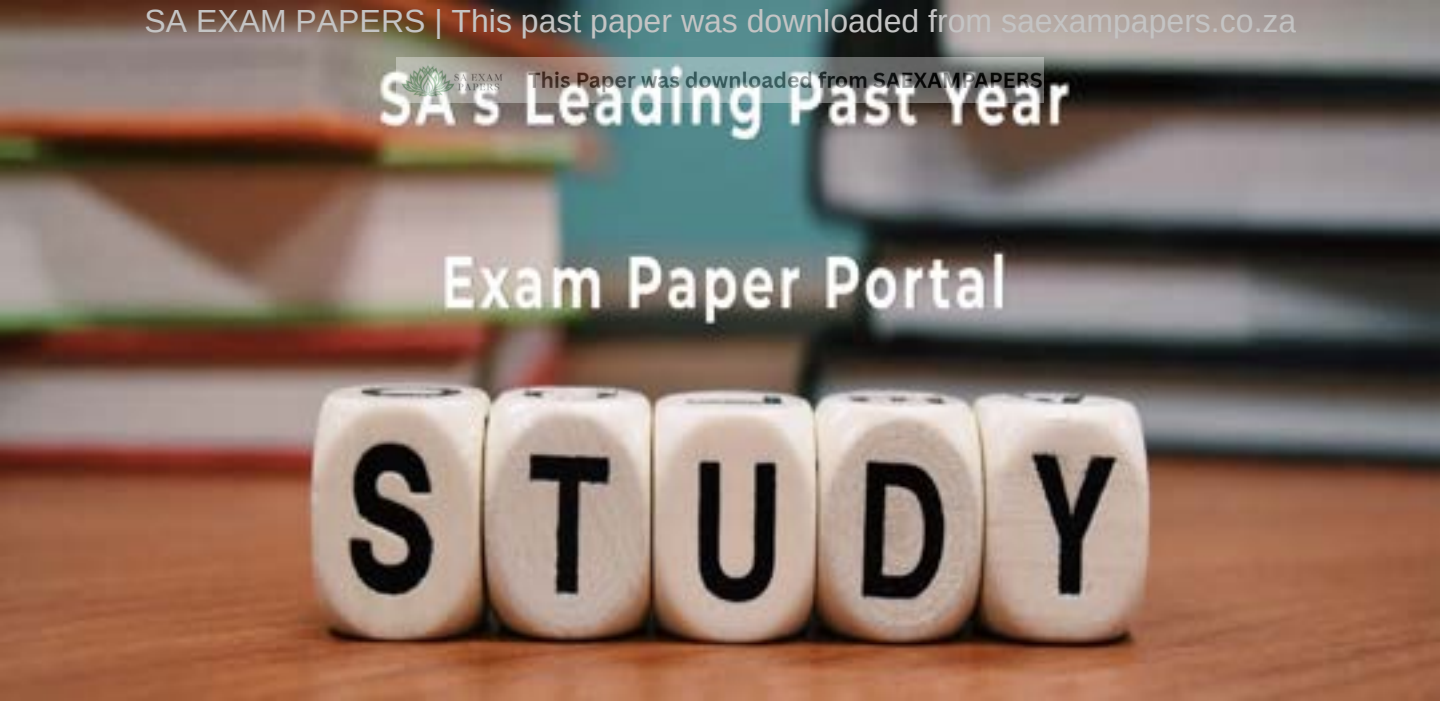


Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porofensie Ya Kapa Botjhabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2026

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 answer and write only the letter (A–D) next to the question numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

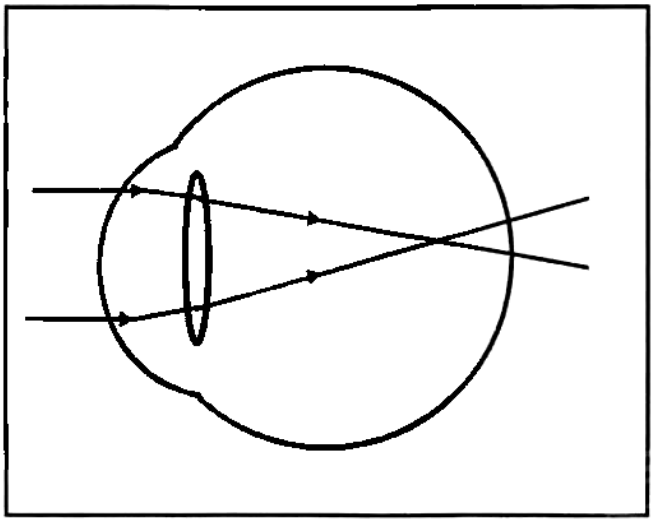
1.1.1 During which stage of meiosis do spindle fibres begin to form?

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

1.1.2 Which structures secrete progesterone during pregnancy?

A Pituitary gland and Graafian follicle
B Corpus luteum and placenta
C Endometrium and umbilical cord
D Chorion and amnion

1.1.3 The diagram below represents a visual defect.



Which ONE of the following is the CORRECT treatment of the visual defect shown above?

A Glasses with biconvex lenses
B Glasses with biconcave lenses
C Surgery to replace the cornea
D Surgery to replace the retina

1.1.4 Which ONE of the following events occurs in mitosis but NOT in meiosis?

A Two cells are formed at the end of the division
B Crossing over takes place
C Homologous chromosomes arrange at the equator
D Centrioles form at the poles of the cell

1.1.5 Which part of the eye is rich in blood vessels to provide oxygen and nutrients?

A Iris
B Retina
C Choroid
D Vitreous humor

1.1.6 Sperm cells in humans are temporarily stored in the …

A vas deferens.
B epididymis.
C testis.
D seminal vesicle.

