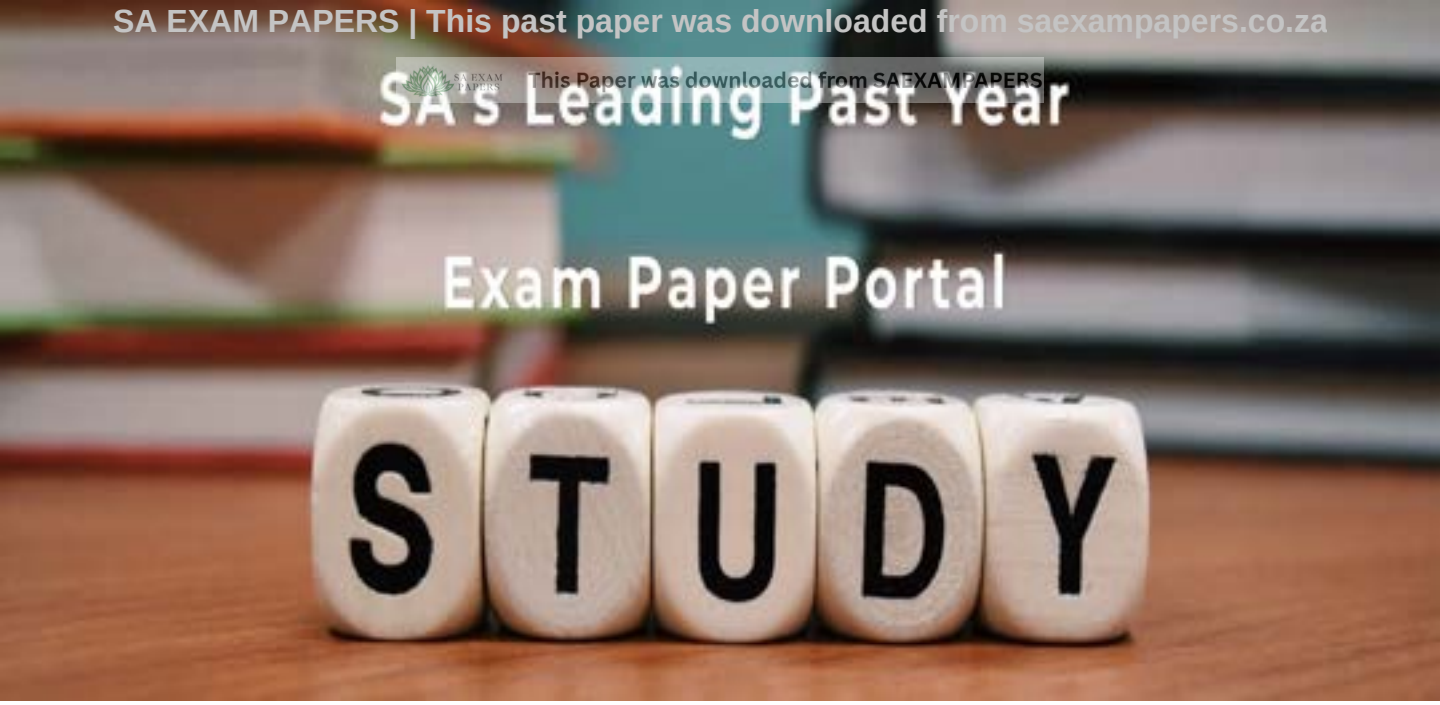


education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12

LIFE SCIENCES

JUNE 2025

MARKS: 150

TIME: 2½ hours

This question paper consists of 16 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, 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 1.1.10) in the ANSWER BOOK,
e.g. 1.1.11 D.

