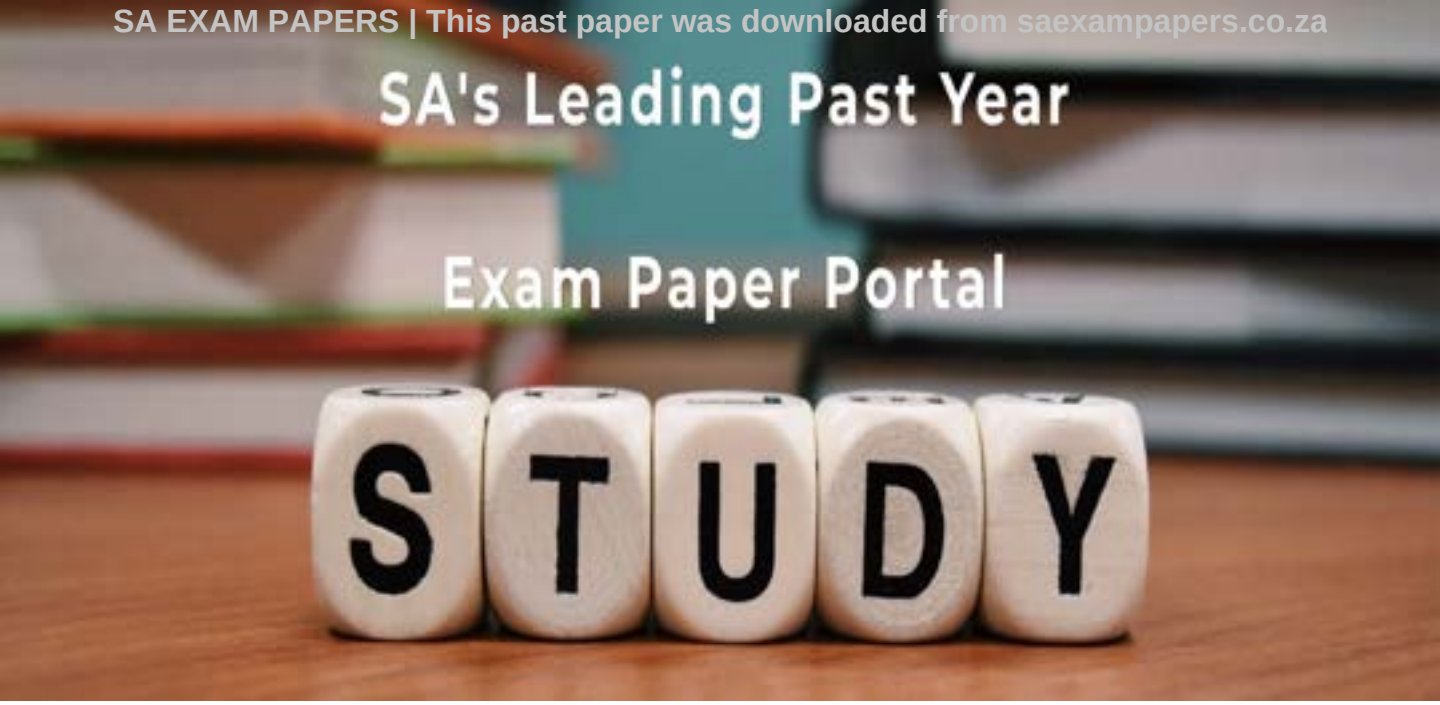

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NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2025

LIFE SCIENCES

MARKS: **150**

TIME: **2½ hours**

JLFSCE

This question paper consists of 17 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 answer 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, 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 may use a non-programmable calculator, protractor and a compass where necessary.
11. Write neatly and legibly.

SECTION A

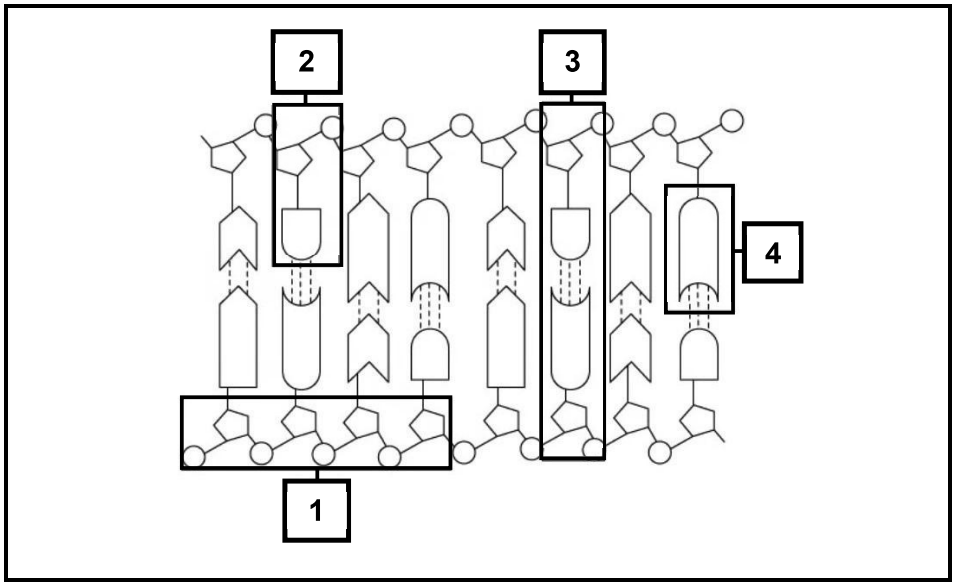
QUESTION 1

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 1.1.9) in the ANSWER BOOK, for example 1.1.10 A.