1.1.7 During Anaphase II of meiosis, the two chromatids of a chromosome are pulled apart. Each chromatid moves towards opposite poles at a rate of 2 micrometres per second.

What is the distance, in micrometres, between the two chromatids after 10 seconds? Distance is calculated as speed x time.

A 20
B 40
C 60
D 80

1.1.8 Barotrauma is a condition that occurs when pressure builds up in the middle ear, causing the tympanic membrane to bulge. It is most common among deep-sea divers.

Divers are advised not to dive when they have a middle-ear infection because the …

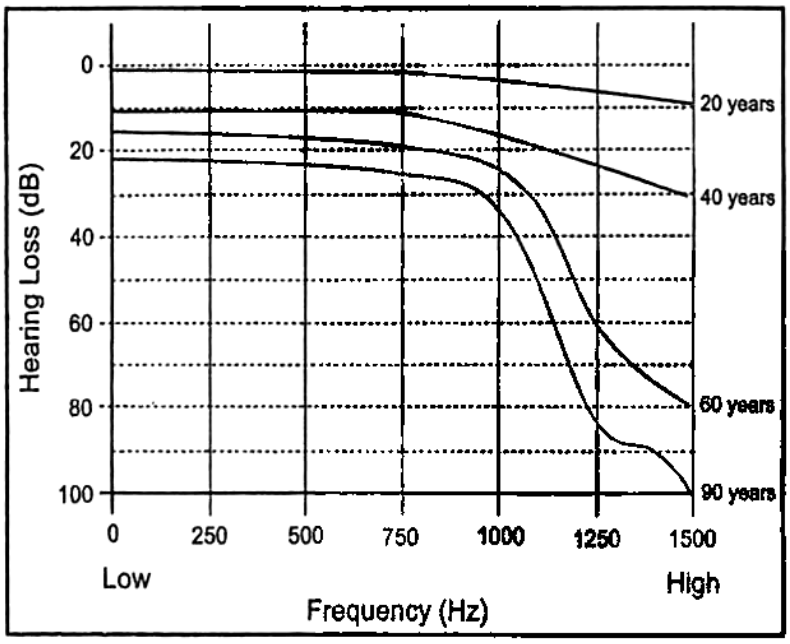
A auditory canal cannot equalise the pressure in the middle ear.
B eustachian tube is blocked and air cannot enter the middle ear.
C tympanic membrane is hardened and cannot pass the vibrations to the middle ear.
D ossicles are fused together and cannot vibrate freely in the middle ear.

1.1.9 An organism has a diploid number of 16. The total DNA content of the somatic cell is measured as 8 picograms (pg).

Which combination shows the chromosome number and DNA content of the cell after DNA replication, and the chromosome number and DNA content of a gamete formed by meiosis?

	Chromosome number after replication	DNA content of the cell after replication	Chromosome number of gamete	DNA content of gamete
A	16	16	8	4
B	32	16	8	16
C	8	16	16	8
D	16	16	4	8

1.1.10 The diagram below shows the effect of age on hearing ability.



A reasonable conclusion that can be made from this graph is that …

A younger people have the same ability to hear all frequencies.
B as people age they can hear higher frequencies better.
C 60-year-olds can hear frequencies that younger people cannot hear.
D older people lose the ability to hear higher frequencies.

(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 1.2.10) in the ANSWER BOOK.

1.2.1 The structure that the Graafian follicle develops into after ovulation

1.2.2 The hormone that stimulates puberty in females

1.2.3 The structure that creates pressure waves in the fluid of the inner ear

1.2.4 A receptor in the utriculus

1.2.5 A progressive brain disorder characterised by memory loss and confusion

1.2.6 A hormone that stimulates gamete formation in males

1.2.7 Smooth muscles in the eye that adjusts the curvature of the lens

1.2.8 The site of fertilisation in the female reproductive system

1.2.9 Interaction between an ovarian hormone and the pituitary gland preventing development of follicles during pregnancy

