GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2024

LIFE SCIENCES

TIME: 2½ hours

MARKS: 150

19 pages

LIFE SCIENCES P1

C2831E

X05

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

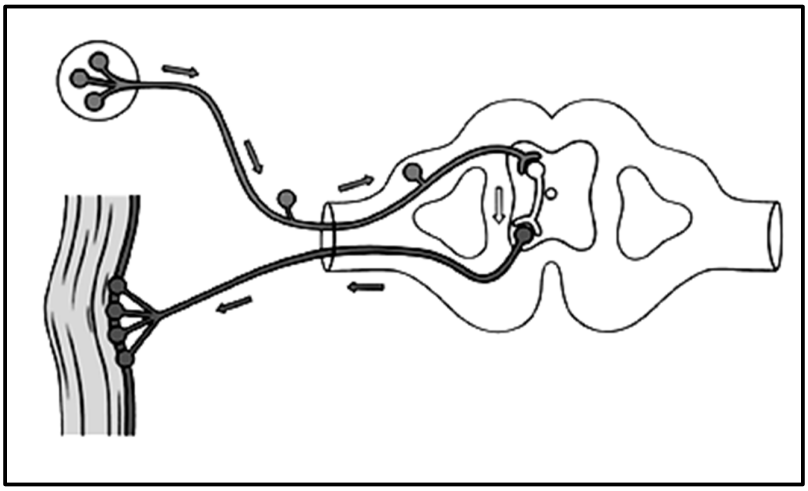
1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
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 Four 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 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

Questions 1.1.1 and 1.1.2 are based on the diagram below.



1.1.1 The correct order in which the impulses travel in the diagram above is ...

A receptor, interneuron, sensory neuron, motor neuron, effector.
B receptor, effector, motor neuron, interneuron, sensory neuron.
C receptor, motor neuron, interneuron, sensory neuron.
D receptor, sensory neuron, interneuron, motor neuron.

1.1.2 The pathway shown in the diagram is known as the …

A reflex action.
B reflex pathway.
C reflex arc.
D reaction.

1.1.3 Which part of the brain is responsible for interpreting hearing?

A Cerebellum
B Cerebrum
C Corpus callosum
D Medulla oblongata

1.1.4 In guinea pigs, one parent had black fur and the other had white fur. The resulting offspring were all grey. This interaction between the F1 alleles that resulted in the grey fur colour can be referred to as:

A Complete dominance
B Incomplete dominance
C Co-dominance
D Crossing over

1.1.5 Which of the following is an example of a chromosomal mutation?

A Albinism
B Colour blindness
C Down syndrome
D Haemophilia

1.1.6 A farmer is growing pea plants. The allele for tall plants is T, and the allele for dwarf plants is t. Which cross would need to be carried out to ensure a phenotypic ratio of 1 : 1?

A tt x tt
B Tt x Tt
C TT x Tt
D Tt x tt

1.1.7 The microscopic structures that carry out a part of protein synthesis under the control of the nucleus are ...

A ribosomes.
B chloroplasts.
C mitochondria.
D cell walls.

1.1.8 The ABO blood groups are an inherited characteristic.

What would the possible blood group of the offspring be when the parents have the genotypes I^AI^A and I^Ai?

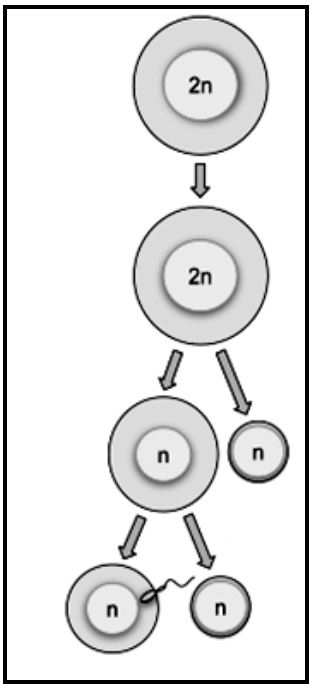
A Group O only
B Group A and group O
C Group AB only.
D Group A only

1.1.9 What are the receptors in the ear responsible for maintaining balance called?

A Organ of corti and cristae
B Oval window and round window
C Maculae and cristae
D Maculae and eustachian tube

1.1.10 The diagram below represents:

A Oogenesis
B Spermatogenesis
C Spermatogenesis and oogenesis
D Meiosis



(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 1.2.8) in the ANSWER BOOK.