1.1.1 The tough, non-elastic tissue that covers the outer part of the eyeball is the …

A retina.
B choroid.
C conjunctiva.
D sclera.

1.1.2 The diagram shows part of a DNA molecule.



Which combination of parts represents one nucleotide?

A 1
B 2
C 3
D 4

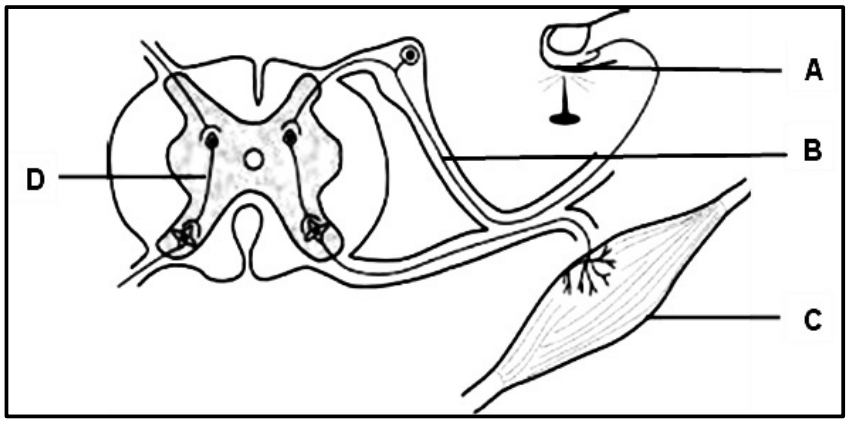
1.1.3 How many amino acids are coded for by a DNA template containing 180 nucleotides?

A 30
B 60
C 180
D 540

1.1.4 During which phase of meiosis does crossing over occur when homologous chromosomes pair up?

A Prophase I
B Prophase II
C Interphase
D Metaphase I

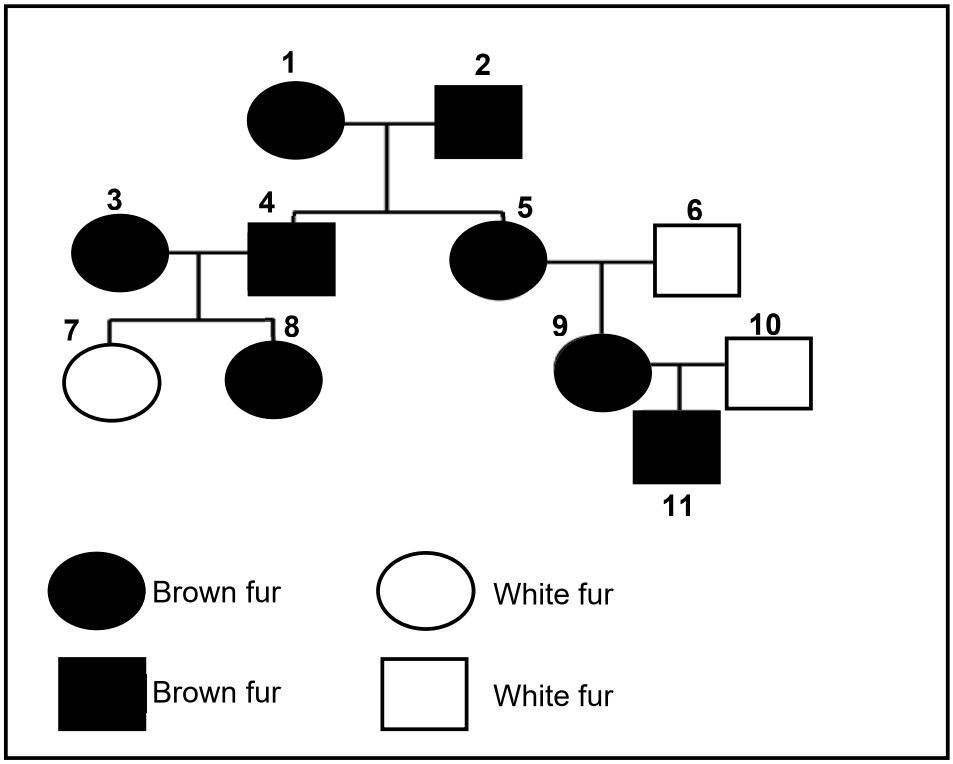
1.1.5 The diagram below represents a reflex arc.