1.2.10 Tiny, coiled structures in the testis where spermatogenesis occurs

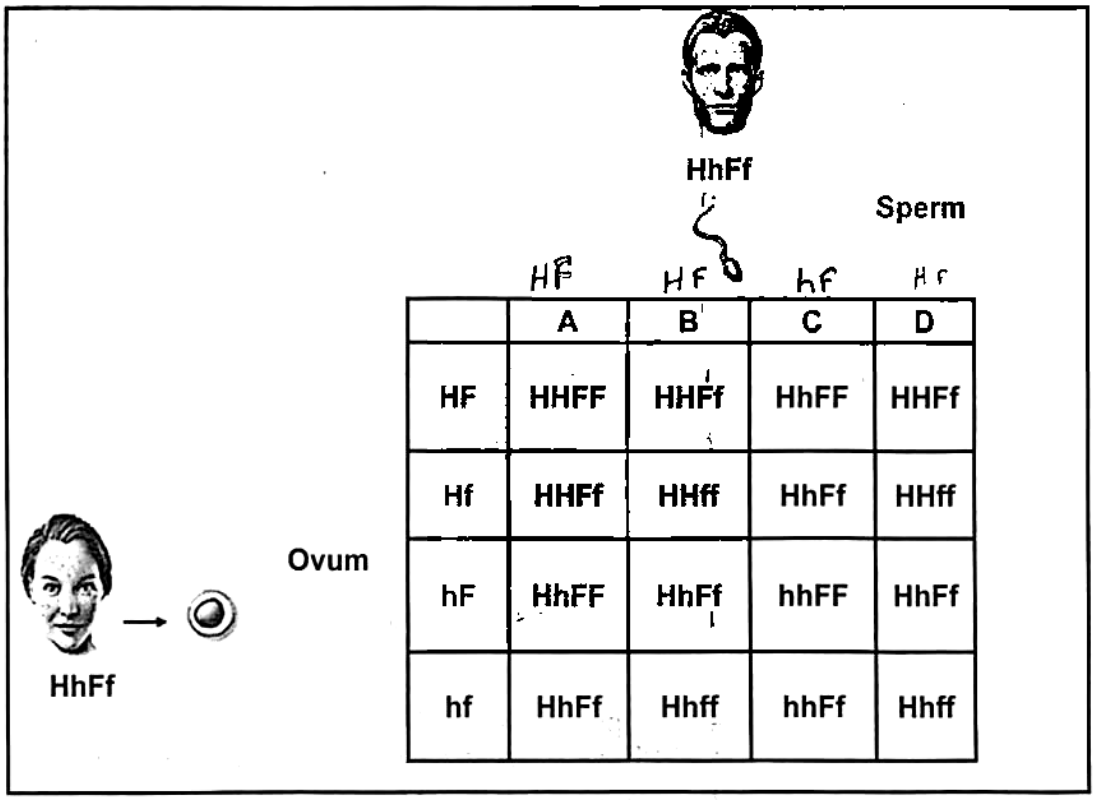
(10 x 1) (10)

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	Embryos develop inside eggs which are laid outside the female body	A B	Ovoviviparous Viviparous
1.3.2	Fertilisation where semen and ova are released in the water	A B	External Internal
1.3.3	Storage of waste products in the amniotic egg	A B	Allantois Chorion

(3 x 2) (6)

1.4 In humans, one gene controls the shape of the hairline and another controls the presence of freckles. The hairline can be curved, forming a point on the forehead (called a **widow's peak**), which is represented by allele (**H**), or **straight** represented by allele (**h**). Freckles are tiny brown spots on the face and can be **present** (**F**) or **absent** (**f**). The diagram below shows a cross between a male and female who are both heterozygous for both genes.



	A	B	C	D
HF	HHFF	HHFf	HhFF	HHFf
Hf	HHFf	HHff	HhFf	HHff
hF	HhFF	HhFf	hhFF	HhFf
hf	HhFf	Hhff	hhFf	Hhff

1.4.1 State the characteristics that are being investigated in this cross. (2)

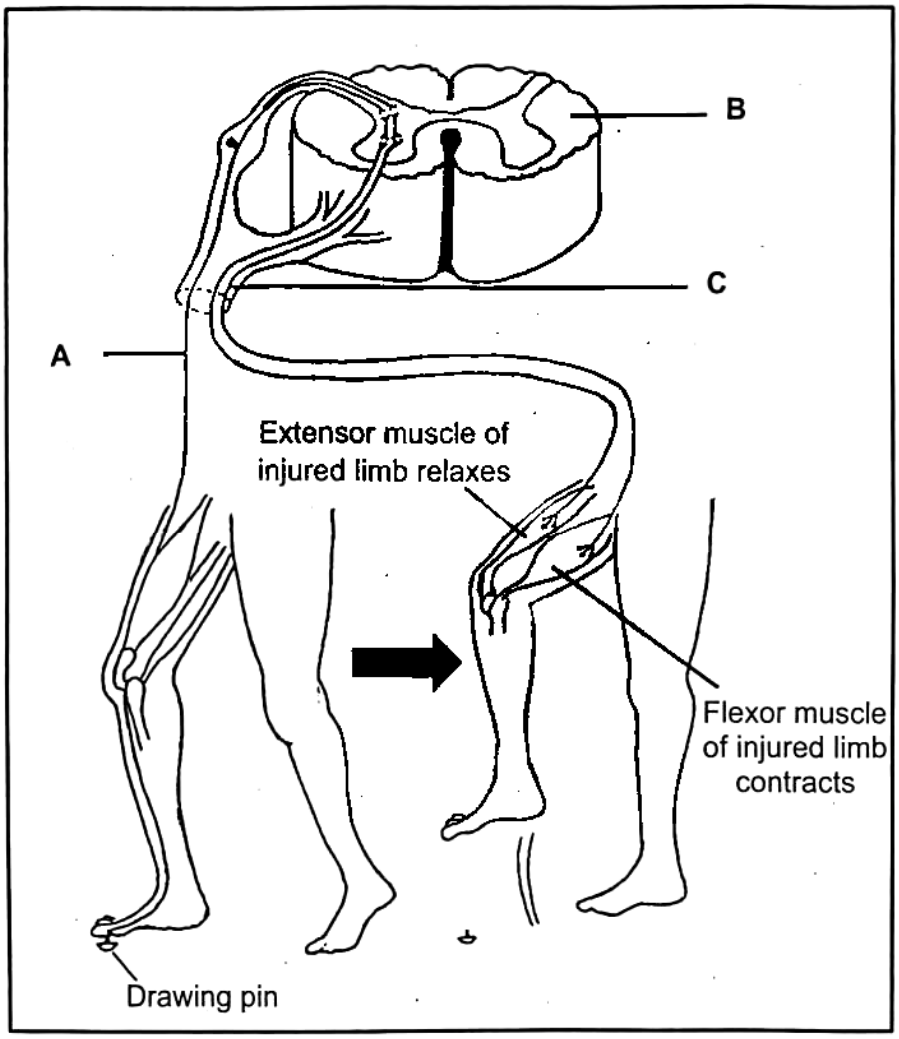
1.4.2 Determine the genotype of the sperm cells indicated as **A**, **B**, **C** and **D** in the Punnet square. (2)

