KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES

JUNE EXAMINATION

2025

MARKS: 150

TIME: $2^1/_2$ hours

This question paper consists of 19 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 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. You must use a non-programmable calculator, protractor and a compass, where necessary.
10. 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 number (1.1.1 to 1.1.9) in your ANSWER BOOK, for example 1.1.10 D.

1.1.1 The involuntary actions are regulated in the …

A cerebrum.
B cerebellum.
C medulla oblongata.
D corpus callosum.

1.1.2 Which ONE of the following is the CORRECT path that sound waves and vibrations take through the ear?

A Pinna → ossicles → tympanic membrane → oval window
B Pinna → ossicles → oval window → tympanic membrane
C Pinna → tympanic membrane → oval window → ossicles
D Pinna → tympanic membrane → ossicles → oval window

1.1.3 A segment of DNA made up of **120** nitrogenous bases has **42** adenines.

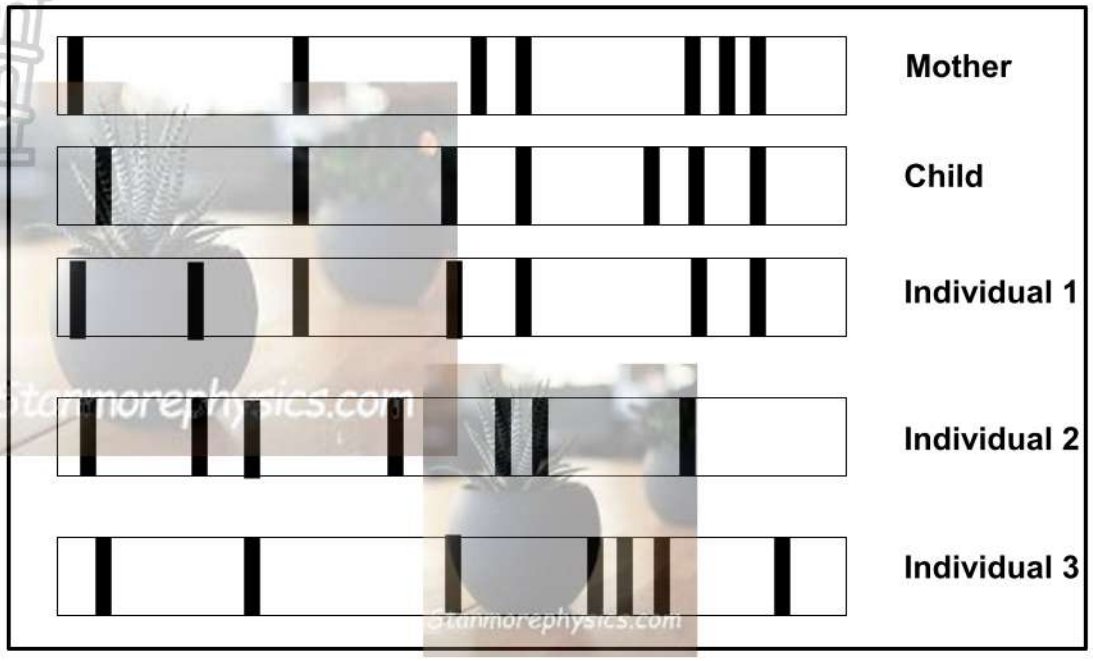
What is the percentage of guanine in this segment?

A 36%
B 15%
C 18%
D 65%

1.1.4 Which ONE of the following crosses will result in a **1:1** phenotypic ratio?

	PARENT 1	PARENT 2
A	Homozygous dominant	Homozygous dominant
B	Homozygous recessive	Homozygous dominant
C	Heterozygous	Heterozygous
D	Homozygous recessive	Heterozygous

1.1.5 The DNA profiles of mother, child and three individuals are given below.



The evidence in the DNA profiles shows that …

A individual 1 is the father.
B individual 2 is the father.
C individual 3 is the father.
D none of the individuals is the father of the child.

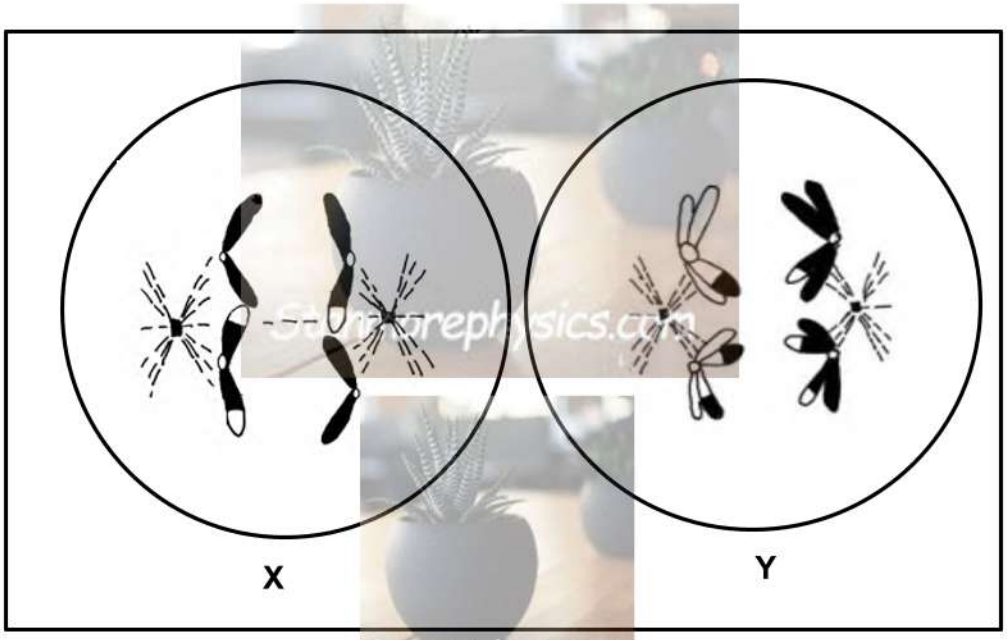
1.1.6 Below is a list of statements.