1.2.1 The attachment of the developing embryo to the uterine lining

1.2.2 The manipulation of biological processes to satisfy human needs

1.2.3 The type of inheritance where both alleles are equally dominant

1.2.4 The point of crossing over between homologous chromosomes

1.2.5 A diagram showing the inheritance of genetic disorders over many generations

1.2.6 The process whereby the eye adjusts to the amount of light

1.2.7 The part of the ear that equalises pressure on either side of the tympanic membrane

1.2.8 The bundle of nerves that connects the brain's two hemispheres

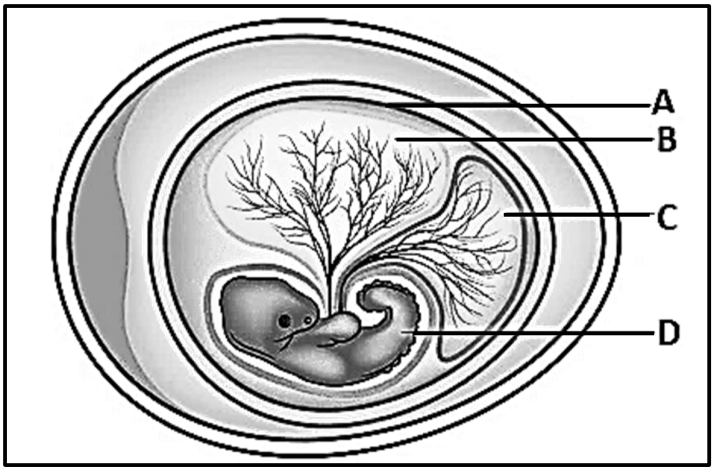
(8 x 1) **(8)**

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 numbers (1.3.1 to 1.3.4) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 The structure that gives rise to spindle fibres during meiosis and mitosis in animals	A: Centrioles B: Centromeres
1.3.2 A possible gamete in a dihybrid cross	A: H B: HhBb
1.3.3 Alleles of blood groups	A: Complete dominance B: Co-dominance
1.3.4 The location of DNA	A: Mitochondria B: Chloroplast

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

1.4 The diagram below shows the embryonic development in birds.



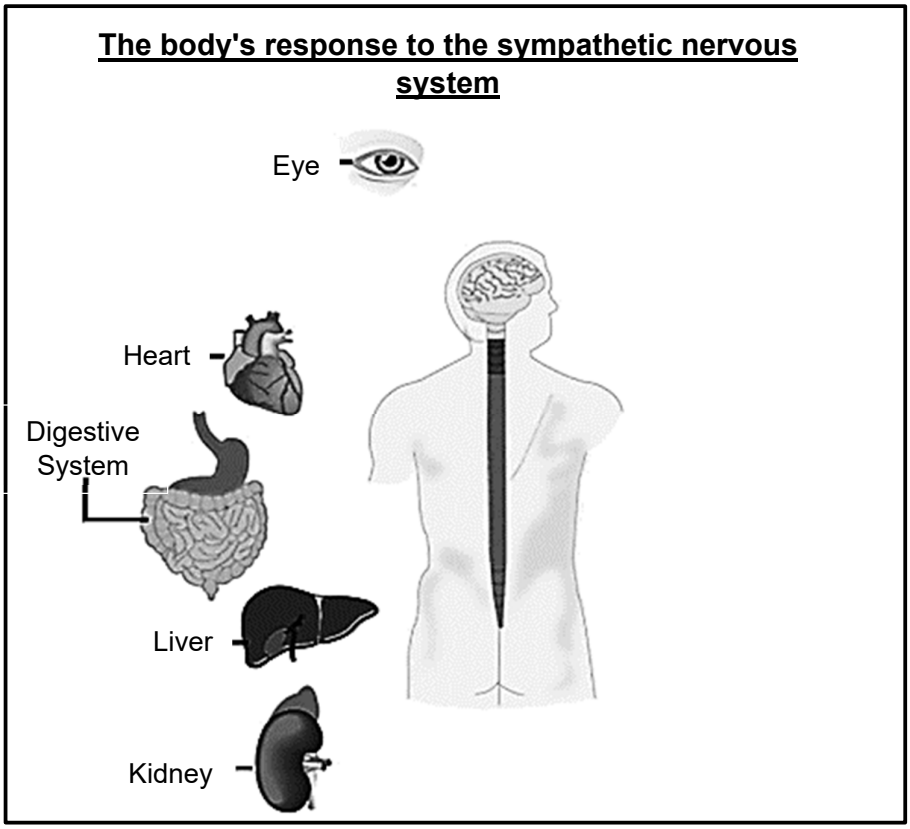
1.4.1 Name the type of embryonic development shown in the diagram above. (1)

