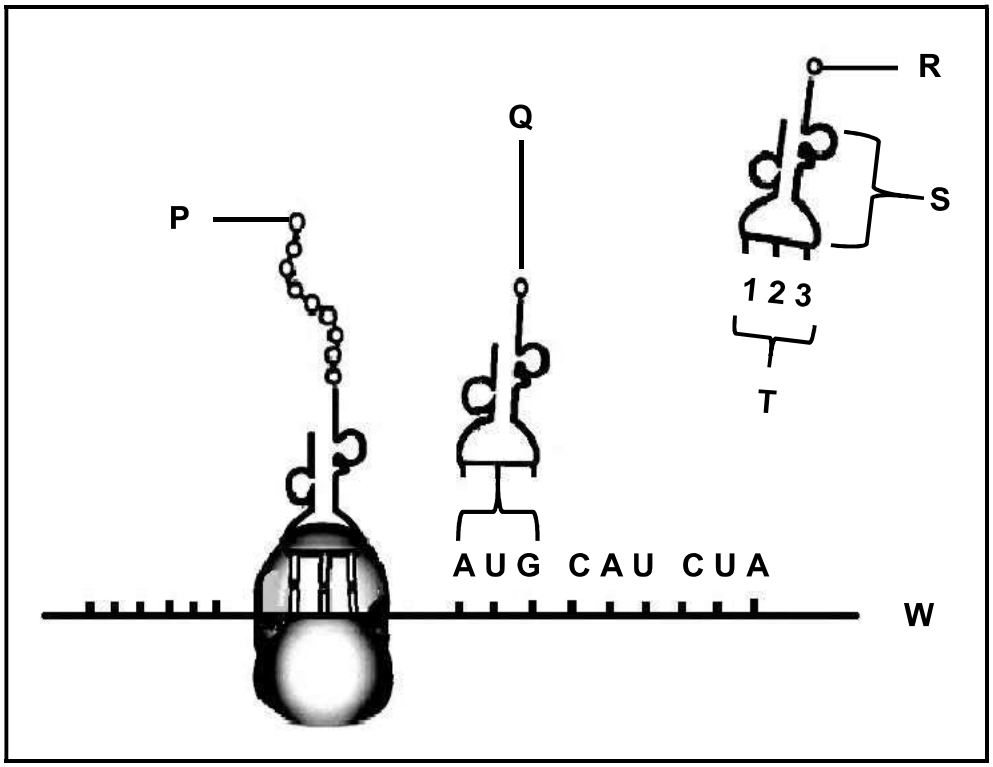
(B) A skin cell in organism **E** (1)
(5)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents a stage of protein synthesis.



2.1.1 Identify molecule:

(a) **P** (1)

(b) **S** (1)

2.1.2 If **R** is the next amino acid required after **Q**, then identify:

(a) Anticodon **T** (2)

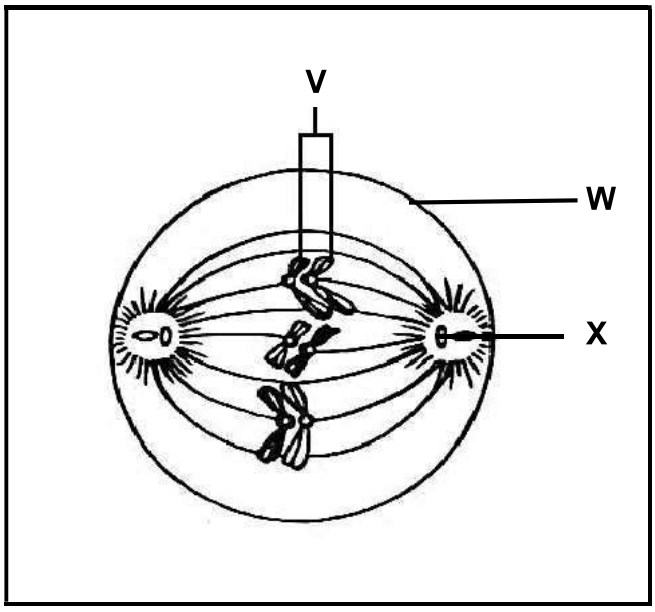
(b) The DNA base triplet that codes for **R**. (2)

2.1.3 Describe the role of DNA during the formation of molecule **W**. (2)

2.1.4 Name and describe the process represented in the diagram. (7)
(15)

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2.2 The diagram below represents a phase of meiosis in animals.