(i) Matching of tissues for organ transplants
(ii) Identify missing persons
(iii) Paternity testing
(iv) Tracing ancestry

Which ONE of the following combinations are the uses of DNA profiling?

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

1.1.7 The diagram below represents two phases of meiosis.



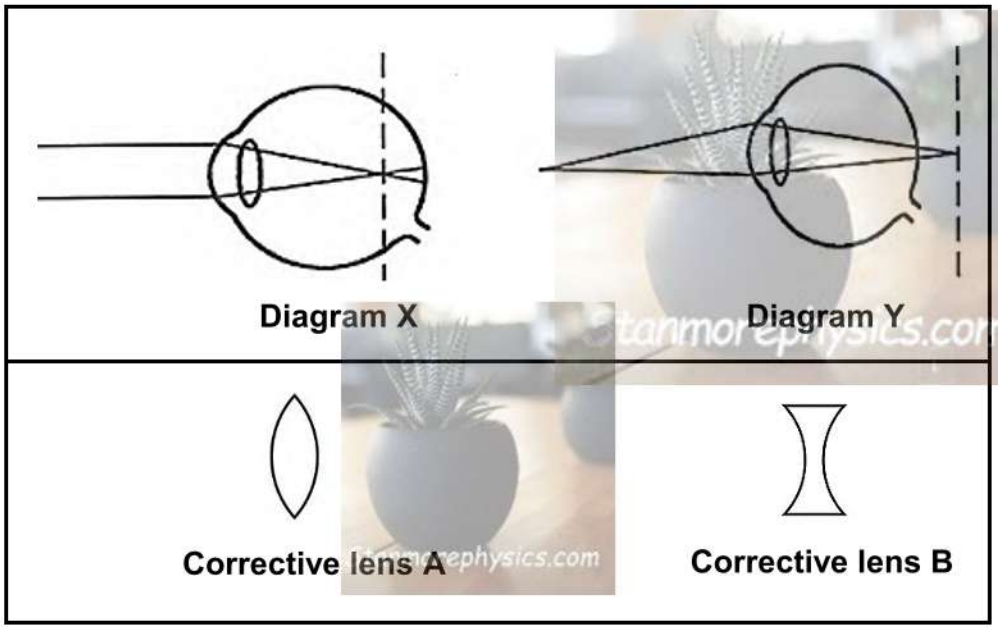
Which ONE of the following is the correct representation of the phases in the diagrams?

	PHASE X	PHASE Y
A	Anaphase I	Metaphase I
B	Metaphase II	Anaphase I
C	Anaphase II	Anaphase I
D	Metaphase I	Metaphase II

1.1.8 Which ONE of the following is a CORRECT difference between the structure of a DNA and RNA molecule?

	DNA	RNA
A	Is a double stranded molecule	Is a single stranded molecule
B	Sugar and phosphate are present in the nucleotide	Sugar and phosphate are absent in the nucleotide
C	Weak hydrogen bonds are absent	Weak hydrogen bonds are present
D	The natural shape is a single stranded molecule	The natural shape is a double helix

1.1.9 The diagrams (**X** and **Y**) below show the human visual defects and corrective lenses (**A** and **B**). The dotted lines in each diagram indicate the focal point.



Which ONE of the following is the CORRECT combination for the diagram, visual defect and its corrective lens?

	DIAGRAM	VISUAL DEFECT	CORRECTIVE LENS
A	**X**	Short-sightedness	**A**
B	**X**	Long-sightedness	**B**
C	**Y**	Short-sightedness	**B**
D	**Y**	Long-sightedness	**A**

(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 number (1.2.1 to 1.2.7) in your ANSWER BOOK.

1.2.1 The X and Y sex chromosomes

1.2.2 The blood vessel that carries oxygen and nutrients from the placenta to the foetus

1.2.3 The division of the nucleus during cell division

1.2.4 The tissue lining the uterine walls that is rich in blood capillaries

1.2.5 The type of bond that is found between amino acids during the protein synthesis

1.2.6 Chemical messengers that are produced by endocrine glands in the human body

1.2.7 The period of development of the foetus within the uterus

(7 x 1) **(7)**

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 number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II	
1.3.1	The hormone that stimulates puberty in a female	A: B:	Oestrogen Prolactin
1.3.2	A structure that holds two chromatids together	A: B:	Centromere Centriole
1.3.3	The phase during the cell cycle where the DNA makes an exact copy of itself	A: B:	Prophase I Telophase I

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

1.4 In apple plants, the fruit size is controlled by a gene with two alleles, big (**B**) and small (**b**) and the fruit colour is also controlled by a gene with two alleles green (**G**) and red(**g**)

1.4.1 Name the type of cross that involves two characteristics. (1)

1.4.2 Give the:

(a) Phenotype of an apple plant with the genotype **BbGG** (1)

(b) Possible genotypes in the gametes of an apple plant that is heterozygous for fruit size and has red colour (2)