Which ONE of the following pathways represents the correct order of structures of a reflex arc?

A A → B → C → D
B A → B → D → C
C C → D → B → A
D D → C → B → A

1.1.6 The diagram below shows the inheritance of fur colour in rabbits.



Which statement CORRECTLY describes the relationship between the phenotype and the type of allele?

A White fur is the phenotype expressed by the recessive allele in the heterozygous condition
B Brown fur is the phenotype expressed by the recessive allele in the homozygous condition
C White fur is the phenotype expressed by the dominant allele in the heterozygous condition
D Brown fur is the phenotype expressed by the dominant allele in the heterozygous condition

1.1.7 The following is a list of events that occur in the nucleus.

(i) The DNA double helix unwinds, and two DNA strands separate
(ii) Each original DNA strand is used as a template on which its complement is built
(iii) Free nucleotides build a DNA strand onto each of the original two DNA strands by attaching to their complementary nitrogenous bases
(iv) Two identical DNA molecules are formed

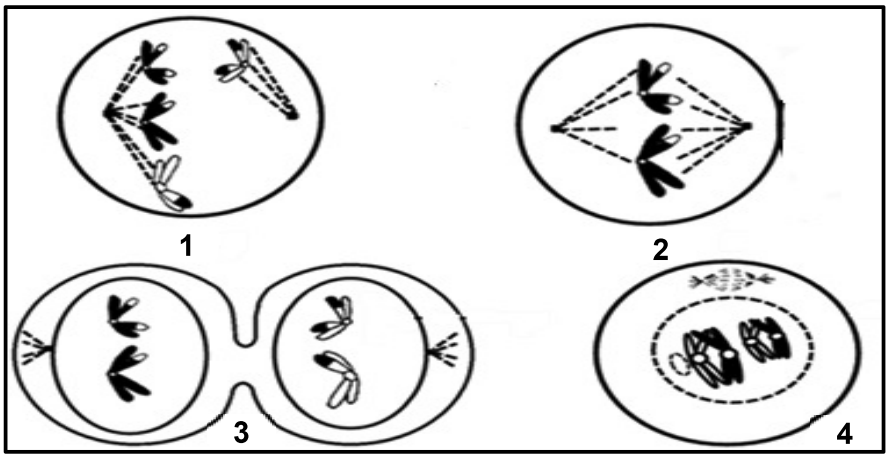
Which ONE of the following is a combination of events that occur during DNA replication?

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

1.1.8 How do the muscles control the constriction of the pupil?

A Both circular and radial muscles contract
B Circular muscles contract and radial muscles relax
C Circular muscles relax and radial muscles contract
D Both circular and radial muscles relax

1.1.9 The diagrams below represent different phases of meiosis.



Identify the correct event taking place at each phase.

	1	2	3	4
A	Random arrangement of chromosomes at the equator	Crossing over	Non-disjunction	Cytokinesis
B	Random arrangement of chromosomes at the equator	Cytokinesis	Crossing over	Non-disjunction
C	Non-disjunction	Random arrangement of chromosomes at the equator	Cytokinesis	Crossing over
D	Crossing over	Non-disjunction	Random arrangement of chromosomes at the equator	Cytokinesis

(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 1.2.8) in the ANSWER BOOK.

1.2.1 The division of the nervous system that is made up of the cranial and spinal nerves

1.2.2 A disorder of the nervous system caused by the breakdown of the myelin sheath of neurons

1.2.3 Phase in cell cycle where DNA replication occurs

1.2.4 Development where offspring are well developed, able to move and feed themselves and have their eyes open when they hatch