2.2.1 Identify the phase represented by the diagram. (1)

2.2.2 Give ONE visible reason for your answer to QUESTION 2.2.1. (1)

2.2.3 Label part **W**. (1)

2.2.4 State ONE function of part **X**. (1)

2.2.5 Name the female organ where meiosis occurs. (1)

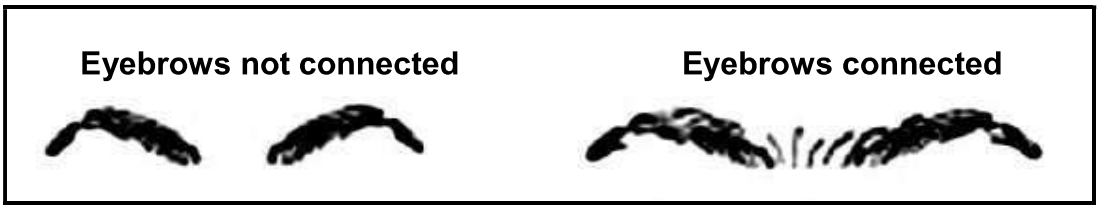
2.2.6 Give the number of chromosomes in each cell at the end of meiosis represented by this diagram. (1)

2.2.7 List THREE characteristics that the two structures indicated by **V** have in common. (3)

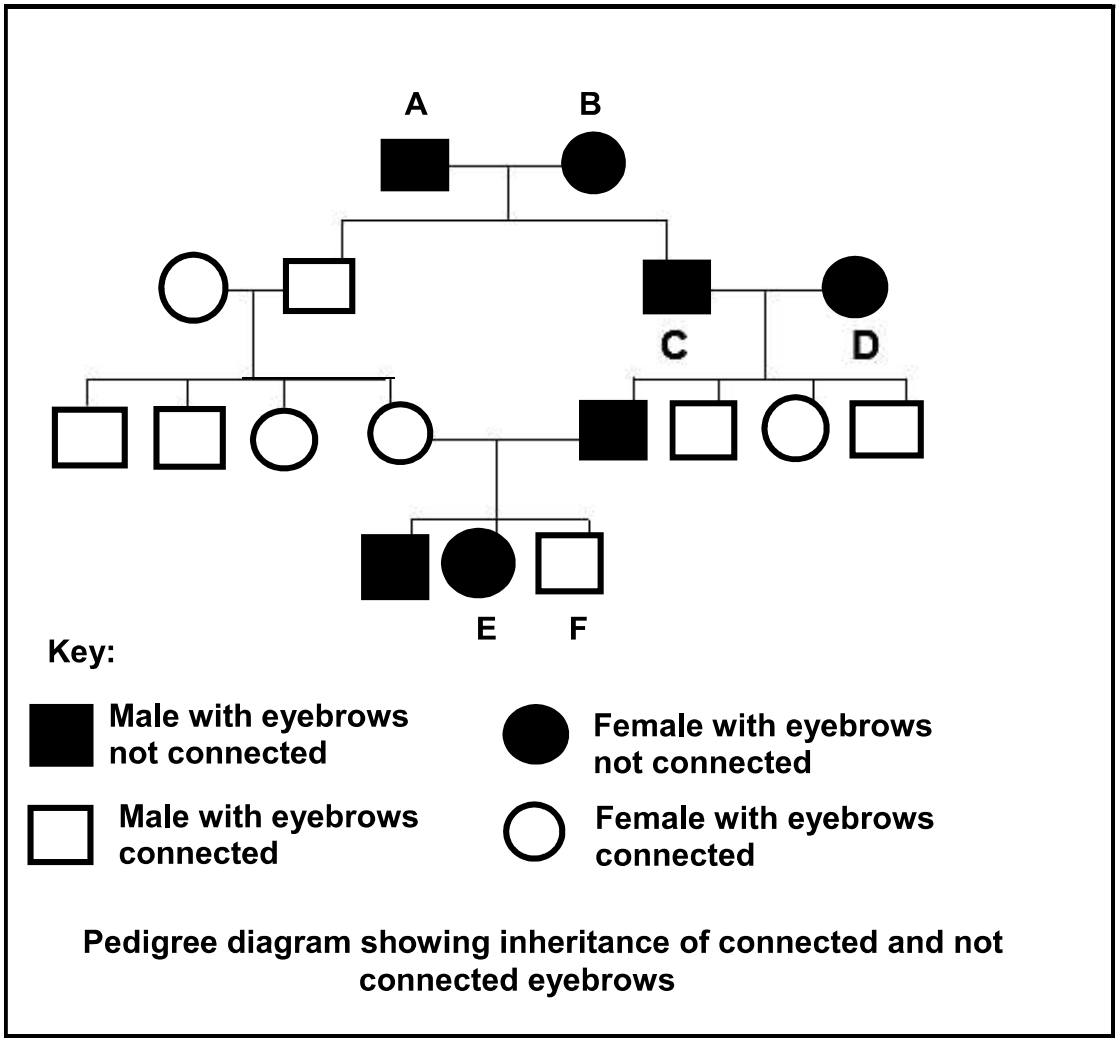
2.2.8 Explain TWO ways in which meiosis is important. (4)
(13)