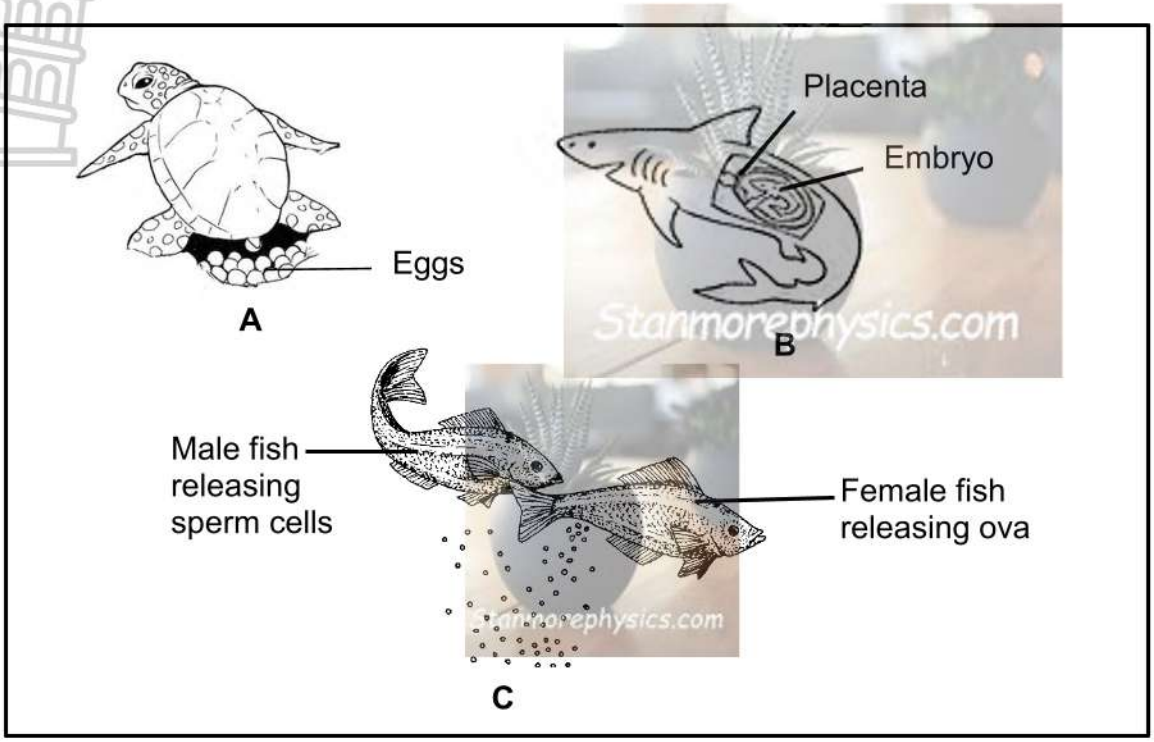
1.4.3 Two apple plants with genotypes **BBGg** and **BbGg** were crossed.

What is the percentage chance of these apple plants having an offspring that is homozygous recessive for both characteristics? (2)

1.4.4 A farmer wanted to grow plants that bear apples that are big and red **only**.

Give the genotypes of **both** parents that must be crossed. (2)
(8)

1.5 The diagrams below represent reproductive strategies in different organisms (**A**, **B** and **C**).



1.5.1 Identify ONE organism (**A, B** or **C**):

(a) That is viviparous (1)

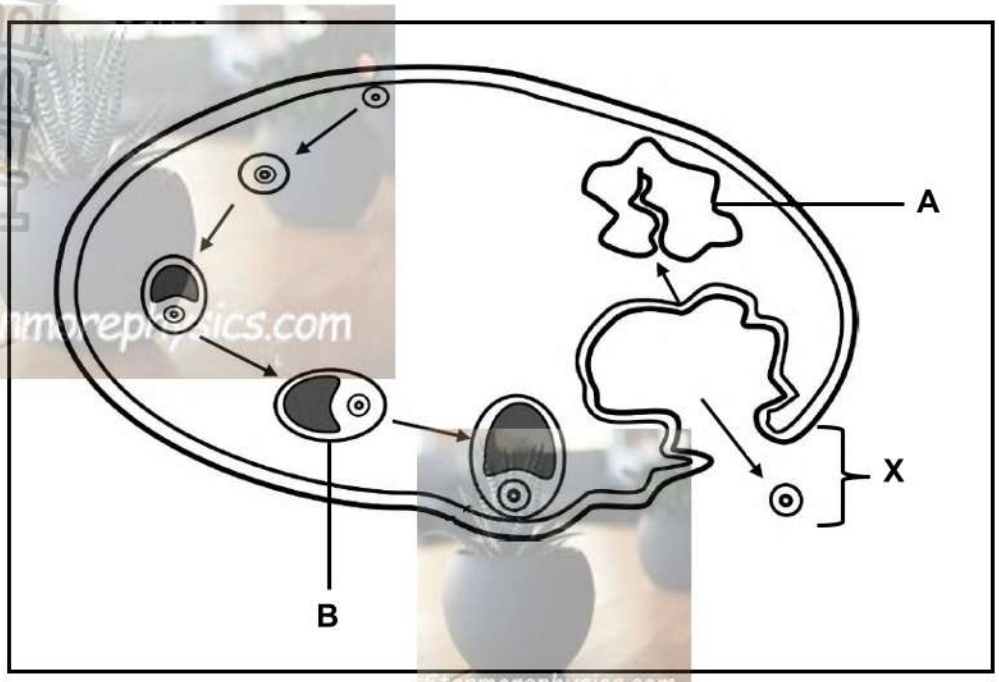
(b) Where extra-embryonic membranes develop for protection and nourishment of the developing young (1)