1.2.5 The type of lens required to correct long-sightedness

1.2.6 The structures in animal cells that give rise to spindle fibres during cell division

1.2.7 The layer of the eye which contains photoreceptors

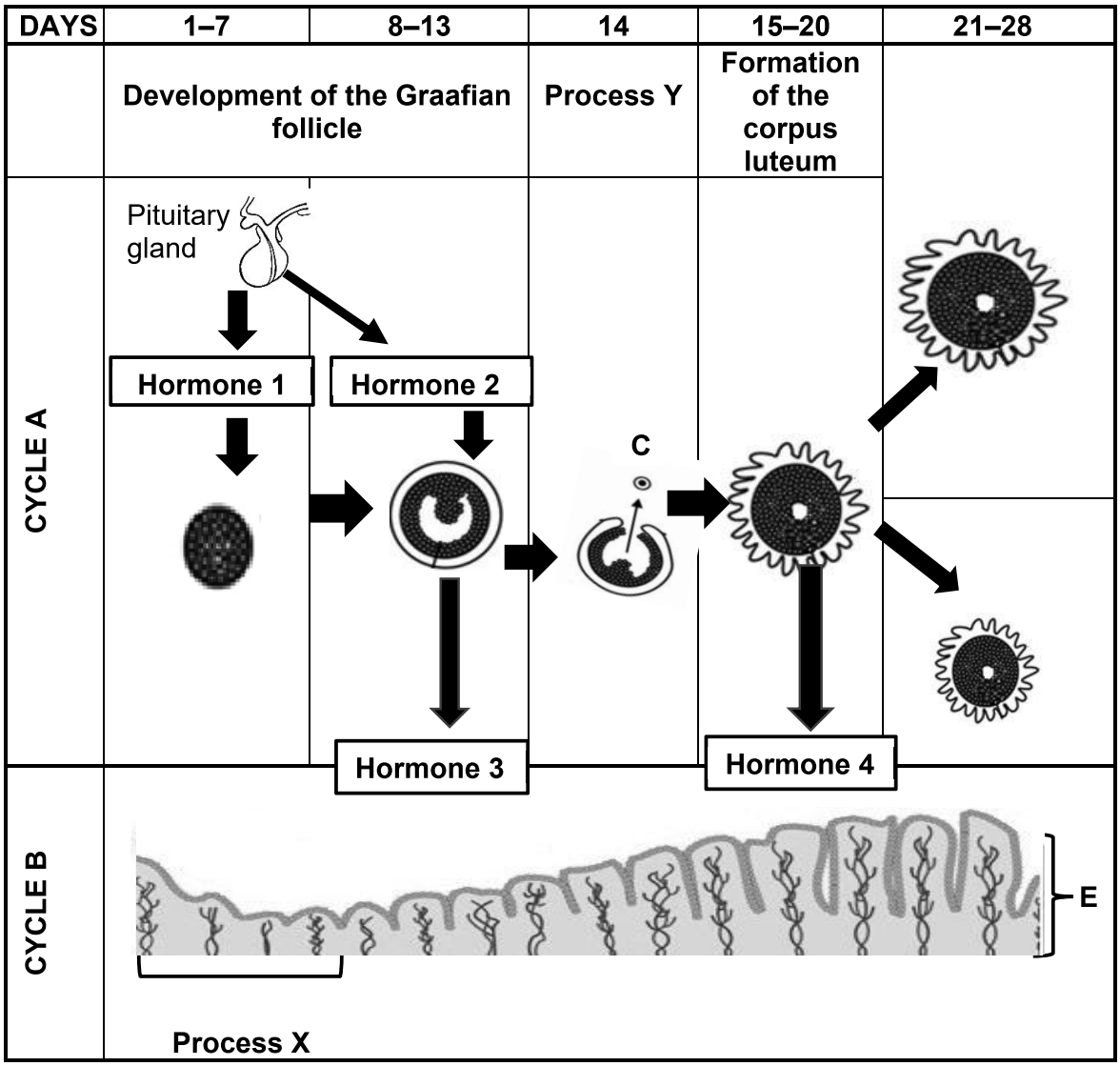
1.2.8 The microscopic gap between two neurons allowing impulses to be transmitted from one to the next (8 x 1) (8)

1.3 Indicate whether each of the descriptions 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	Receptors responsible for maintaining balance in the body	A: B:	Maculae Cristae
1.3.2	The process where the eye lens changes shape to allows a person to see at different distances	A: B:	Accommodation Pupillary mechanism
1.3.3	A structure in the nervous system that detects a stimulus	A: B:	Effector Receptor

(3 x 2) (6)

1.4 The diagram below represents the menstrual cycle.



1.4.1 Identify process:

(a) **X** (1)

(b) **Y** (1)

1.4.2 Name hormone:

(a) **2** (1)

(b) **4** (1)

1.4.3 Name cycle:

(a) **A** (1)

(b) **B** (1)

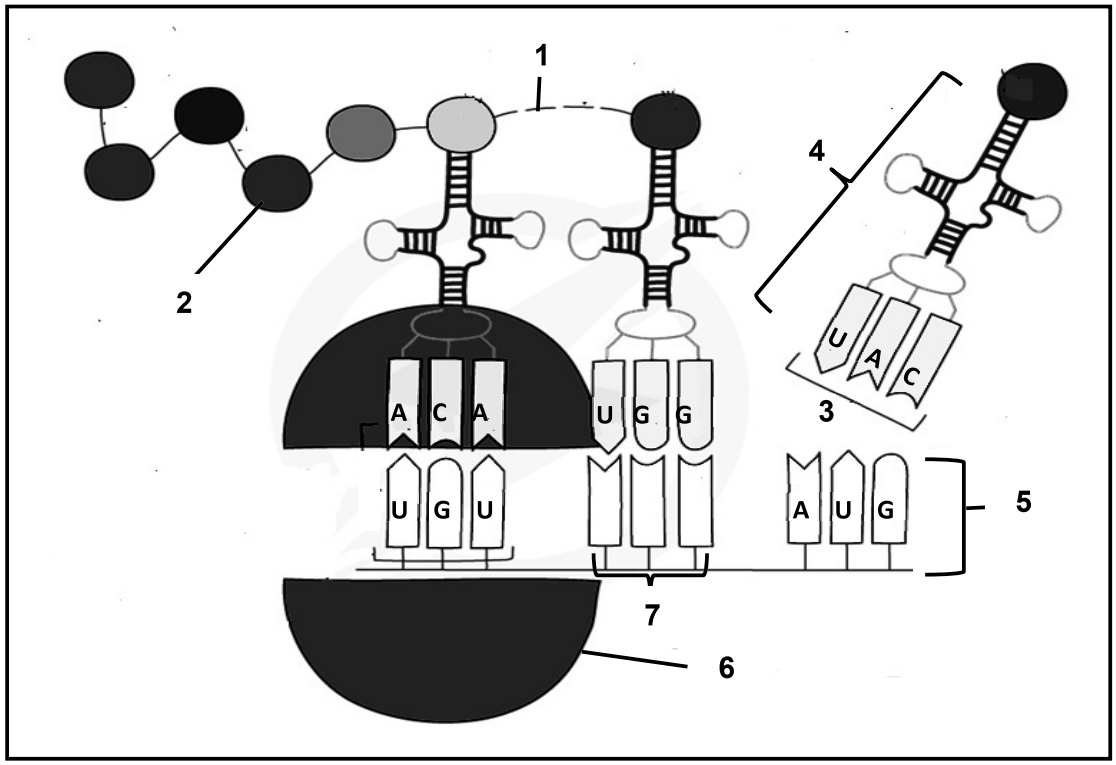
1.4.4 Identify the organ where cycle **A** occurs. (1)