1.4.2 Give the LETTER ONLY of the part that:

(a) Nourishes the embryo
(b) Stores and removes waste
(c) Protects the growing embryo (3)

1.4.3 State TWO physical characteristics of a precocial chick upon hatching. (2)
(6)

1.5 A learner is caught while truanting (bunking) from his Life Sciences class. A teacher yells out to him to go back to class. He knows he is going to be in trouble both at school and home. He considers going back to class, but as the teacher approaches, he decides to run away. The diagram below shows organs in the body responding to the sympathetic nervous system.



1.5.1 Describe how the learner's sympathetic nervous system helps him to escape with regard to the following organs:

(a) The eye (1)
(b) The heart (1)
(c) The liver (1)

1.5.2 Explain the role that the gland attached to the kidney plays in the sympathetic nervous system. (2)

1.5.3 Name the process that will increase in the cells during a sympathetic response. (1)

1.5.4 Identify the purpose of the increase in the process mentioned in QUESTION 1.5.3. (1)

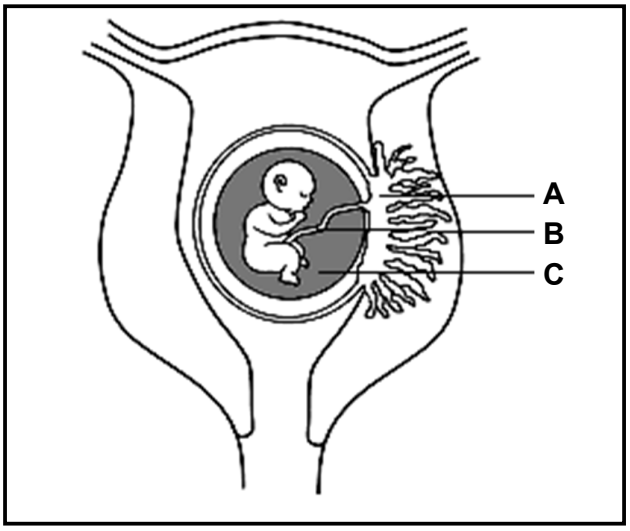
1.5.5 Name the branch of the nervous system that allows the learner to calm down once he is far away from the teacher. (1)
(8)