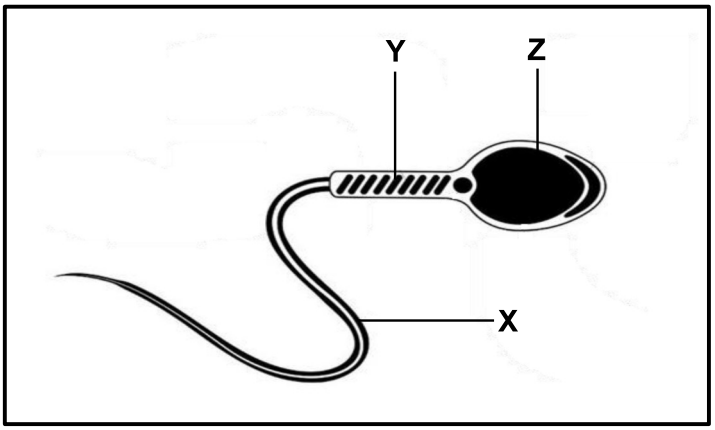
1.1.1 What will the percentage of thymine be in a DNA molecule, if 35% of the nitrogenous bases are guanine?

A 35%
B 30%
C 70%
D 15%

1.1.2 Which ONE of the following can occur during meiosis I?

A Chromatids separate to move to opposite poles
B Identical haploid cells form
C Non-disjunction
D Alleles of a gene fuse together

1.1.3 The diagram below shows the structure of the sperm cell.



Which ONE of the following combinations is correct?

A	X – Tail	Y – Mitochondria	Z – Nucleus
B	X – Flagellum	Y – Middle piece	Z – Acrosome
C	X – Tail	Y – Acrosome	Z – Head
D	X – Cilium	Y – Mitochondria	Z – Acrosome

1.1.4 The hormone responsible for secondary sexual characteristics in males is ...

A luteinising hormone.
B testosterone.
C progesterone.
D oxytocin.

1.1.5 In a dihybrid cross, an animal with long ears (**L**) and red fur (**R**) was crossed with an animal with short ears (**l**) and black fur (**r**).

Which ONE of the following could represent the genotypes of the parents?

A LLRR × llrr
B LlRr × LlRr
C llRR × llrr
D Llrr × LLRr

1.1.6 The chances of having a male child in humans are ...

A 25%
B 50%
C 75%
D 100%

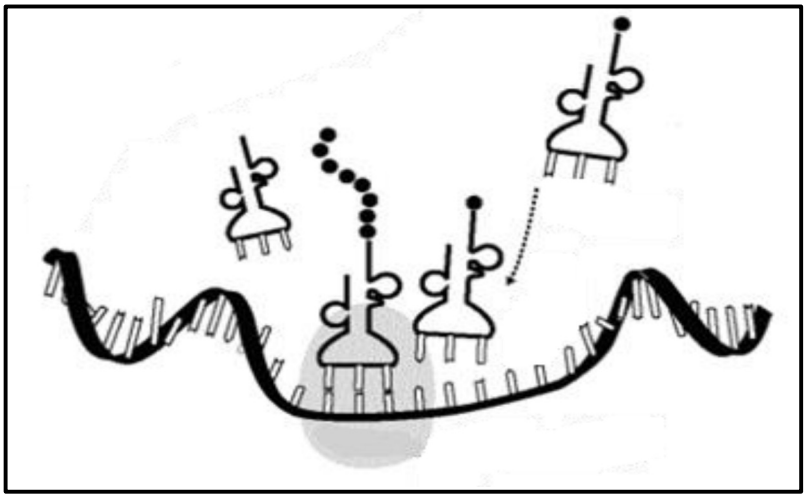
1.1.7 The scientist that bred pea plants to investigate the priniciples of genetics:

A James Watson
B Maurice Wilkins
C Rosalind Franklin
D Gregor Mendel

1.1.8 DNA and RNA are examples of ...

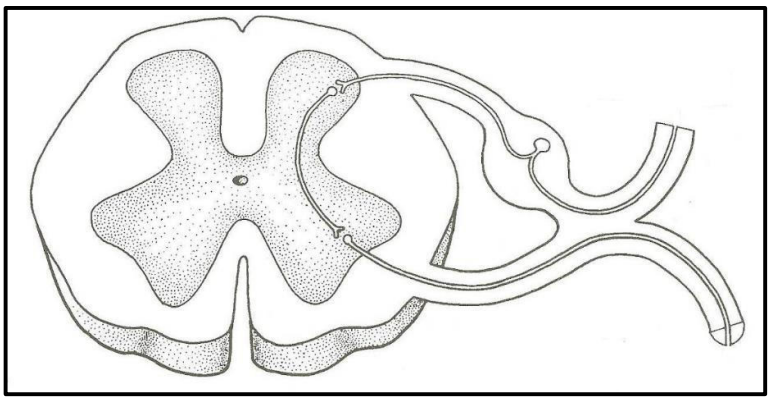
A amino acids.
B proteins.
C nucleic acids.
D enzymes.