1.4.5 Name structure:

(a) **C** (1)

(b) **E** (1)

1.5 The diagram below represents transcription.



1.5.1 Name the part of the cell where transcription takes place. (1)

1.5.2 Identify the:

(a) Chemical bond labelled **1** (1)

(b) Molecule labelled **5** (1)

1.5.3 Give the:

(a) Collective name for the nitrogenous bases labelled **3** (1)

(b) Name of the molecule labelled **4** (1)

(c) Name of the organelle labelled **6** (1)

1.5.4 Give the sequence of the bases at triplet labelled **7**. (1)

1.5.5 Give the NUMBER and the NAME of the part that serve as the building blocks of proteins. (2)

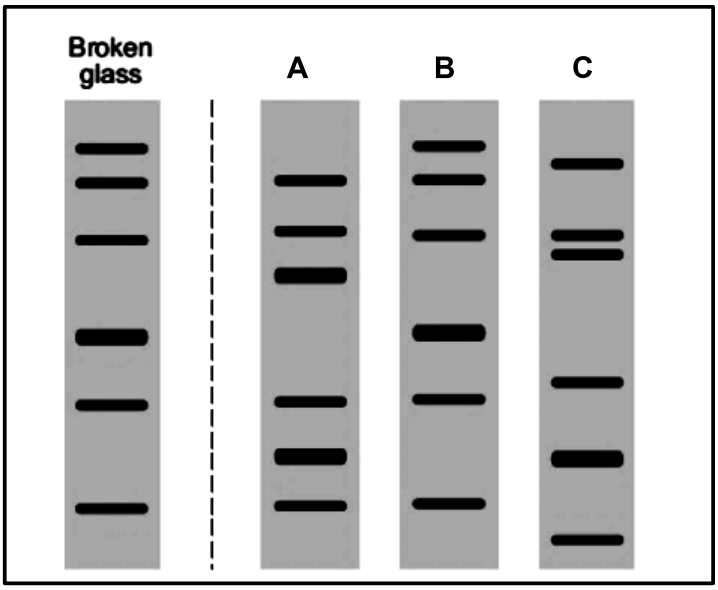
TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Scientists used DNA profiling to compare blood found at a crime scene with the blood of three suspects **A**, **B** and **C**.

The diagram shows the scientists' results.



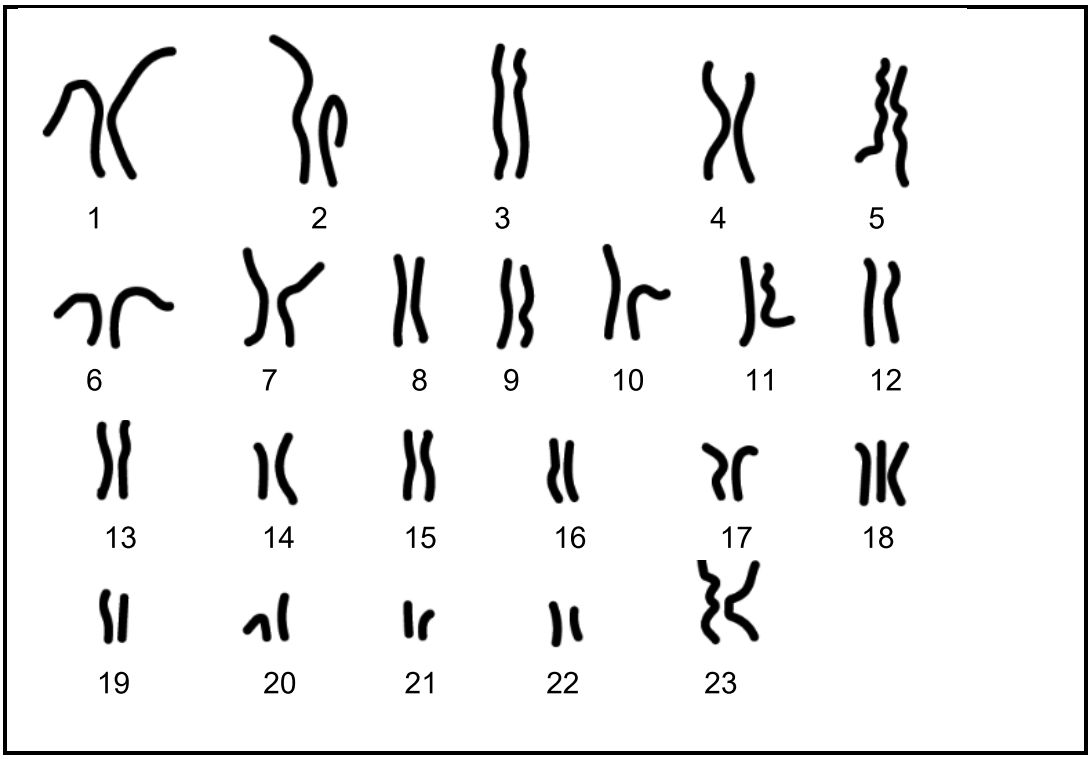
2.1.1 Define the term *DNA profile.* (2)