(c) Where two extra-embryonic membranes develop for protection of the developing young (1)

(d) That has a high percentage chance of losing many gametes due to external environmental conditions during reproduction (1)

1.5.2 Name the type of egg produced by organism **A**. (1)
(5)

1.6 The diagram below shows events during the ovarian cycle of a human female.



1.6.1 Identify:

(a) Process **X** (1)

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

1.6.2 Name the hormone that is:

(a) Secreted by structure **A** (1)

(b) Secreted by structure **B** (1)

(c) Responsible for process **X**. (1)

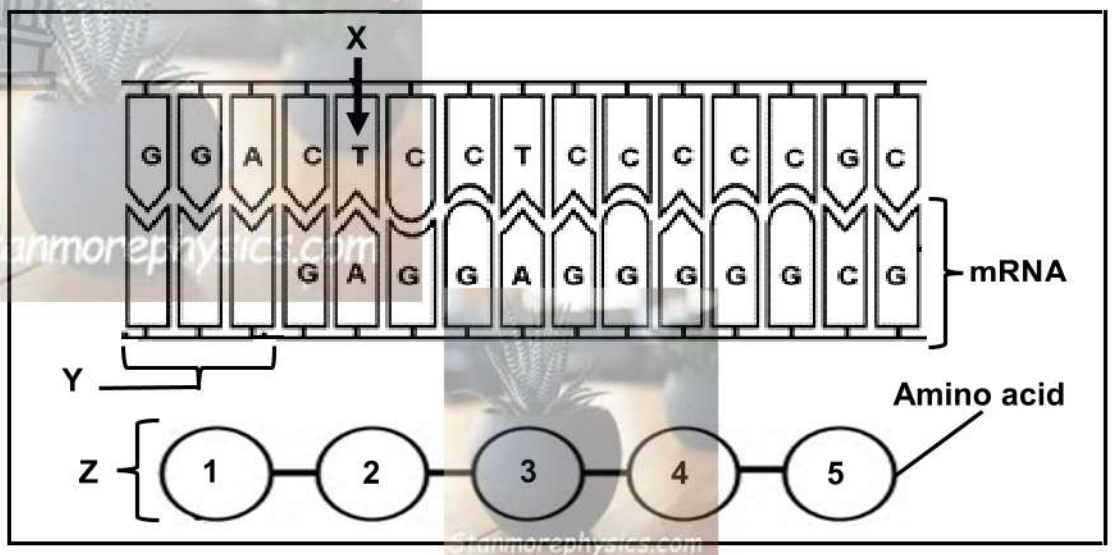
(d) Influencing the enlargement of the cell inside structure **B** (1)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents a stage during protein synthesis.



2.1.1 Identify molecule **Z**. (1)

2.1.2 Name the organelle on which molecule **Z** is formed. (1)

2.1.3 How many codons are represented in the process above? (1)

2.1.4 Describe the role of mRNA during protein synthesis. (2)

2.1.5 Give the triplet of nitrogenous bases at **Y** from left to right. (1)

2.1.6 The table below shows the amino acids and tRNA anticodon.

Amino Acid	tRNA anticodon
Lysine	CGC
Valine	CAC
Glutamic acid	GAG
Proline	CCU
Glutamine	CUC

With reference to the DIAGRAM and TABLE above:

(a) Give the anticodon for amino acid **5** (1)

(b) Identify amino acid **3** (1)

(c) If nitrogenous base **T** at area **X** is replaced by **A**, explain how this will affect molecule **Z**. (4)
(12)

2.2 Name and describe the process whereby mRNA is formed from DNA. **(7)**

2.3 Read the extract below.

MEIOSIS: A HIGHLY REGULATED PROCESS

Meiosis I and meiosis II, are required to produce gametes. During meiosis I, exchange of genetic material occurs to ensure variation between the chromatids of homologous chromosomes. These homologous chromosomes separate into different daughter cells.

In some cases, non-disjunction occurs between the chromosomes. This can lead to the formation of offspring with different syndromes.

2.3.1 Give ONE characteristic of homologous chromosomes. (1)

2.3.2 Name the process whereby the chromatids of homologous chromosomes exchange genetic material. (1)

2.3.3 State the phase in which the process named in QUESTION 2.3.2 occurs. (1)

2.3.4 Using the extract, give TWO reasons why meiosis is important. (2)

2.3.5 State what is meant by *non-disjunction*. (1)

2.3.6 Explain how non-disjunction can lead to Down syndrome in humans. (3)
(9)

2.4 Haemophilia is caused by a recessive allele carried on the X chromosome ($\mathbf{X^h}$).

A heterozygous female for haemophilia is married to a haemophiliac male.

Use a genetic cross to show the phenotypic ratio of their offspring. **(6)**

2.5 A certain family with a biological child and adopted child, had blood tests done to determine their blood groups.

The results were as follows:

- The mother was blood group B
- The father was blood group AB
- Child **1** was blood group A
- Child **2** was blood group O

2.5.1 How many alleles control the inheritance of blood groups in humans? (1)

2.5.2 Give the genotype of:

(a) The mother (1)