1.1.9 What is illustrated in the diagram below?



A tRNA molecules transferring amino acids during translation.
B Transcription taking place on the DNA template inside the nucleus.
C DNA nucleotides attaching to the template strand during DNA replication.
D The mRNA molecule leaving the nucleus.

1.1.10 Where in the human body will you find the structure illustrated in the diagram below?



A Cerebellum
B Spinal cord
C Brain
D Effector muscle (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 1.2.9) in the ANSWER BOOK.

1.2.1 A genetic cross that involves the inheritance of a single characteristic

1.2.2 The hormone responsible for repairing the endometrium after menstruation

1.2.3 The division of the cytoplasm during the process of meiosis

1.2.4 The neuron that transports impulses towards the effector

1.2.5 The bonds found between the monomers of a protein

1.2.6 Structures in the testes responsible for providing the mother cells for spermatogenesis

1.2.7 The type of dominance where neither alleles of a gene are fully expressed, and the phenotype shows an intermediate state

1.2.8 The part of the brain that controls the breathing rate

1.2.9 A representation showing all the nuclear chromosomes in a cell

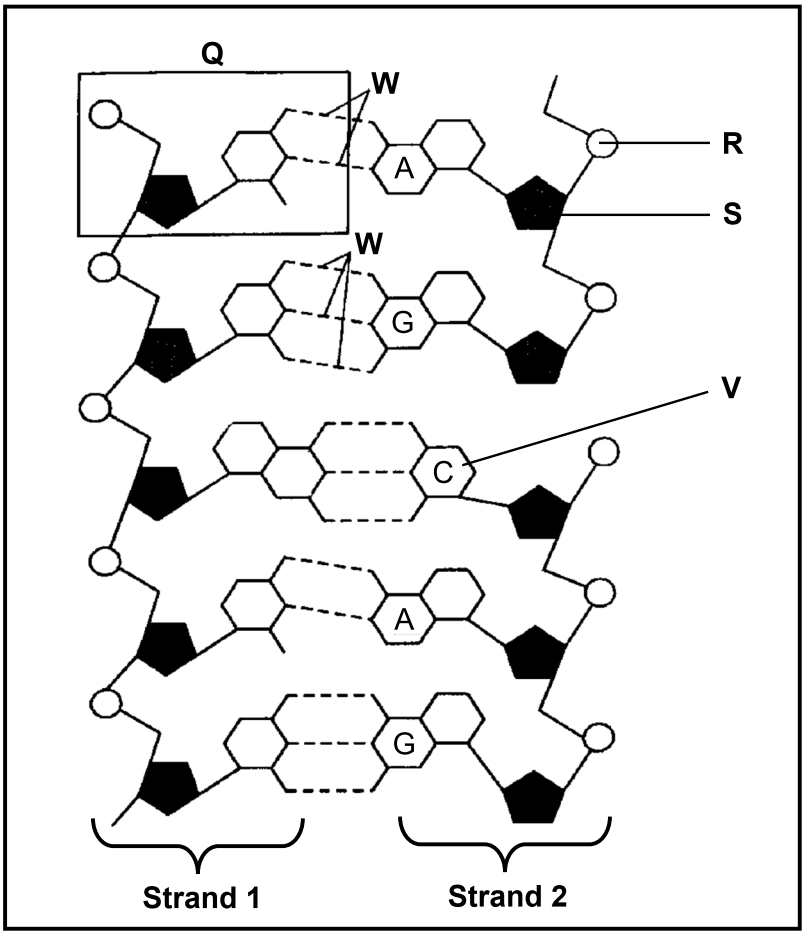
(9 x 1) **(9)**

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 numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II
1.3.1	Process(es) involved in protein synthesis	A: DNA replication B: Transcription
1.3.2	Diploid cells are being produced	A: Meiosis B: Oogenesis
1.3.3	Part of the central nervous system	A: Cranial nerves B: Spinal cord