TOTAL SECTION A 50

SECTION B

QUESTION 2

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



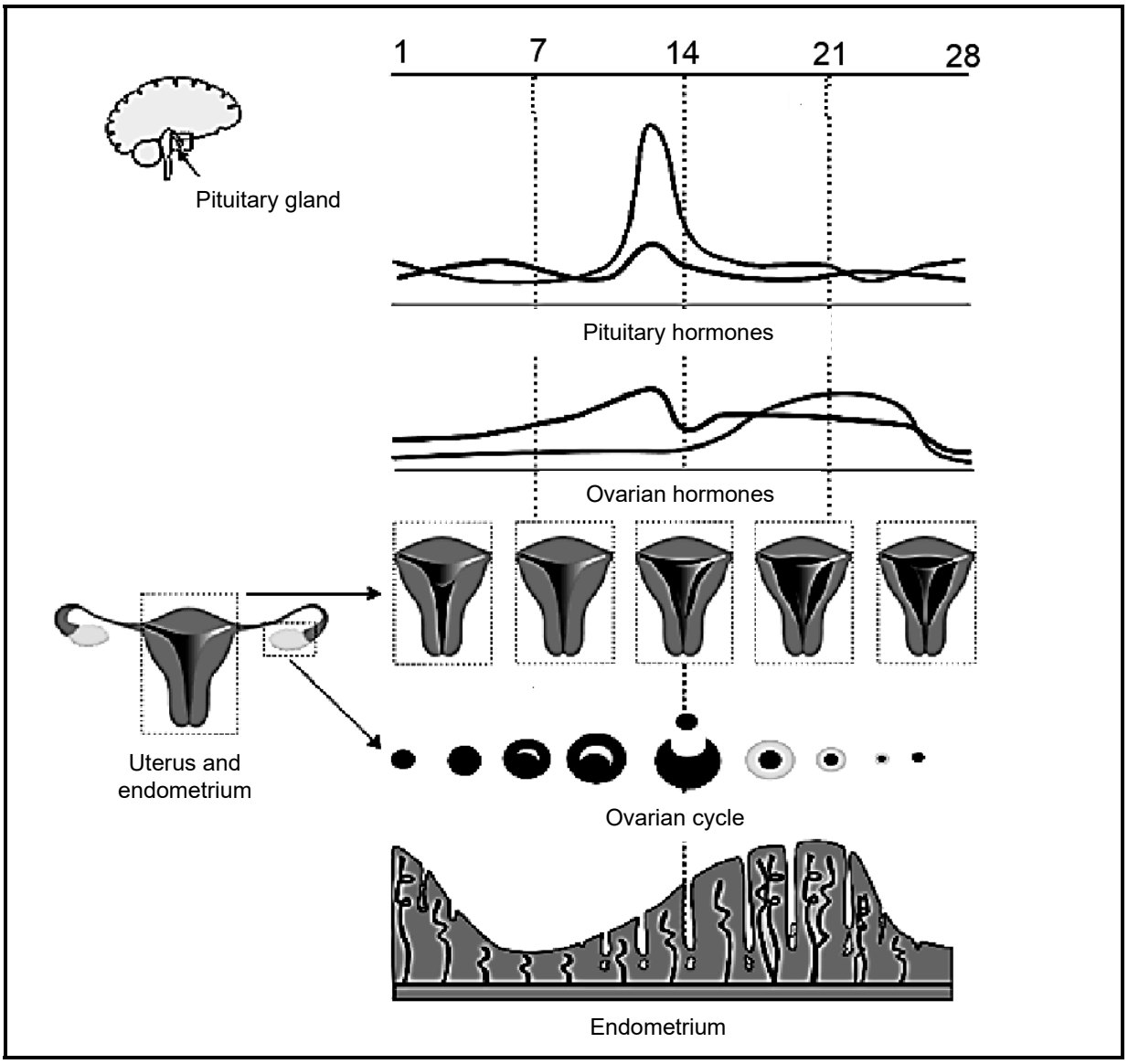
2.1.1 Name the hormone that is produced by structure **A** during pregnancy. (1)

2.1.2 Describe the consequence for the foetus if structure **A** should produce an insufficient amount of the hormone mentioned in QUESTION 2.1.1. (2)

2.1.3 The foetus's lungs are not fully developed for gaseous exchange during the gestation period. Give the **NAME** and **LETTER** of the part that serves as the pathway for transporting gases from the mother to the foetus and vice versa. (2)

2.1.4 Explain how the developing foetus would be affected if the membranes around structure **C** were to tear. (4)
(9)

2.2 The diagram below shows the hormonal control of the menstrual cycle.



2.2.1 Name the pituitary hormone which shows a sharp increase just before the 14th day of the menstrual cycle. (1)

2.2.2 Describe the functions of the hormone mentioned in QUESTION 2.2.1. (2)

2.2.3 Name the hormone that causes the endometrium to start thickening from day 7 and state ONE other function of this hormone. (2)

2.2.4 Name the TWO ovarian hormones and state their origin. (4)
(9)

2.3 Study the text and diagrams 1 and 2 below and answer the questions that follow.

The diagram below shows a contrast between a healthy brain (left) and a brain with Alzheimer's disease (right). The exact cause of the disorder is not yet established. However, several pieces of evidence show the involvement of genetics, lifestyle-related factors, and environmental factors. The brain tissues of Alzheimer's patients are typically shrunken. In the Alzheimer's brain, abnormal levels of a naturally occurring protein clump together to form amyloid plaques that collect between neurons and disrupt cell function. This causes synaptic loss and eventually results in the death of brain cells. These changes at the cellular level result in the symptoms of Alzheimer's.