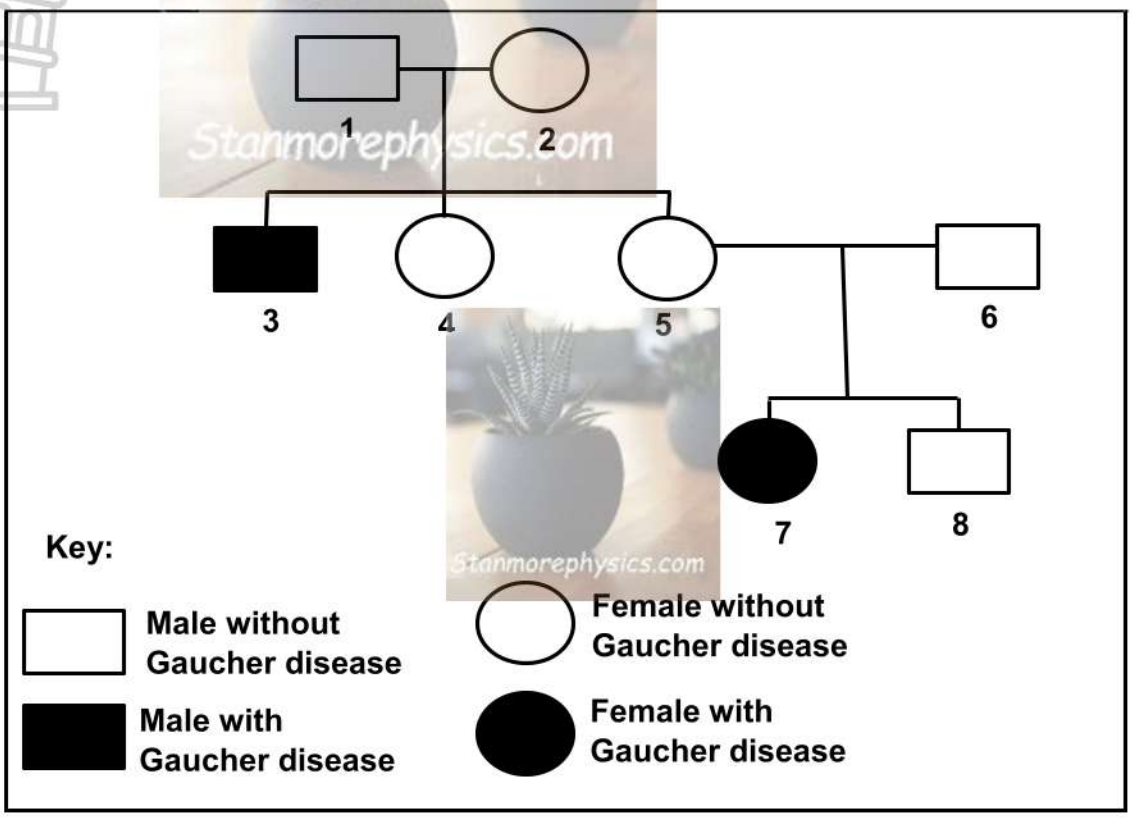
(b) Child **1** (1)

2.5.3 Which ONE of the children (**1** or **2**) is the adopted child? (1)

2.5.4 Explain your answer in QUESTION 2.5.3. (3)
(7)

2.6 Gaucher disease is a genetic disorder that is caused by an autosomal recessive allele **(g)**. This disorder results in the damage to many organs and tissues.

The diagram below shows the inheritance of Gaucher disease in a family.



2.6.1 Name the diagram shown above. (1)

2.6.2 Give the phenotype of individual **3**. (1)

2.6.3 How many:

(a) Generations are represented in the diagram? (1)

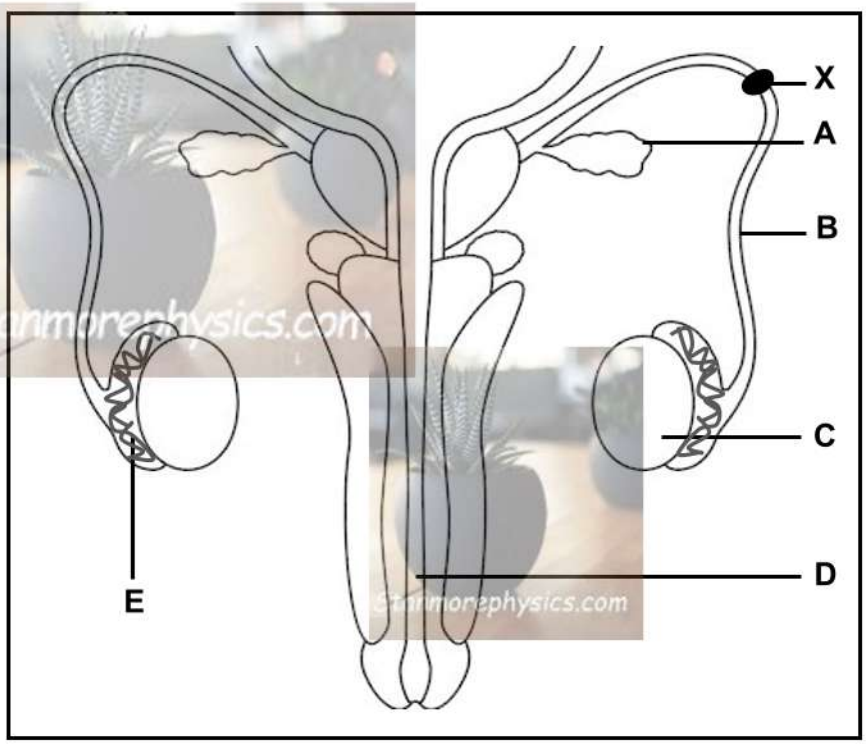
(b) Offspring does individual **1** and **2** have? (1)

2.6.4 Give the genotype of individual **6**. (1)

2.6.5 Using evidence from the diagram, explain your answer in QUESTION 2.6.4. (4)
(9)
[50]

QUESTION 3

3.1 The diagram below represents the male reproductive system.



3.1.1 Identify part:

(a) **A** (1)

(b) **D** (1)

3.1.2 State ONE function of part **E**. (1)

3.1.3 Name and describe the process taking place in part **C** that leads to the formation of gametes. (5)

3.1.4 Tube **B** was cut and tied at point **X** during a surgical procedure.

Explain why this person will still be able to reproduce. (3)
(11)

3.2 Describe the development of the zygote until implantation. **(4)**

3.3 Read the extract below.

> In some people the thyroid gland does not produce enough hormone (hypothyroidism) and in some it produces too much thyroid hormone (hyperthyroidism). These thyroid disorders lead to imbalances in the rate of metabolism.