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

1.4 The diagram below represents a molecule found in a cell.



1.4.1 Identify:

(a) Unit **Q** (1)

(b) **R** (1)

(c) **S** (1)

(d) The full name of **V** (1)

(e) **W** (1)

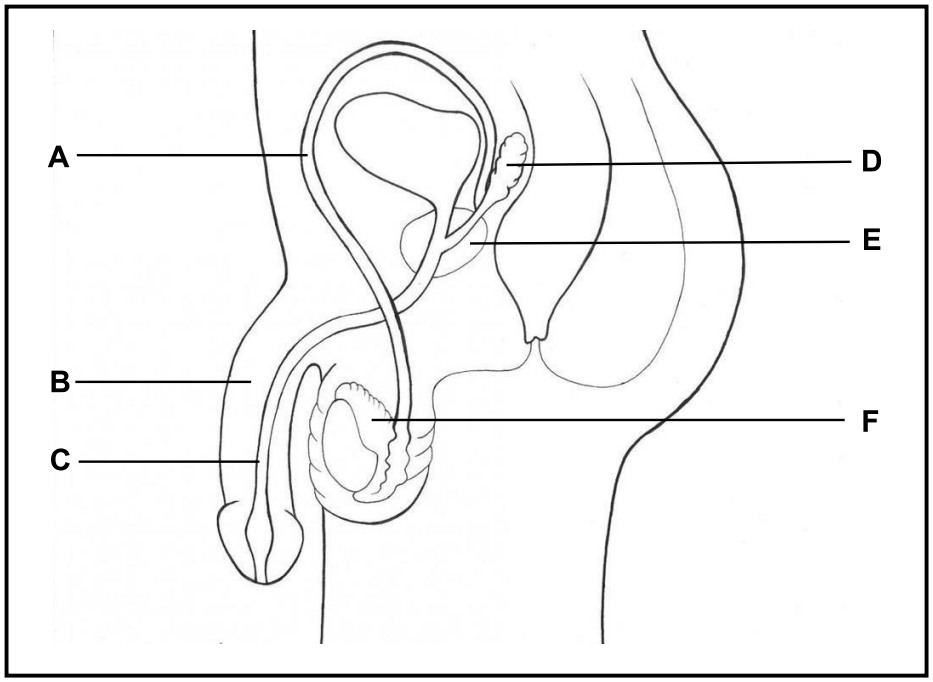
1.4.2 Identify the molecule in the diagram above. (1)

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

1.4.4 Write down the sequence of the nitrogenous bases for **strand 1** from the top to the bottom. (2)

1.4.5 Besides the nucleus, name ONE other location in an animal cell where DNA can be found. (1)
(10)

1.5 The diagram below represents the side view of the male reproductive system.



1.5.1 Give the LETTER and the NAME of the ...

(a) structure where sperm cells are temporarily stored to mature. (2)

(b) structure that provides sperm cells with fructose sugar. (2)