2.1.2 Which suspect (**A**, **B** or **C**) is most likely to have been the criminal? (1)

2.1.3 Describe how DNA profiling could be used to prove paternity. (6)

2.1.4 Apart from identifying criminals and paternity testing, state TWO other uses of DNA profiling in humans. (2)

2.2 Edward syndrome is a rare and serious condition caused by abnormal meiosis during the formation of gametes. Babies with Edwards Syndrome have problems growing and gaining weight. Many of these babies die soon after birth. The image below shows the karyotype from a somatic cell of an individual with Edwards syndrome.



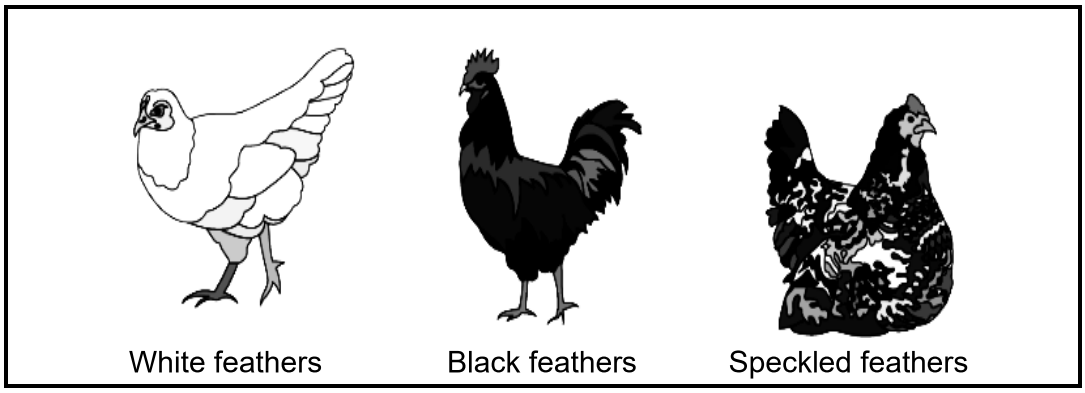
2.2.1 How many autosomes are there in a nucleus of this cell? (1)

2.2.2 Name the type of chromosomes found at position 23. (1)

2.2.3 Give ONE difference in the karyotype of a person with Edwards Syndrome and Downs syndrome? (2)

2.2.4 Describe how abnormal meiosis can cause Edwards Syndrome. (6)

2.3 Feather colour in chickens is control by two alleles, black (**B**) and white (**W**). A homozygous, white-feathered chicken can be crossed with a homozygous, black-feathered chicken to produce speckled offspring as shown in the diagram below.