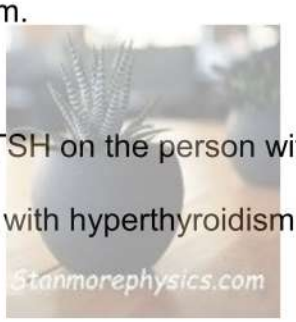
3.3.1 Name the hormone secreted by the thyroid gland. (1)

3.3.2 Using the extract, tabulate ONE difference between hypothyroidism and hyperthyroidism. (3)

3.3.3 Explain:

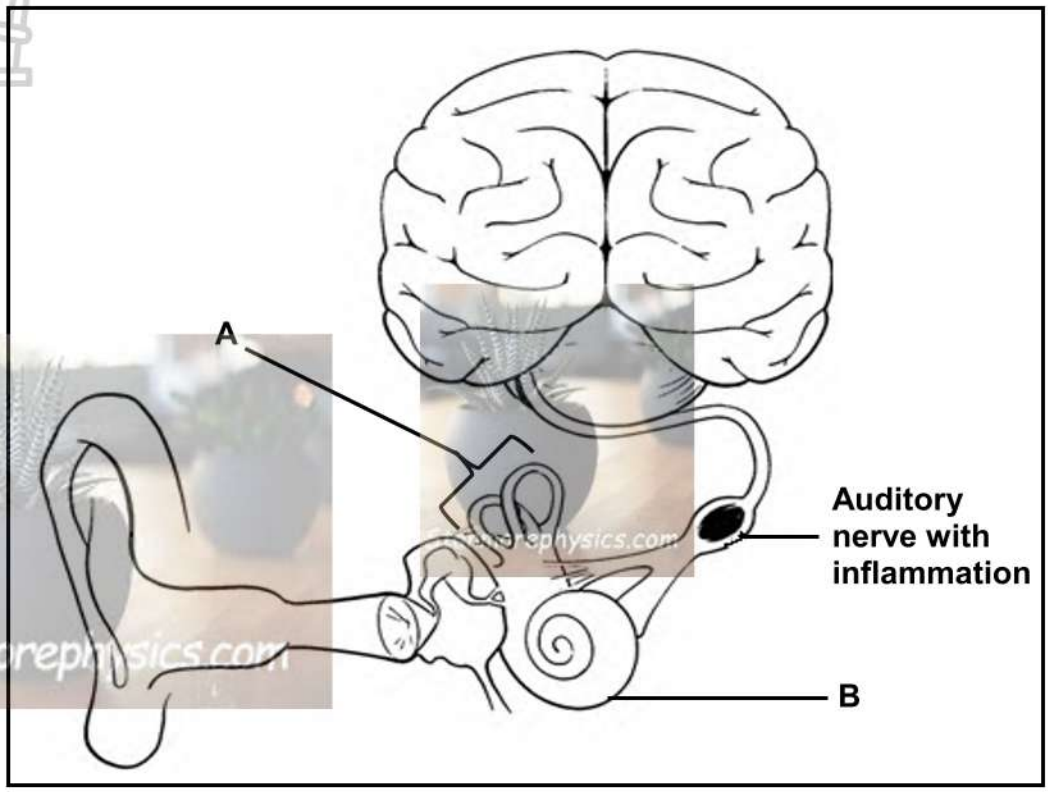
(a) The levels of TSH on the person with hypothyroidism (3)

(b) Why a person with hyperthyroidism may lose weight? (3)
(10)



3.4 Vestibular neuronitis is a condition resulting from the swelling (inflammation) of the auditory nerve transporting impulses from the semi-circular canals. This inflammation blocks the transmission of impulses.

The diagram below represents the human ear and brain.



3.4.1 Identify part **B**. (1)

3.4.2 Name the:

(a) Part of the brain that receives the nerve impulse arising from part **A** (1)

(b) Receptors found in structure **A** (1)

(c) Stimulus for the receptors named in QUESTION 3.4.2(b) (1)

3.4.3 Explain how balance will be affected in a person with vestibular neuronitis. (3)
(7)

3.5 Describe the pupillary mechanism when a person enters a dimly lit room. **(4)**

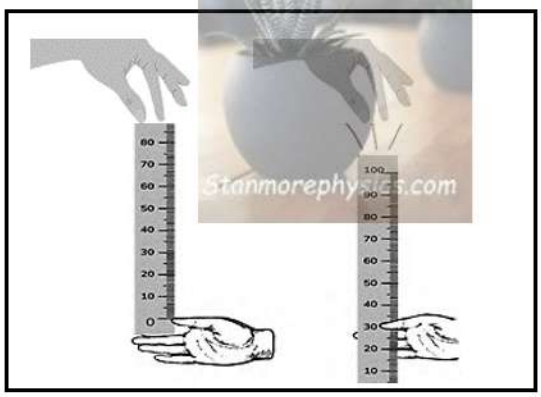
3.6 Reaction time refers to the time it takes for a person to respond to a stimulus.