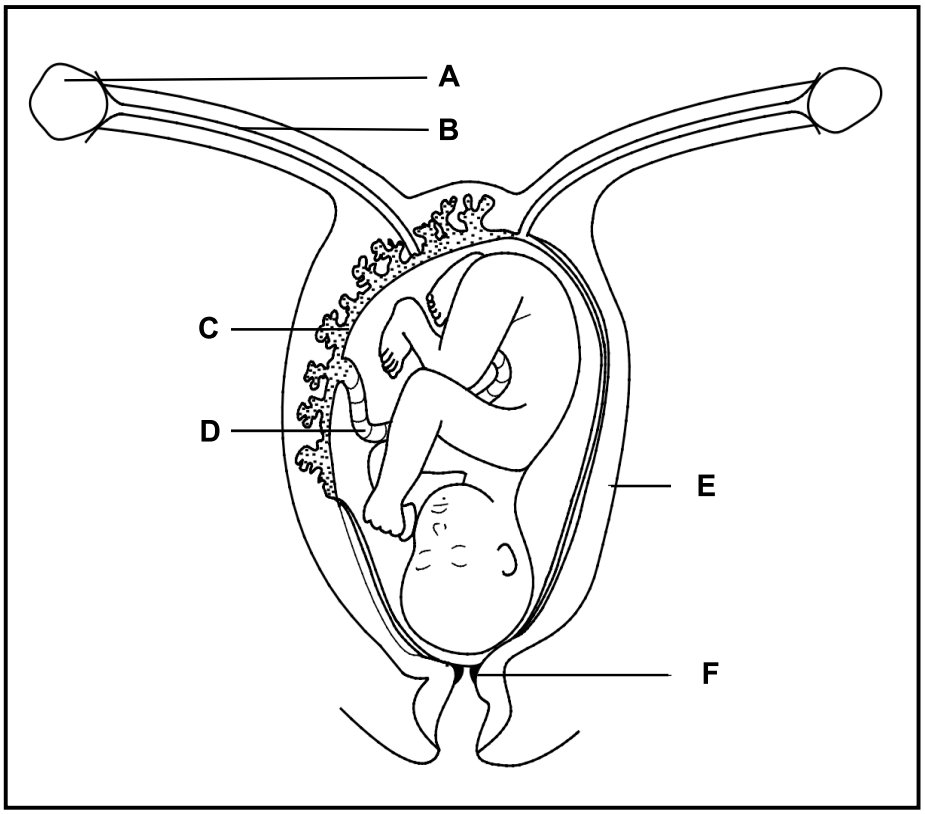
1.5.2 Identify part **A**. (1)
(5)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents a developing foetus in the uterus.



2.1.1 Give the LETTER of the part where:

(a) fertilisation usually occurs (1)

(b) ova are produced (1)

(c) a mucus plug forms during gestation (1)

2.1.2 Give TWO functions of part **C**. (2)

2.1.3 Describe ONE structural adaptation of part **E** for gestation. (2)

2.1.4 Explain how the development of the foetus would be affected if a tumour starts growing in part **D**, pushing on the blood vessels inside. (4)

2.1.5 Explain the chance of fertilisation taking place in the diagram above. (4)
(15)

2.2 Describe the process of *oogenesis*. **(5)**

2.3 Read the extract below.

Monotremes are a very unique group of mammals that lay eggs. The duck-billed platypus is a well-known example, but is just one of five species of monotremes. The other four species are all types of echidnas, also known as spiny anteaters. They resemble hedgehogs, having quill-covered bodies, but possess much longer snouts.

The mating behaviour of echidnas is extremely intricate and scientists have struggled to discover the mechanism, as echidnas do not seem interested in mating while in captivity. Females lay one egg with a soft leathery shell 22 days after mating with a male. She has a pouch, similar to a kangaroo's, and will immediately desposit her egg in the pouch until it hatches ten days later. Once hatched the young hairless echidna starts feeding on milk produced by the mother, while staying in the pouch.

2.3.1 What type of fertilisation occurs in echidnas? (1)

2.3.2 Give TWO advantages of the type of fertilisation mentioned in QUESTION 2.3.1. (2)

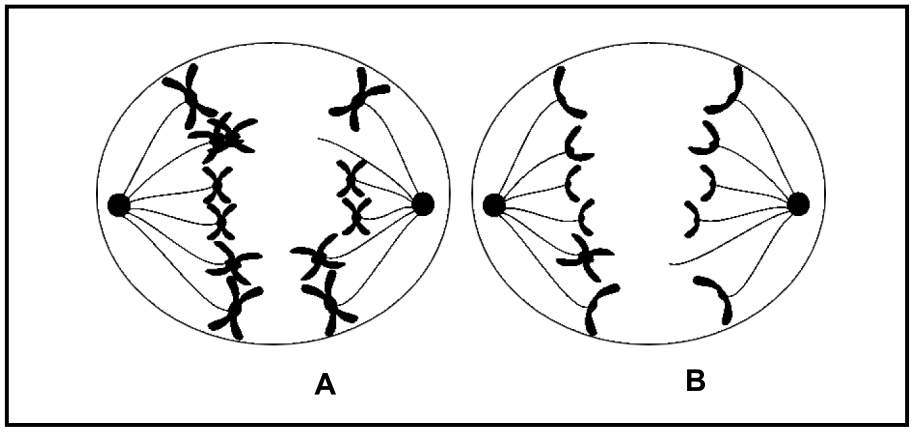
2.3.3 Which reproductive strategy is found in echidnas? (1)