1.4.3 Which process reduced the alleles for the different characteristics in a somatic cell from four to two in each gamete? (1)

1.4.4 Name the process in reproduction indicated by the Punnett square. (1)

1.4.5 Give the percentage of offspring which have a widow's peak hairline, but no freckles. (1)

1.5 The diagram below represents a reflex action.



1.5.1 Give the LETTER and NAME of the part that:

(a) Transmits an impulse to the spinal cord (2)

(b) Represents a peripheral nervous system (2)

1.5.2 Name the effectors that were involved in this reflex arc. (2)

1.5.3 How many neurons transmitted the impulse from the spinal cord to the effectors? (1)

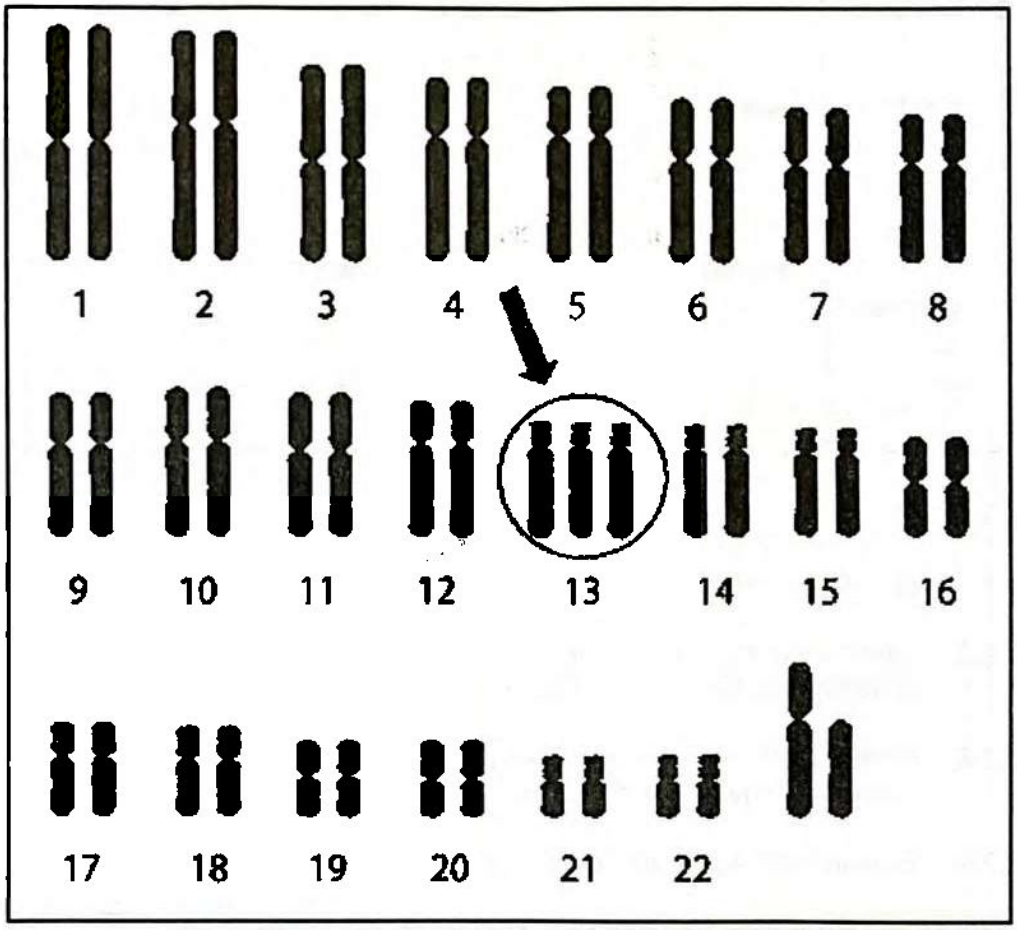
[50]

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents a karyotype of a child with Patau syndrome. Some of the Patau syndrome symptoms include slow breathing, heart defects and kidney malfunctioning.