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2.3 Human eyebrows are either connected or not connected to each other.



The pedigree diagram below shows the inheritance of 'connected' and 'not connected' eyebrows in a family.



Pedigree diagram showing inheritance of connected and not connected eyebrows

2.3.1 Which type of eyebrows is controlled by the dominant allele? (1)

2.3.2 Give a reason for your answer to QUESTION 2.3.1 using evidence from the pedigree diagram. (2)

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2.3.3 State the number of:

(a) Generations represented in this pedigree diagram (1)

(b) Offspring of individuals **C** and **D** (1)

2.3.4 What percentage of the females in this family has connected eyebrows? Show ALL workings. (2)

2.3.5 State Mendel's law of dominance. (2)
(9)

2.4 Blood groups are an inherited characteristic. The table below shows the percentage people in a community with each of the different blood groups.

Blood group	**O**	**A**	**B**	**AB**
Percentage of the community (%)	46	35	14	5

2.4.1 How many genes control blood groups? (1)

2.4.2 (a) What is the blood group of an individual with the genotype $I^A I^B$? (1)

(b) How does the inheritance of the blood group mentioned in QUESTION 2.4.2(a) differ from the inheritance of other blood groups? (1)

2.4.3 Give the possible genotypes for blood group **A**. (2)

2.4.4 Explain how it is genetically possible to have four blood groups in a community. (2)

2.4.5 Draw a bar graph to represent the information in the table. (6)
(13)

[50]

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QUESTION 3

3.1 A group of learners investigated the frequency of dominant and recessive genetic traits in their school. Their hypothesis was:

There are more learners with dominant genetic traits than learners with recessive genetic traits.

They investigated 200 learners for the following traits:

DOMINANT TRAIT	RECESSIVE TRAIT
Unattached earlobe	Attached earlobe
Rolled tongue	Unrolled tongue
Bent little finger	Straight little finger

The table below shows the results obtained.