2.3.4 Provide TWO reasons to show evidence of parental care in echidnas. (2)

2.3.5 Do these mammals show precocial, or altricial development? (1)

2.3.6 Give ONE characteristic of the echidna to support your answer to QUESTION 2.3.5. (1)
(8)

2.4 The two diagrams below represent two phases of meiosis.



2.4.1 Identify the phases represented by:

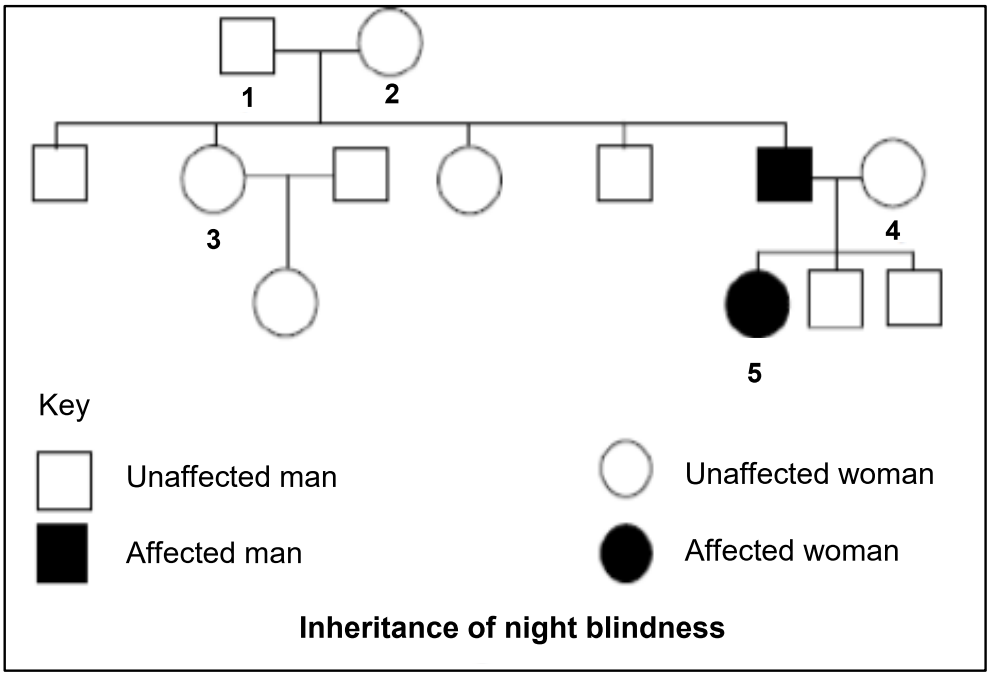
(a) **A** (1)

(b) **B** (1)

2.4.2 Explain why both cells (**A** and **B**) show non-disjunction. (3)

2.4.3 Tabulate TWO differences between mitosis and meiosis. (5)
(10)

2.5 The pedigree diagram below shows the inheritance of a type of night blindness in a family. This disorder is sex-linked and is caused by a recessive allele (n). Having normal night vision is caused by a dominant allele (N).



Inheritance of night blindness

2.5.1 What is meant by a *sex-linked disorder*? (1)

2.5.2 How many of the male descendents of parents **1** and **2** are unaffected? (1)

2.5.3 Give the genotype of:

(a) Individual **2** (2)

(b) Individual **5** (2)

2.5.4 If individual **5** has children with an unaffected man, what percentage of her daughters will have an allele for night blindness, but is NOT affected? (2)

2.5.5 Name TWO genetic disorders, except for night blindness, that are sex-linked. (2)

2.5.6 Explain how it was possible for individuals **1** and **2** to have an affected child, while both of them are unaffected. (2)
(12)
[50]

QUESTION 3

3.1 Read the extract below.

The Development and Shaping of the Brain

The making of the human brain from the tip of a 3 millimeter neural tube is a marvel of biological engineering. To arrive at the more than 100 billion neurons found in a newborn baby, the brain must grow at the rate of about 250 000 nerve cells per minute, on average, throughout the course of pregnancy. But it is not the volume of growth alone that makes the production of a human brain so exceptional compared to other organs. The brain has many functions, and how the functions are specifically assigned to each location in the brain, are stunning in their complexity; yet the feat of growing a human brain occurs in hundreds of millions of individuals each year.