2.1.1 How many autosomes are represented in this karyotype? (1)

2.1.2 State why the karyotype shown represents a somatic cell. (1)

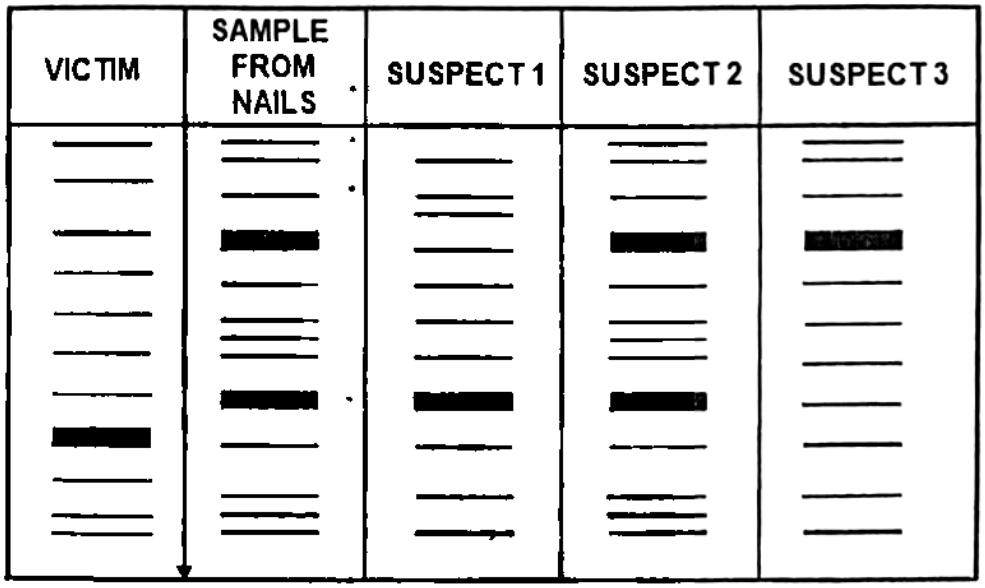
2.1.3 Name the error in meiosis that resulted in the abnormal number of chromosomes at position 13. (1)

2.1.4 State the phase of meiosis in which the error mentioned in QUESTION 2.1.3 occurs. (1)

2.1.5 Describe the abnormal gamete involved in fertilisation that produced a child with Patau syndrome. (2)

2.1.6 Explain how the karyotype of a boy with Down syndrome is different to that of a boy with Patau syndrome. (4)

2.2 The victim of a violent crime scratched her attacker. Blood and skin cells were collected from beneath the victim's fingernails. DNA profiles of the victim and three suspects were then obtained, as shown in the diagram below.



2.2.1 (a) Which suspect attacked the victim? (1)

(b) Give an explanation for your answer. (1)

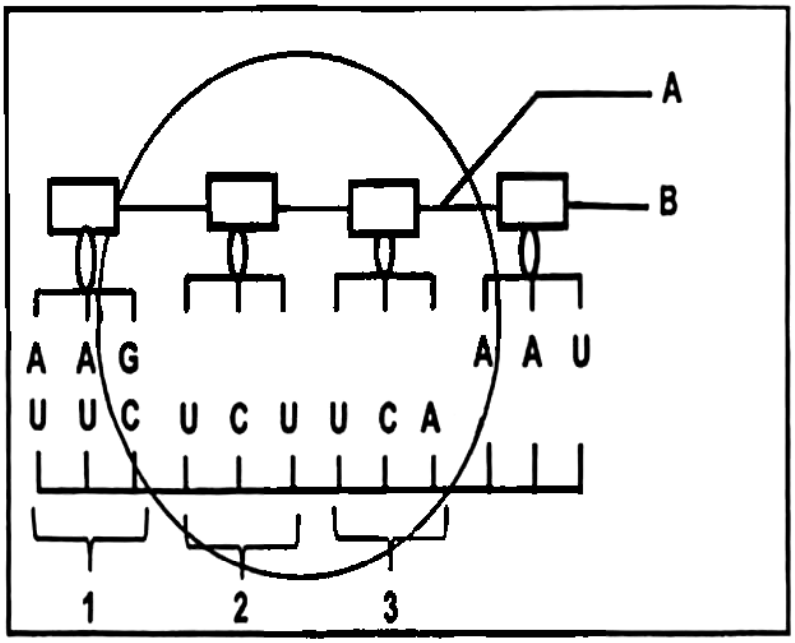
2.2.2 When confronted the attacker says the victim scratched herself in order to frame him. Explain why this is not possible. (2)

2.2.3 Explain ONE reason why a DNA profile alone is not sufficient evidence to convict someone of the crime. (2)

2.2.4 Explain ONE advantage of using DNA profiles in solving crimes. (2)

2.3 State FOUR similarities between DNA replication and transcription. (4)

2.4 The diagram below shows a stage in protein synthesis.



The table below shows the tRNA molecules that code for different amino acids.

ACU, ACC, ACA, ACG — **Threonine**	AAU, AAC — **Asparagine** AAA, AAG — **Lysine**	AGU, AGC — **Serine** AGA, AGG — **Arginine**

2.4.1 Identify:

(a) Bond **A** (1)

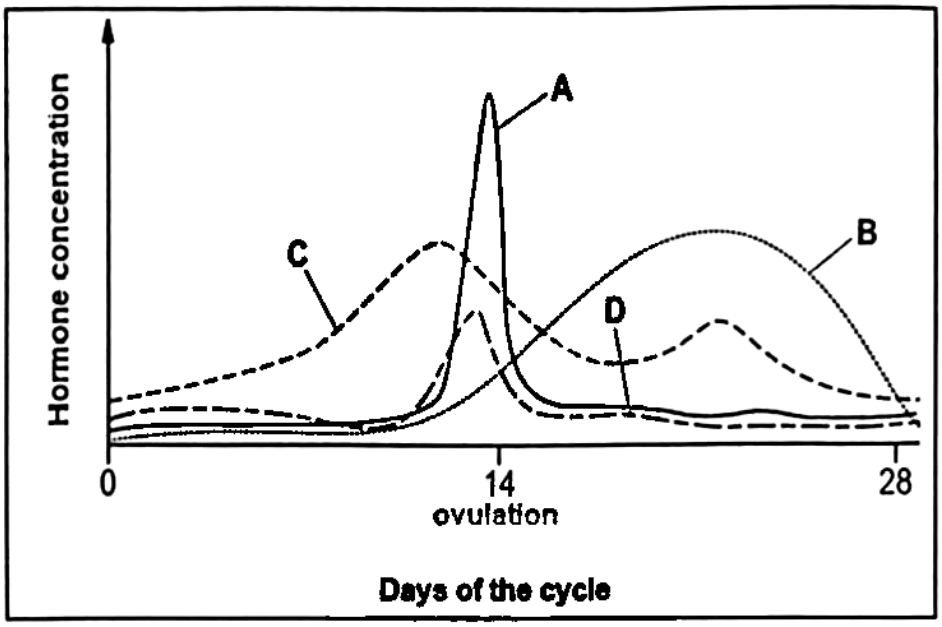
(b) Molecule **B** (1)