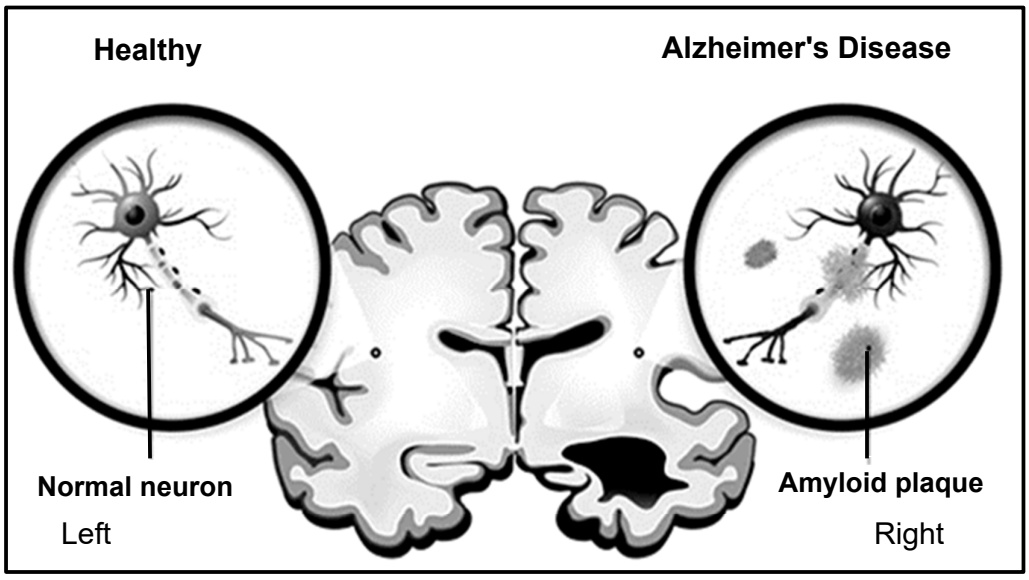


Diagram 1

2.3.1 Identify ONE structural problem of an Alzheimer's brain mentioned in the text above. (1)

2.3.2 Identify the type of neuron depicted in the diagram above. (1)

2.3.3 Name the membrane that surrounds the axon and state its function. (2)

2.3.4 State TWO symptoms of Alzheimer's disease. (2)

The diagram below shows the transmission of impulses between two neurons.