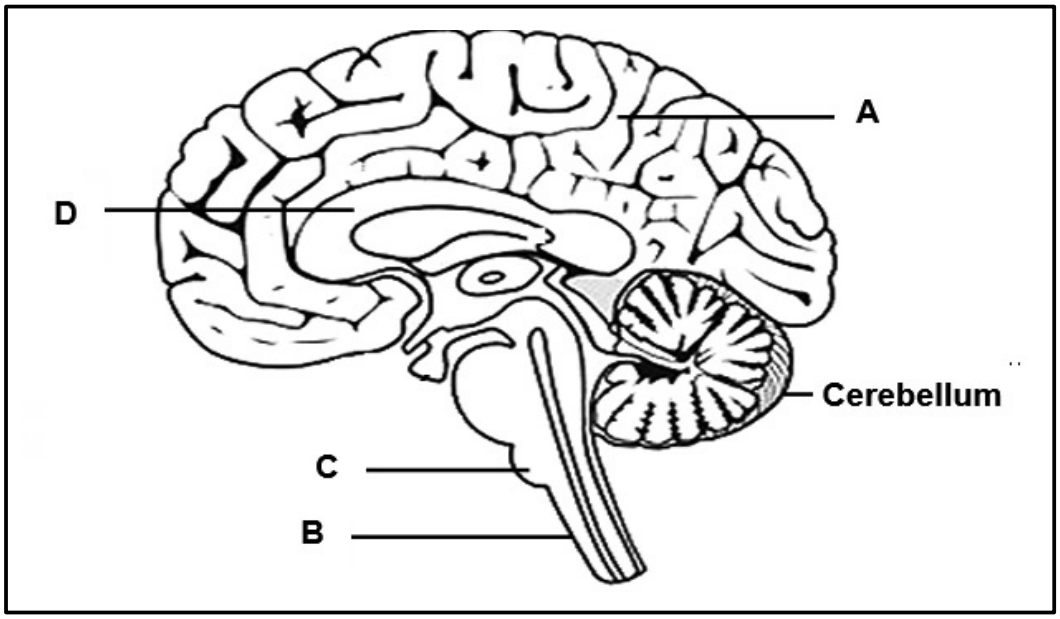


2.3.1 State the type of inheritance described above. (1)

2.3.2 Explain your answer to QUESTION 2.3.1. (2)

2.3.3 If two speckled offspring were interbred, use a genetic cross to determine the genotypes and phenotypic ratio of their offspring. (6)

2.4 The diagram below represents part of the central nervous system of a human.



2.4.1 Identify parts:

(a) **C** (1)

(b) **D** (1)

2.4.2 Give the LETTER of the part that receives and interprets impulses from sense organs. (1)

2.4.3 Describe the location of the cerebellum. (2)

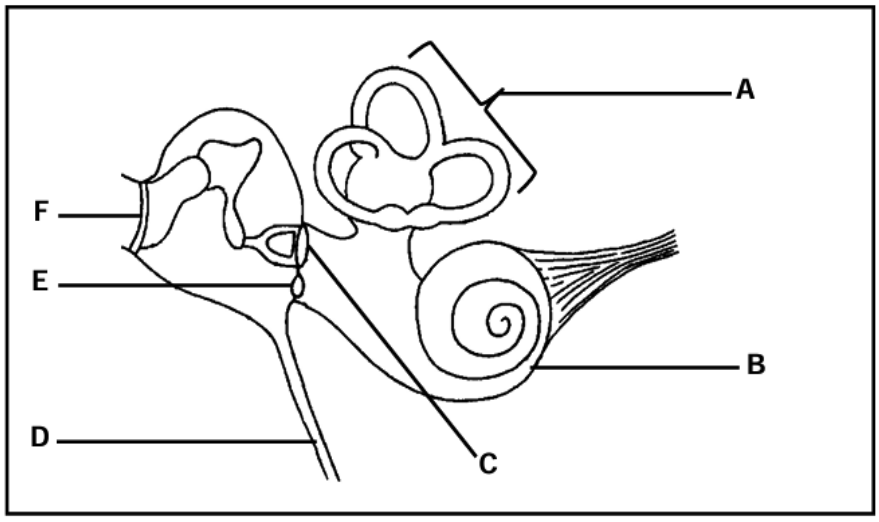
2.4.4 A high school soccer player suffered a head injury during a match after colliding with another player. The player can still see clearly but has difficulty balancing when kicking.

Explain why:

(a) The player is still able to see clearly despite his head injury (2)

(b) It is possible that the injury affected the cerebellum (2)

2.5 The diagram below shows part of the human ear.



2.5.1 Identify parts:

(a) **A** (1)

(b) **F** (1)

2.5.2 Provide the LETTER ONLY of the part of the ear where the following will be inserted:

(a) A grommet (1)

(b) A cochlear implant (1)

2.5.3 How does the function of parts **C** and **E** differ? (2)

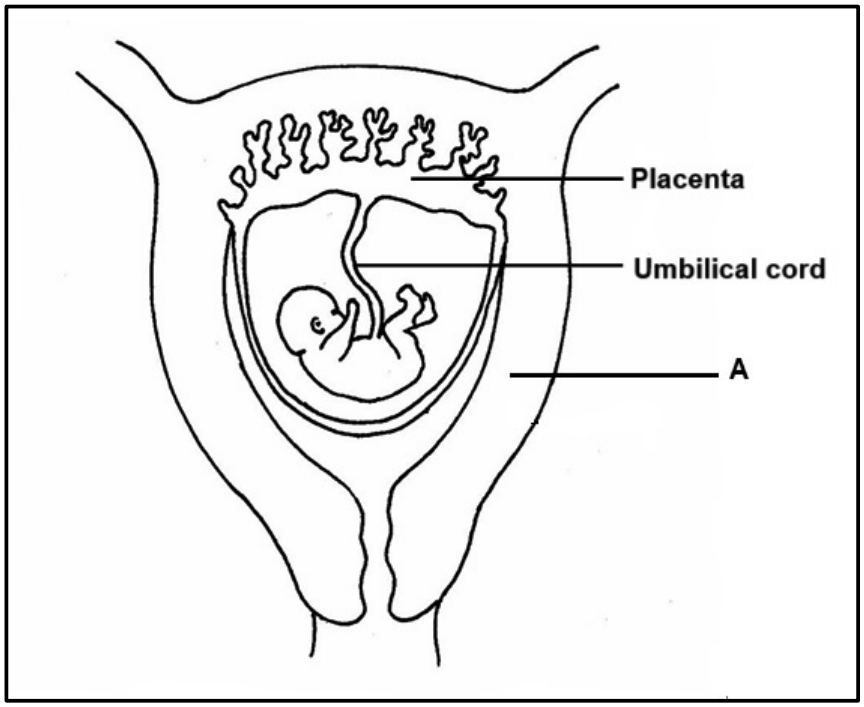
2.5.4 Name the receptors that are found in part **B**. (1)