2.4.2 Write down the mRNA codon that codes for asparagine in the diagram. (1)

2.4.3 In codon **3,** guanine was replaced by cytosine as a result of a mutation.

Explain how this will affect the protein that will be formed. (4)

2.5 The diagram below represents the hormonal control of the menstrual cycle.



2.5.1 Provide the LETTER and NAME of the hormone that:

(a) Stimulates the development of the Graafian follicle (2)

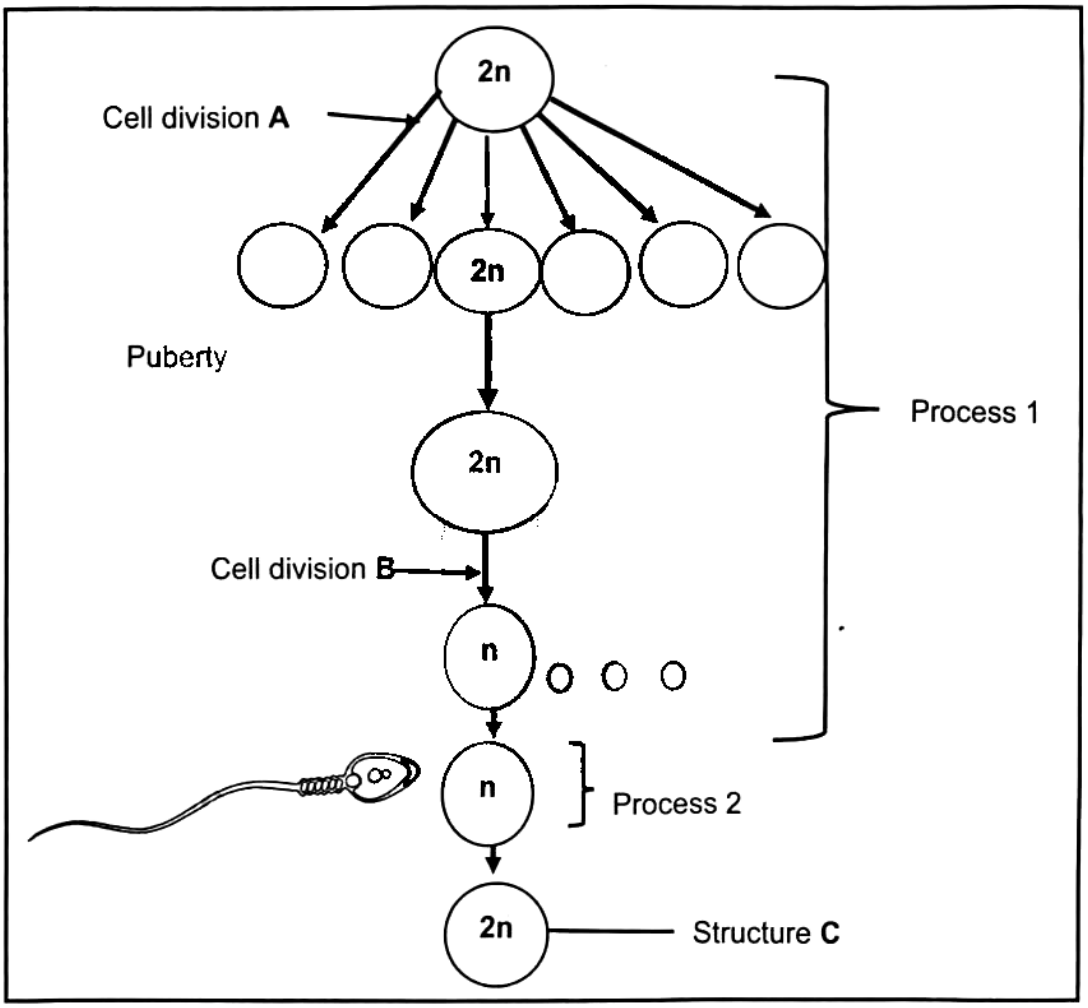
(b) Stimulates the Graafian follicle to release a mature ovum (2)

2.5.2 On which day of the cycle did ovulation occur? (1)

2.5.3 Explain your answer to QUESTION 2.5.2. (2)

2.5.4 Explain the effect of the negative feedback mechanism between hormones **B** and **C** if fertilisation occurs. (4)

2.6 The diagram below shows two processes occurring in the female reproductive system.



2.6.1 Identify:

(a) Cell division **A** (1)

(b) Cell division **B** (1)

(c) Process **1** (1)

(d) Process **2** (1)

2.6.2 Identify the organ in which process **1** occurs. (1)

2.6.3 Describe the development of structure **C** until the formation of the placenta. (5)

[50]

QUESTION 3

3.1 Read the extract below.

> Adrenoleukodystrophy (ALD) is a disorder that damages the nerve insulation around the brain and spinal cord. ALD significantly affects reflex arcs by damaging the myelin sheath in the central and peripheral nervous system.
>
> ALD is caused by a build-up of very long fatty acids (VLCFAs) around nerve fibres. VLCFAs accumulate and destroy myelin around the nerve fibres, disrupting nerve impulse transmission which may lead to slower or blocked nerve communication.
>
> In addition to motor problems such as loss of coordination symptoms, also include loss of memory, learning difficulties, vision- and hearing loss.
>
> A neurologist may diagnose ALD through a combination of blood tests measuring levels of VLCFAs, often followed by genetic testing for mutations and MRI scans to check for brain damage.