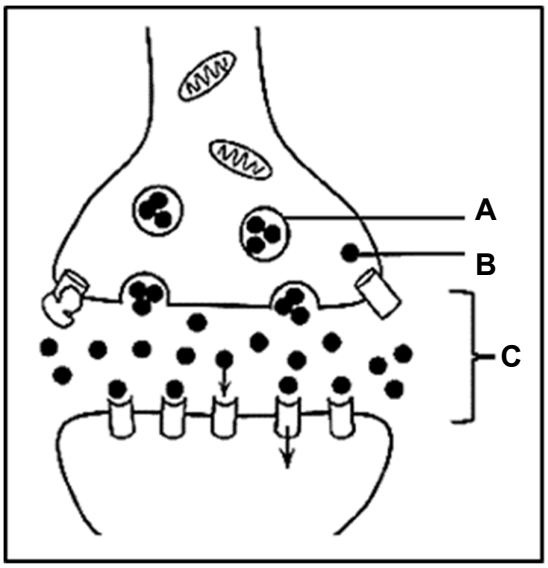


Diagram 2

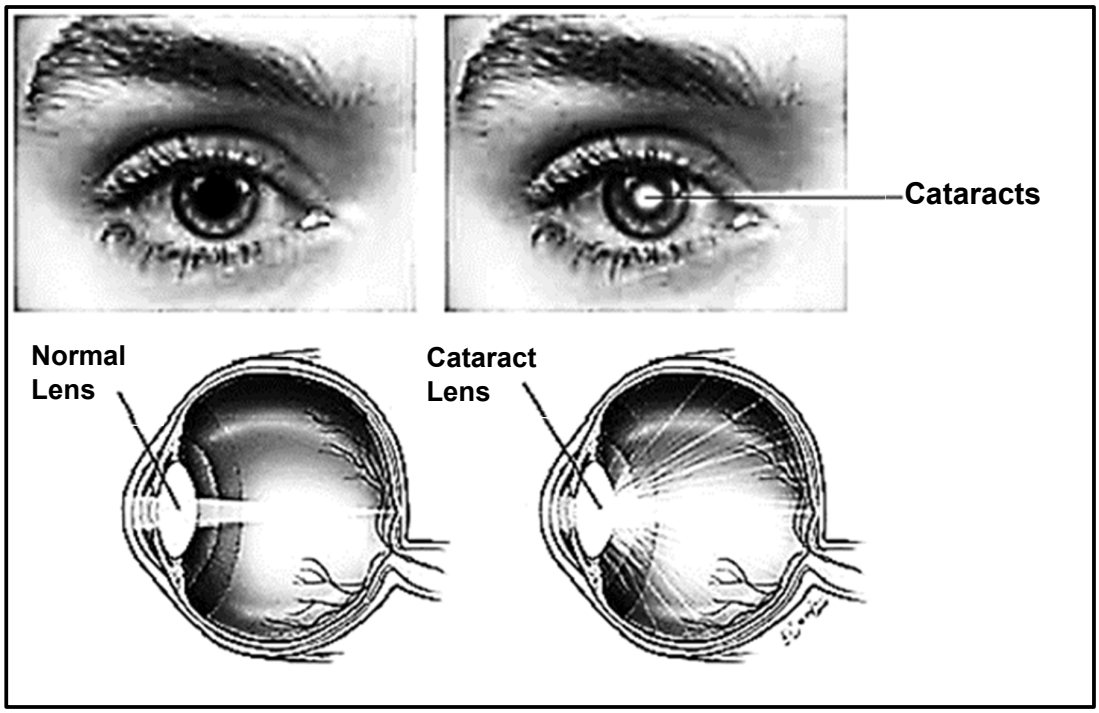
2.3.5 The information in the passage states that Alzheimer's results in synaptic loss. Give the LETTER of the region in diagram 2 which represents the synapse. (1)

2.3.6 State the significance of the synapse and identify the specific area where its loss might lead to the Alzheimer's symptoms mentioned in QUESTION 2.3.4. (2)

2.3.7 Name the part of a neuron that:

(a) Transmits impulses to the cell body (1)
(b) Transmits impulses away from the cell body (1)
(11)

2.4 The diagram below show the contrast between a normal eye and an eye with a cataract.

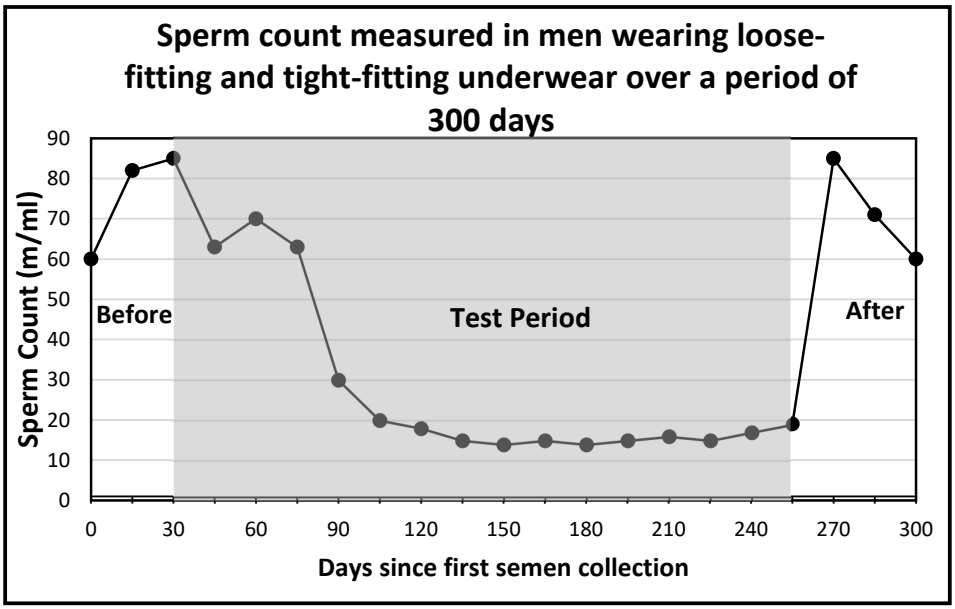


2.4.1 Tabulate TWO differences between the normal eye and the cataract eye as observed in the diagram. (5)

2.4.2 Name the treatment recommended for cataracts. (1)

2.4.3 Name and describe the process that causes the lens of the normal eye to adjust to an object that is seen less than 6 meters away after having been focussed on a distant bird. (5)
(11)