The brain's 100 trillion or so interconnections provide the physical basis for its speed and sophistication. But how is such an intricate network constructed in the first place? Does the genetic material of the fertilised egg already contain a full set of building specifications for the human brain, in which every cell is created as a building block in the overall design?

[From https://www.ncbi.nlm.nih.gov/books/NBK234146/]

3.1.1 The extract above mentions *interconnections*. What is the scientific name for these connections between neurons? (1)

3.1.2 State TWO ways how the production of the brain is exceptional compared to other organs in the human body. (2)

3.1.3 How many brain cells will grow in an hour in a foetus? Show ALL calculations. (3)

3.1.4 Which word in the extract hints that the production of brain tissue is encoded in DNA? (1)

3.1.5 Which part of the brain will contain the most neurons? (1)
(8)

3.2 An investigation was done to determine the effect of a new hearing aid on the hearing quality of middle-aged adults.

The investigation was conducted as follows:

- 300 participants between the ages of 45 and 65 participated voluntarily in the investigation.
- Participants had to undergo a hearing test. During the test, a sound with a specific frequency would be played, starting at a soft volume and then slowly amplifying it over a short period. Participants had to signal the moment they could hear the sound for the first time. This was done for ten different sounds.
- After this initial test, 250 participants were given the hearing aids and had to wear them for a week.
- After a week, while those with the hearing aids were still wearing them, all the participants had to repeat the hearing test.

The table below shows the number of participants with hearing aids and the average number of seconds when they started to hear the sounds in the hearing test.

	NUMBER OF PARTICIPANTS	
Avg. number of seconds	**Before wearing the hearing aid**	**While wearing the hearing aid**
0–2	12	134
2.1–4	37	96
4.1–6	112	17
6.1–8	77	2
8.1–10	12	1

3.2.1 For this investigation, give:

(a) The dependent variable (1)

(b) The aim (2)

3.2.2 Why can this investigation be regarded as reliable? (1)

3.2.3 Suggest a reason why participants with the hearing aids had to wear them for a week before the follow-up hearing test. (1)

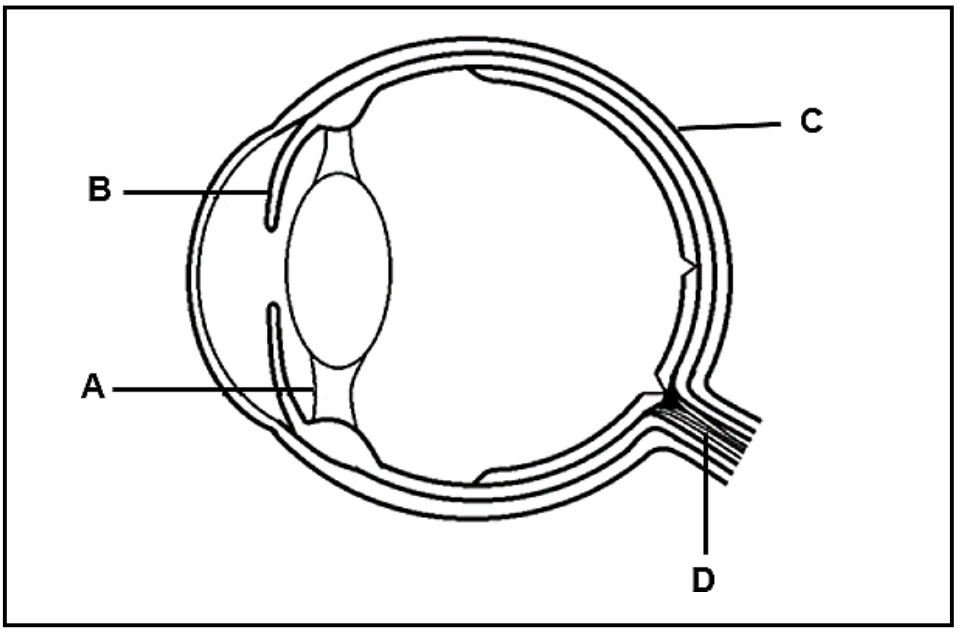
3.2.4 Explain why 50 participants had to do the follow-up hearing test without having received the hearing aids. (2)