An investigation was done by learners to determine the relationship between gender and the reaction time.

Two learners (male and female) athletes, aged 17, were asked to participate in the investigation.

The procedure was done as follows:

- One learner held a reaction time ruler while the participant placed the thumb at the position as shown in the diagram below.
- The learner dropped the ruler while the participant quickly caught it.
- The reaction time when the ruler was caught, was recorded.
- This was repeated five times and the average was calculated for each learner.



The results are shown in the table below:

Attempt	Reaction time (s)	
	Male	Female
1	0,10	0,11
2	0,098	0,11
3	0,10	0,10
4	0,095	0,096
5	0,093	0,10

3.6.1 State what is meant by a *stimulus*. (1)

3.6.2 Identify:

(a) The independent variable (1)

(b) The dependent variable (1)

(c) TWO controlled variables relating to the selection of the participants (2)

3.6.3 Explain why the investigation should have been done under the same environmental conditions for both learners. (2)

3.6.4 State why these results CANNOT be considered reliable for this investigation, although 5 attempts were done per individual. (1)

3.6.5 Calculate the average reaction time for the **male** learner. Show ALL working and round off the answer to one decimal place. (2)

3.6.6 State the conclusion for the average reaction time results obtained during the investigation. (2)

3.6.7 Explain how a faster reaction time can be useful when driving a car. (2)
(14)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

FINAL

KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES

JUNE EXAMINATION 2025

MARKING GUIDELINE

MARKS: 150

This memorandum consists of 8 pages

PRINCIPLES RELATED TO MARKING LIFE SCIENCES SEPTEMBER 2024

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

4. **If comparisons are asked for and descriptions are given**
   Accept if 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 sequence is muddled and links do not make sense**
   Where sequence and links are correct, credit. Where sequence and links is incorrect, do not credit. If sequence and links becomes correct again, resume credit.

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

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

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

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

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

14. **If only letter is asked for and only name is given (and vice versa)**
    No credit

15. **If units are not given in measurements**

Candidates will lose marks. Memorandum will allocate marks for units separately

16. Be sensitive to the **sense of an answer, which may be stated in a different way**.

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 appears in any official language other than the learners' 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.

SECTION A

QUESTION 1

1.1	1.1.1	C✓✓		
	1.1.2	D✓✓		
	1.1.3	B✓✓		
	1.1.4	D✓✓		
	1.1.5	C✓✓		
	1.1.6	A✓✓		
	1.1.7	C✓✓		
	1.1.8	A✓✓		
	1.1.9	D✓✓	(9 x 2)	**(18)**
1.2	1.2.1	Gonosome✓		
	1.2.2	Umbilical vein✓		
	1.2.3	Karyokinesis✓		
	1.2.4	Endometrium✓		
	1.2.5	Peptide✓bond		
	1.2.6	Hormones✓		
	1.2.7	Gestation✓	(7 x1)	**(7)**
1.3	1.3.1	A only✓✓		
	1.3.2	A only✓✓		
	1.3.3	None✓✓	(3 x 2)	**(6)**
1.4	1.4.1	Dihybrid✓		(1)
	1.4.2	(a) Big and green fruit✓		(1)
		(b) - Bg✓ - bg✓		(2)
	1.4.3	0✓✓%		(2)
	1.4.4	BBgg ✓✓ bbgg		
		OR BBgg ✓✓ BBgg		
		OR BBgg ✓✓ Bbgg		(2) **(8)**
1.5	1.5.1	(a) B✓		(1)
		(b) A✓		(1)
		(c) B✓		(1)
		(d) C✓		(1)
	1.5.2	Amniotic✓ egg		(1) **(5)**

1.6 1.6.1 (a) Ovulation✓ (1)
(b) Graafian follicle✓ (1)

1.6.2 (a) Progesterone✓ (1)
(b) Oestrogen✓ (1)
(c) Luteinizing hormone✓/ LH (1)
(d) Follicle stimulating hormone✓ / FSH (1)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1.1 Protein✓/peptide (1)

2.1.2 Ribosome✓ (1)

2.1.3 Five✓ / 5 (1)

2.1.4 - Copies the coded information from DNA molecule✓
- to the ribosomes✓/ for the arrangement of amino acids (2)

2.1.5 CCU✓ (1)

2.1.6 (a) CGC✓ (1)

(b) Glutamine✓ (1)

(c)
- mRNA codon changed from GAG to GUG✓
- leading to (tRNA) anticodon changing from CUC to CAC✓
- bringing valine instead of glutamine✓
- resulting in the formation of a different protein✓ (4)

(12)

2.2
- Transcription✓*
- The DNA double helix unwinds✓
- Weak hydrogen bonds break between the strands✓/ strands unzips to form two separate strands
- One strand is used as the template✓
- to form mRNA✓
- using free RNA nucleotides✓ from the nucleoplasm
- The mRNA is complementary to the DNA✓
- mRNA now has the coded message for protein synthesis✓

Compulsory✓* + Any 6 **(7)**

2.3 2.3.1 Chromosomes that:
- Are identical in size✓/length
- Are identical in shape✓
- Have genes that code for the same characteristic occupying the same locus✓
- Have centromere in the same position✓ Any (1)

(Mark first ONE only)