2.5.5 Explain the effect on hearing if part **D** is blocked. (4)

[50]

QUESTION 3

3.1 The diagram shows a human foetus developing in the uterus.



3.1.1 Name the fluid labelled **A**. (1)

3.1.2 Explain ONE function of fluid **A** surrounding the foetus. (2)

3.1.3 Describe the development of the placenta and umbilical cord from the time of implantation. (6)

3.1.4 Explain how the presence of high levels of oestrogen and progesterone prevents pregnancy. (4)

3.1.5 An ectopic pregnancy occurs when a fertilised ovum implants outside of the uterus, usually in a Fallopian tube.

Explain why the Fallopian tube is not a suitable environment for an embryo to develop. (4)

3.2 3.2.1 State TWO physical changes that take place in females during puberty. (2)

3.2.2 Describe the process of spermatogenesis in males. (4)

3.3 3.3.1 Explain TWO ways that internal fertilisation can increase reproductive success. (4)

3.3.2 How would parental care affect the chances of offspring survival? (1)

3.4 Horner's syndrome interferes with the pupillary mechanism and results in the pupil staying constricted.
Explain how this would affect a person's sight if they walked into a dimly lit room. (3)

3.5 A micro-organism contains a gene which causes the production of an insect poison.

Scientists transferred the gene for production of the insect poison into wheat plants. This makes genetically modified wheat (GM wheat).

The scientists:

- Grew wheat plants with the insect poison gene (GM wheat plants) in fields and in greenhouses. Greenhouses are enclosed structures where the environment can be controlled
- Grew wheat plants without the insect poison gene (non-GM wheat) in fields and in greenhouses
- Measured the crop yield of the wheat plants

The table below shows the results.

COMPARISON OF CROP YIELD BETWEEN WHEAT WITH AND WHEAT WITHOUT INSECT POISON GENE GROWN IN FIELDS AND GREENHOUSES

TYPE OF WHEAT	CROP YIELD OF WHEAT PLANT (IN ARBITRARY UNITS)	
	WHEAT GROWN IN GREENHOUSES	WHEAT GROWN IN FIELDS
Wheat with insect poison gene	60	50
Wheat without insect poison gene	55	70

3.5.1 State the combination of environment and type of wheat that produced the highest yield. (1)

3.5.2 Why is it important to include non-GM wheat plants in the experiment as controls? (2)

3.5.3 Calculate the difference in yield between GM wheat and non-GM wheat grown in the fields. Show ALL your working. (2)

3.5.4 Explain ONE reason why the non-GM plants grew better in the field than the GM plants regardless of the insect poison present in GM plants. (2)

3.5.5 How does the insect poison produced by GM wheat affect insect populations and biodiversity in the environment? (1)

3.6 The relationship between blood groups and risk to specific diseases has been a subject of scientific research for many years.
A group of researchers investigated the relationship between different blood groups and risk to specific diseases like cancer, infections, diabetes and cardiovascular disease.

The investigation was conducted as follows:

- A random group of 500 individuals between the age of 20 and 50 was selected
- The blood group (A, B, AB or O) of all participants was recorded
- Scientists also recorded the occurrence of cancer, infections, diabetes and cardiovascular disease in the 500 participants
- The percentage of participants within each blood group who have a specific disease was calculated and recorded

The table below shows the results at the end of the investigation of the relationship between different blood groups and risk to specific diseases.

	RISK TO DISEASE			
BLOOD GROUP	**CARDIOVASCULAR DISEASE (%)**	**DIABETES (%)**	**INFECTIONS (%)**	**CANCER (%)**
A	30	20	15	10
B	23	22	18	12
AB	35	18	20	15
O	12	16	25	8

3.6.1 State the aim of the investigation. (2)

3.6.2 State TWO planning steps that were considered before conducting this investigation. (2)

3.6.3 State ONE way in which the researchers ensured the reliability of the results. (1)

3.6.4 Plot a bar graph to represent the data of cardiovascular disease within each blood group. (6)
[50]

TOTAL SECTION B: 50
GRAND TOTAL: 150