2.5 Five men who normally wear loose-fitting underwear were selected to be part of an investigation. The five men in the study were asked to wear specially designed underwear that was tight-fitting for 14 to 16 hours every day for seven and a half months (the test period). The underwear kept the scrotum and testicles very close to the body. The men provided a sperm sample several times leading up to the test period, several times during the test period and several times after the test period. The chart below shows the average sperm count (million per millilitres (m/ml)) before, during and after the test period.



[Source: Fertility and Sterility by Emily Oster]

2.5.1 State the:

(a) Independent variable
(b) Dependant variable (2)

2.5.2 Besides repeating the experiment, suggest how this investigation could be made more reliable. (1)

2.5.3 Explain how tight-fitting underwear has affected the sperm count. (3)

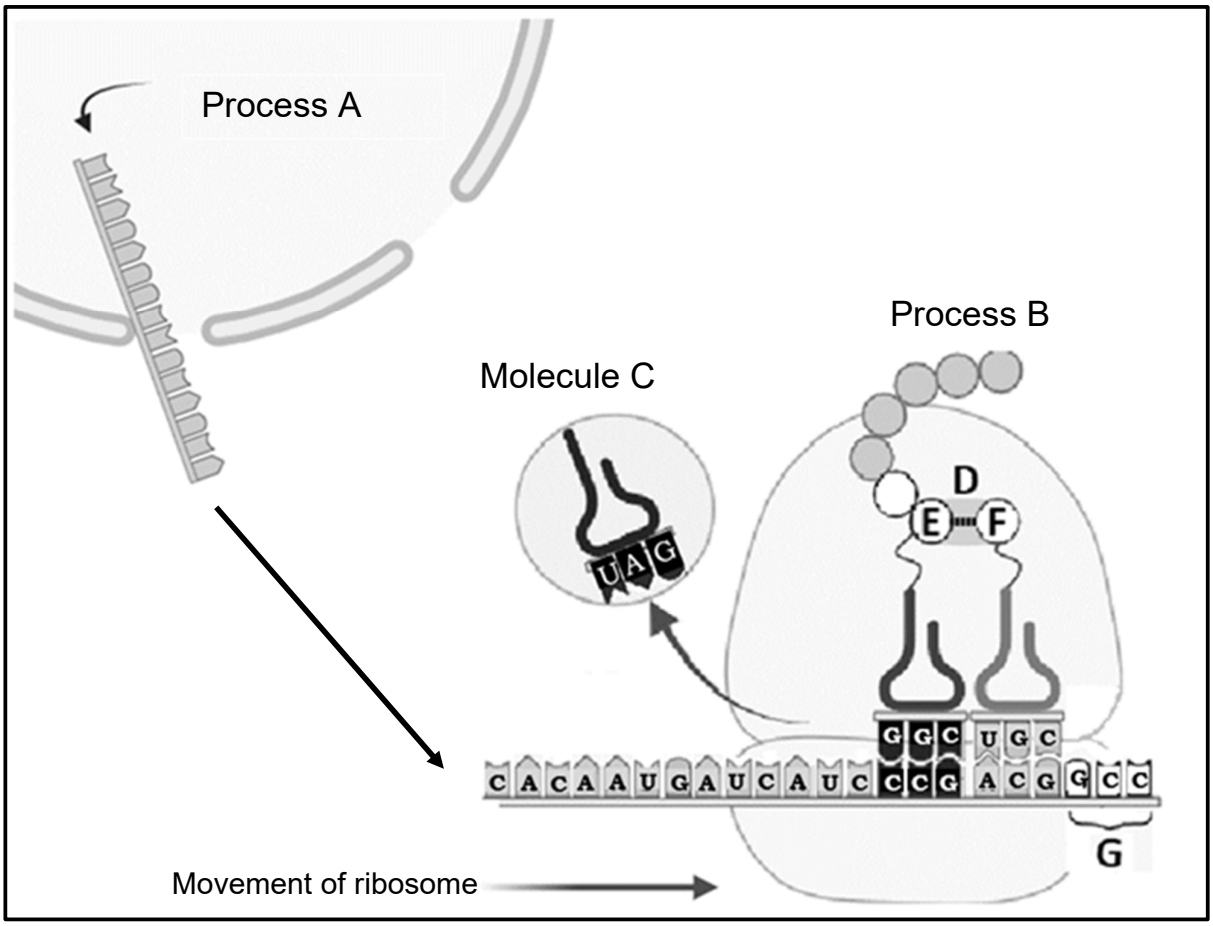
2.5.4 Suggest why the sperm count was measured before the test period started. (2)