3.1.1 Differentiate between a *reflex action* and a *reflex arc*. (2)

3.1.2 From the extract, state the:

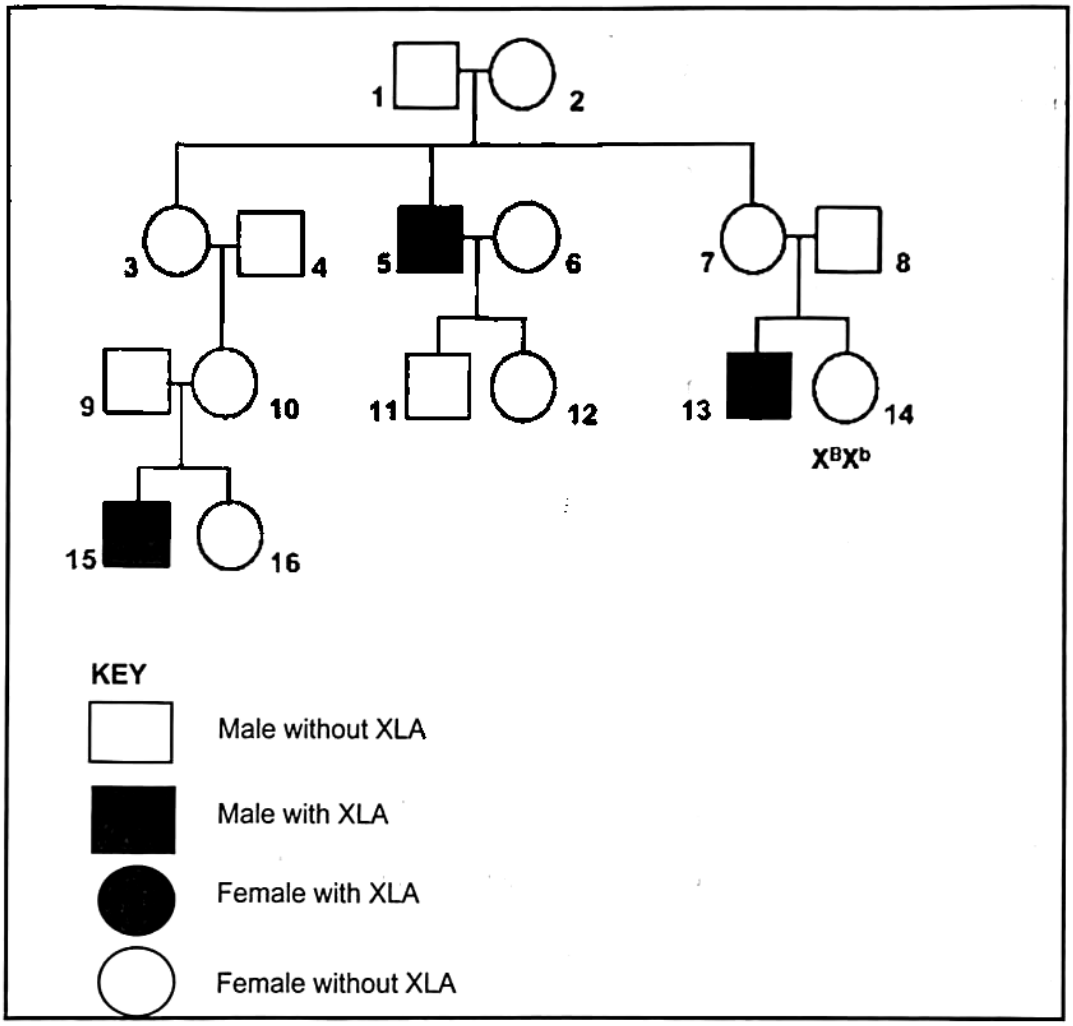
(a) Effect of ALD on impulse transmission (1)

(b) Symptom of ALD caused by damaged nerve fibres in the cerebrum (1)

3.1.3 Name TWO nerve subdivisions of the peripheral nervous system. (2)

3.1.4 Explain how a damaged myelin sheath, in nerves around the brain, can lead to a loss of coordinating voluntary movement. (3)

3.2 XLA syndrome is a rare sex linked inherited immune deficiency caused by a mutation in the BTK gene, leading to a lack of antibody production and recurrent bacterial infection.