	NUMBER OF LEARNERS	
TRAIT	DOMINANT	RECESSIVE
Earlobe	70	130
Tongue	24	176
Little finger	15	185

3.1.1 Identify the independent variable for this investigation. (1)

3.1.2 Explain why the age of the learners need NOT be controlled in this investigation. (2)

3.1.3 State ONE way in which the learners can increase the reliability of their results. (1)

3.1.4 List ONE planning step the learners had to follow before starting to collect the data. (1)

3.1.5 Will the learners accept or reject their hypothesis? (1)

3.1.6 Explain your answer to QUESTION 3.1.5. (2)
(8)

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3.2 Haemophilia is a sex-linked disorder that causes excessive bleeding due to a lack of the blood clotting protein. This disorder is caused by a recessive allele on the X-chromosome (X^h)

3.2.1 Explain why this disorder affects mostly males in a family. (3)

3.2.2 A man with haemophilia and a woman who is heterozygous for haemophilia, decide to have children.

Use a genetic cross to show all the possible genotypes of their children. (6)
(9)

3.3 Scientists carried out an investigation to determine the development of insecticide resistance of insects. A population of insects was treated with an insecticide from the year 1995 to 1998. The percentage that was resistant to the insecticide was calculated.

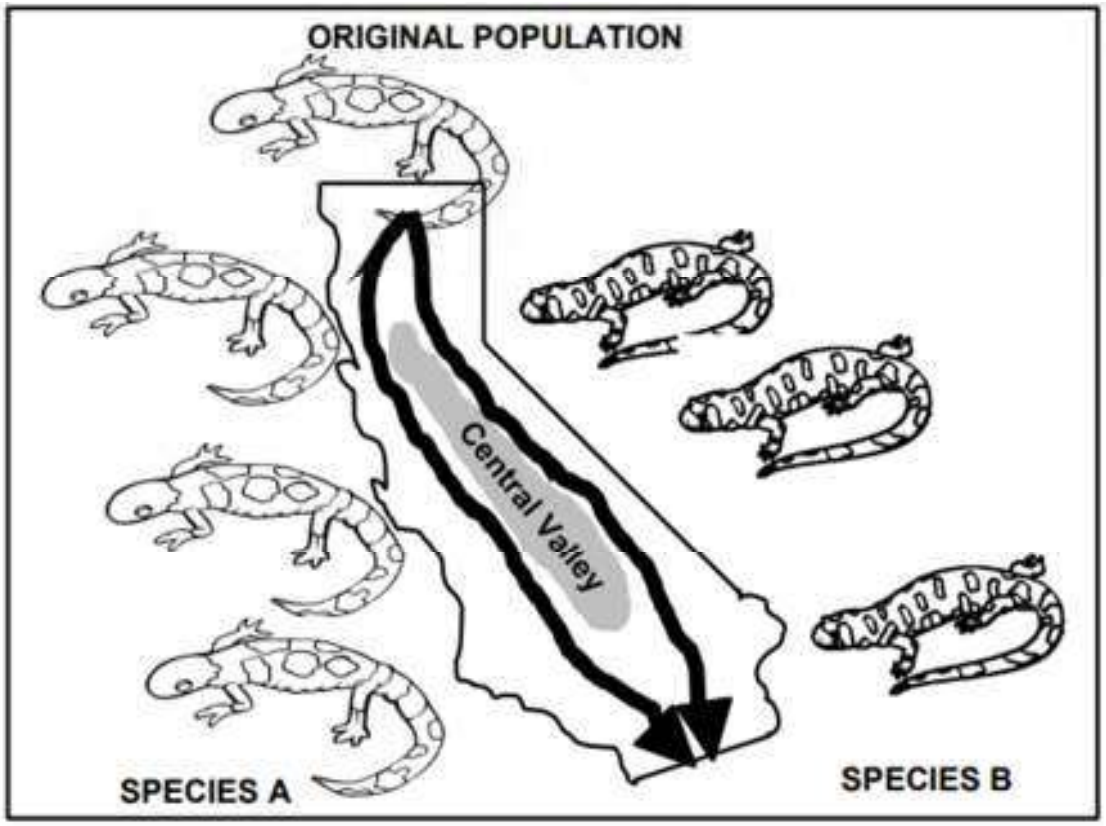
The table below shows data from an insect population in 1995 and 1998.