2.3.2 Crossing over✓ (1)

2.3.3 Prophase I✓ (1)

2.3.4 - Produce gametes✓
- Ensure variation✓ / exchange of genetic variation (2)
(Mark first TWO only)

2.3.5 Failure of chromosomes / chromatids to separate✓ during anaphase (1)

2.3.6 - Failure of chromosomes pair 21 to separate during anaphase I✓/ II
- results in a gamete with an extra copy of chromosome 21✓
- When it fuses with a normal gamete,✓
- a zygote with 47 chromosomes✓ will be formed Any (3)
(9)

2.4 P_1

Phenotype: Non-haemophilic female x Haemophiliac ✓ male

Genotype: X^HX^h x X^hY✓

Meiosis

Gametes: X^H, X^h x X^h, Y✓

Fertilisation

F_1 *generation* Genotype: X^HX^h, X^HY X^hX^h, X^hY✓

Phenotype: non-haemophilic daughter; non-haemophilic son haemophiliac daughter: daughter; haemophiliac son✓

Phenotypic ratio: 1:1:1:1✓*

P_1 and F_1✓

Meiosis and fertilisation✓ Compulsory mark 1* + Any 5

OR

P_1

Phenotype: Non-haemophilic female x Haemophiliac ✓ male

Genotype: X^HX^h x X^hY ✓

Meiosis

Fertilisation

Gametes	X^H	X^h
X^h	X^HX^h	X^hX^h
Y	X^HY	X^hY

1 mark for correct gametes
1 mark for correct genotypes

F_1 *generation*

Phenotype: non-haemophilic daughter; non-haemophilic son haemophiliac daughter: daughter; haemophiliac son✓

Phenotypic ratio: 1:1:1:1✓*

P_1 and F_1✓

Meiosis and fertilisation✓ Compulsory mark 1* + Any 5 **(6)**

2.5 2.5.1 Three✓ / 3 (1)

2.5.2 (a) I^Bi✓ (1)

(b) I^Ai✓ (1)

2.5.3 2✓ (1)

2.5.4
- The genotype of child 2 is ii✓
- For the children, the mother can contribute either the I^B or i✓
- and the father can contribute either the I^A or I^B✓ (3)

(7)

2.6 2.6.1 Pedigree✓ diagram (1)

2.6.2 Male with Gaucher disease✓ (1)

2.6.3 (a) THREE✓ / 3 (1)

(b) THREE✓ / 3 (1)

2.6.4 Gg✓ (1)

2.6.5
- Individual 6 does not have Gaucher disease✓
- but has a child / individual 7 with Gaucher disease✓
- who is homozygous recessive✓ / **gg**
- and inherited the recessive allele / **g** from each parent✓
- Therefore, individuals 5 and 6 are heterozygous✓/ **Gg** Any (4)

(9)

QUESTION 3

3.1 3.1.1 (a) Seminal vesicle✓ (1)

(b) Urethra✓ (1)

3.1.2 Store sperm✓ cells (1)

3.1.3
- Spermatogenesis✓* (1)
- Under the influence of testosterone✓
- Diploid cells in the seminiferous tubules✓ of the testes
- undergo meiosis✓
- to form haploid sperm cells✓ Compulsory mark 1* + 4 (5)

3.1.4
- The other vas deferens is still functional✓
- and will be able to transport semen✓/ sperm cells to the urethra
- and deposited to the vagina to fertilise egg✓ in the oviduct (3)

(11)

3.2
- The zygote divides by mitosis✓ several times
- to form a (solid) ball of cells✓
- called morula✓
- which further divides to form a hollow ball of cells✓
- called blastula✓/ blastocyst Any **(4)**

3.3 3.3.1 Thyroxin✓ (1)

3.3.2 ✓

Hypothyroidism	Hyperthyroidism
- occurs when the thyroid gland does not produce enough hormone✓	- occurs when the thyroid gland produces too much thyroid hormone✓

1 mark for the table + (1 x 2) (3)

3.3.3 (a)
- Low thyroxin levels in the blood✓
- Stimulates the pituitary gland✓
- to secrete more TSH✓/ high levels of TSH (3)

(b)
- Since the thyroxin levels remain high✓
- The rate of metabolism will remain high✓
- More glucose will be used✓ / broken down
- Glucose /fats decrease✓in the blood Any (3)

(10)

3.4 3.4.1 Cochlea✓ (1)

3.4.2 (a) Cerebellum✓ (1)

(b) Cristae✓ (1)

(c) Change in the speed and direction of movement of the head✓ (1)

3.4.3
- Nerve impulses will not be transmitted✓to the cerebellum
- Therefore, no nerve impulses will be sent to the muscles✓
- and no coordination/ balance occur✓ (3)

(7)

3.5
- Circular muscles will relax✓
- Radial muscles contract✓
- Pupil dilates✓
- and more light enters the eye✓ **(4)**

3.6 3.6.1 A change in the environment✓of an organism (1)

3.6.2 (a) Gender✓ (1)

(b) Reaction time✓ (1)

(c)
- Both learners were of the same age✓
- Both learners were Athletes✓ (2)

(Mark the first TWO only)

3.6.3 - To ensure that the gender is the only variable that influences the reaction time✓✓ (2)

3.6.4 Sample size was too small✓ / only 1 male and female were used (1)

3.6.5 Average reaction time = $\frac{0.10 + 0.098 + 0.10 + 0.095 + 0.093}{5}$ ✓

= 0.1✓ (2)

3.6.6 Males have less reaction time than females✓✓/ females have more reaction time than males (2)

3.6.7 - a person can brake faster✓/ respond faster
- to prevent accident✓ (2)

(14)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150