3.2.1 What is the main use of a pedigree diagram? (1)

3.2.2 Define a *sex-linked inheritance*. (1)

3.2.3 Explain why XLA is not caused by a dominant allele. (2)

3.2.4 Give ALL the NUMBER(s) representing:

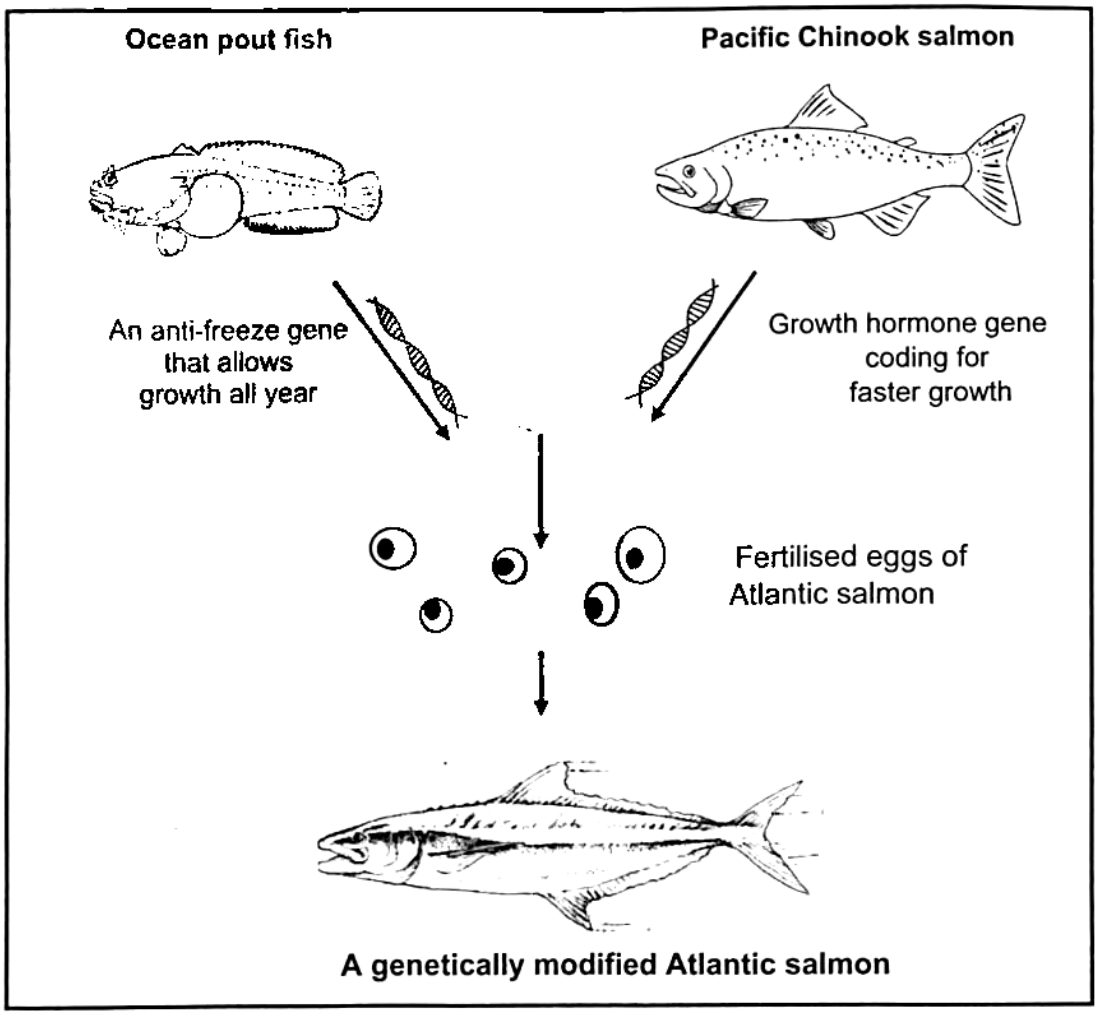
(a) Male(s) without XLA in the F^2 generation (1)

(b) Individuals which are not related to **1** and **2** (2)

3.2.5 Use a genetic cross to show the percentage chance of the next child born from individuals **13** and **14** (X^BX^b) suffering from XLA syndrome. (6)

3.2.6 Explain why it is less common for girls to suffer from XLA syndrome compared to boys. (4)

3.3 A biotechnological process was done on the eggs of Atlantic Salmon, producing a fish that grows fast to a very large size and capable of growth all year round instead of growing only in spring and summer. The diagram below shows steps of the biotechnological process.



3.3.1 Define *biotechnology*. (1)

3.3.2 Differentiate between *cloning* and *genetic engineering*. (4)

3.3.3 Describe how a genetically engineered Atlantic salmon is produced. (6)

3.4 The macula is a small area in the retina that contains many cone cells. It helps people to read, recognise faces and drive. Age-related Macular Degeneration (AMD) damages the macula, which makes reading and recognising faces difficult.

Scientists conducted an investigation to find out whether a **retinal implant** (a very small medical device) could help restore vision in people with advanced AMD.

The procedure was as follows:

- 38 participants, with an average age of 79 years, from five European countries took part in the study. All participants had advanced AMD.
- A microscopic retinal implant was surgically placed under the retina at 17 hospitals across the five countries.
- The participants' ability to read letters and recognise objects was tested before and after the procedure.
- Vision tests were done 12 months later by independent testers who did not know which patients had received the implant.

The results of the investigation are as follows:

- 32 participants completed the 12-month follow-up.
- 84% of these participants showed a clear improvement in reading words and recognising objects.
- Three participants died from causes not related to the implant, one withdrew from the study, and two were unavailable for testing.

3.4.1 State the:

(a) Independent variable (1)

(b) Dependent variable (1)

3.4.2 Explain why all participants had to sign a declaration of consent before participating in this clinical trial. (2)

3.4.3 How many participants showed an improvement in reading ability? Show ALL calculations (round off to the nearest whole number). (3)

3.4.4 Why was the reading ability of the participants assessed before participating in the investigation. (2)

3.4.5 Describe the events that occur after the light rays focus on the yellow spot of the retina until an object is seen. (4)

[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150