3.2.5 List THREE ways how the validity of the investigation could be ensured. (3)

3.2.6 Give a suitable conclusion for this investigation. (2)

3.2.7 Draw a double bar graph to present the data in the table. (6)
(18)

3.3 The diagram below represents the structure of the human eye.



3.3.1 Identify part:

(a) **A** (1)

(b) **C** (1)

3.3.2 Michael pranks his friend Karabo by using the flashlight on his phone and unexpectantly flashing it into his eyes.

Describe how structure **B** will change in Karabo's eyes. (3)

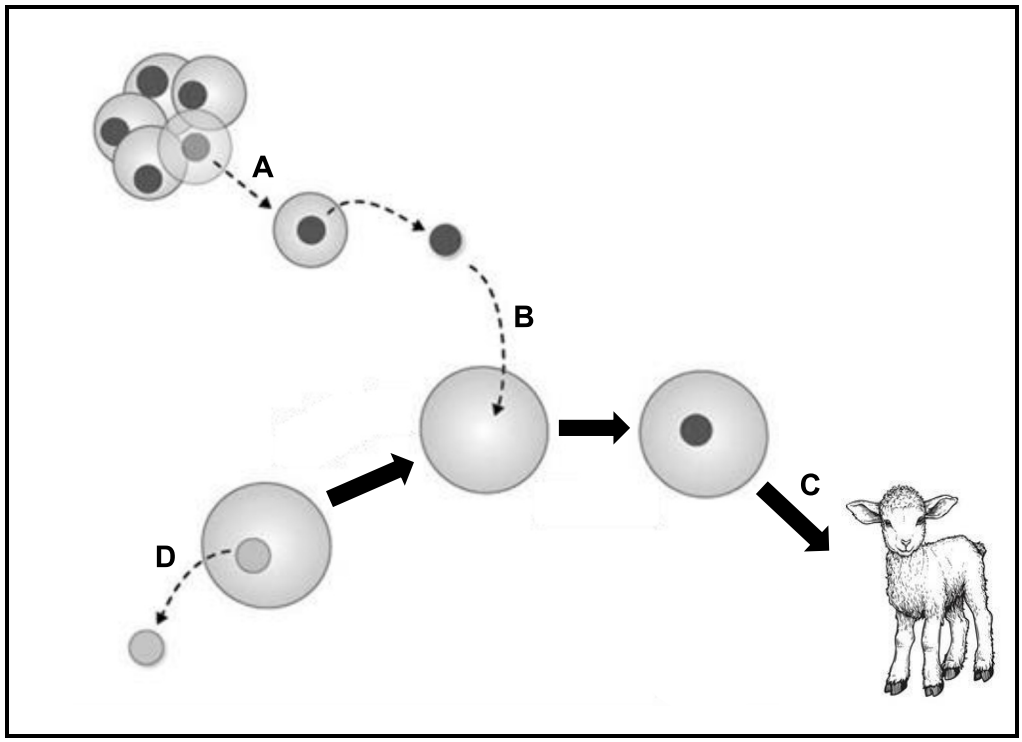
3.3.3 Make a labelled drawing of the cell in **D** that transports impulses towards the brain. (6)
(11)

3.4 A man with blood group **A** marries a woman with blood group **O**. They have two children with the blood groups **A** and **O**.

3.4.1 By using a genetic cross, show the genotypes and phenotypes of the parents and children. (6)

3.4.2 Explain why using blood groups is not an accurate method for paternity testing. (2)
(8)

3.5 The diagram below shows the main steps used during cloning.



3.5.1 Write down the LETTER that represents each of the following:

(a) An ovum's nucleus is being removed (1)

(b) A somatic cell is removed from animal tissue of the animal that is to be cloned (1)

(c) A nucleus of the animal being cloned is inserted into an ovum (1)

3.5.2 State TWO benefits of cloning animals. (2)
(5)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150