CHANGE IN THE RESISTANCE TO INSECTICIDE IN AN INSECT POPULATION		
Characteristic	**Percentage of population in 1995**	**Percentage of population in 1998**
Resistance	0,15	99,1

3.3.1 Describe the change in the insecticide resistance of the insect population between 1995 and 1998. (2)

3.3.2 Describe how natural selection caused insecticide resistance in this population. (7)
(**9**)

3.4 The diagram below shows an evolutionary process taking place in a population of salamanders. The process took place gradually, millions of years ago. Study the diagram and answer the questions that follow.

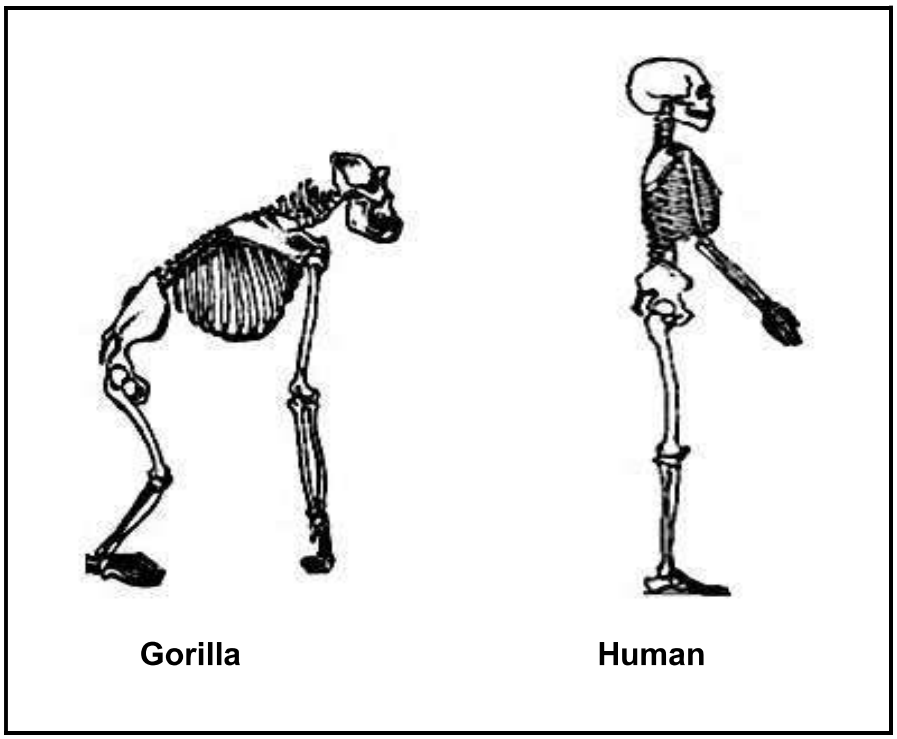


3.4.1 Which evolutionary process is shown in the diagram? (1)

3.4.2 Use the diagram to explain how species **B** evolved from the original species. (6)

3.4.3 Explain why this is not an example of punctuated equilibrium. (4)
(11)

3.5 The diagrams below show the skeletons of a gorilla and a human.



3.5.1 State THREE characteristics of the upper limbs that are the same in both species. (3)

3.5.2 Name TWO *Australopithecus* fossils that were found in South Africa. (2)

3.5.3 Explain the significance of the change of the pelvis towards bipedalism. (4)

3.5.4 Explain how genetic evidence supports the hypothesis that all living humans are “Out of Africa”. (4)
(13)

[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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