2.5.5 Determine what the scientists analysed during days 30 – 255. (2)

(10)
[50]

QUESTION 3

3.1 The diagram below shows two processes that take place in all cells of the body.



3.1.1 Provide a heading for the entire process illustrated above. (1)

3.1.2 Name processes **A** and **B** respectively. (2)

3.1.3 Briefly describe the role of Molecule **C** in Process **B.** (3)

3.1.4 The table below shows different tRNA anti-codons and their corresponding amino acids.

Table 1: List of amino acids with the corresponding anti-codons

tRNA ANTICODON	AMINO ACID
GGC	Proline
CGU	Alanine
UGC	Threonine
CCG	Glycine
ACG	Cysteine
CGG	Alanine

(a) Provide a label for chemical bond **D**. (1)
(b) Identify the amino acids **E** and **F** respectively. (2)

3.1.5 Provide the DNA triplet code that would have coded for codon **G**. (2)

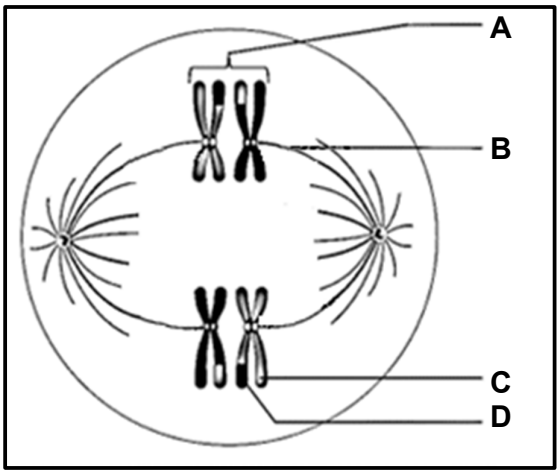
3.1.6 During DNA replication, one nucleotide might be placed in the wrong position on the forming complementary DNA strand.

(a) Name this type of mutation. (1)

If the DNA triplet code that resulted in codon **G** were to undergo the type of mutation mentioned in QUESTION 3.1.6 a), and the DNA triplet changes to CGT, then

(b) Explain the effect that this would have on the resulting protein. (4)
(16)

3.2 The diagram below represents some chromosomes in a human cell in a phase of meiosis.



3.2.1 Provide labels for **A** and **B**. (2)

3.2.2 (a) Identify the phase of meiosis represented above. (1)
(b) Provide ONE visible reason for your answer to QUESTION 3.2.2(a). (2)

3.2.3 Name and describe the process that resulted in parts **C** and **D** being different to each other. (4)

3.2.4 State the importance of the process named in QUESTION 3.2.3. (1)

3.2.5 How many chromosomes would normally be present in each daughter cell once the human cell above has completed meiosis? (1)

3.2.6 At the end of the process of meiosis, one of the daughter cells had an extra chromosome 21. Describe how this may have occurred. (2)
(13)

3.3 The table below shows the results obtained in an investigation where a pure-bred black mouse was crossed with a brown mouse.

The gene for black fur is dominant over the gene for brown fur.

The F_1 generation was then used as parents. Four breeding pairs were used, and the results of the F_2 generation can be seen in the table.

Table 2: Results of investigation

	NUMBER OF BLACK MICE	NUMBER OF BROWN MICE
Parents (P_1)	1	1
F_1 generation	8	0
F_2 generation		
Offspring of first breeding pair	8	0
Offspring of second breeding pair	5	3
Offspring of third breeding pair	3	3
Offspring of fourth breeding pair	8	2

3.3.1 From the data collected, calculate the simplified phenotypic ratio of black mice to brown mice in the F_2 generation. Show all calculations. (2)

3.3.2 Provide evidence from the data collected, that supports the following statement:

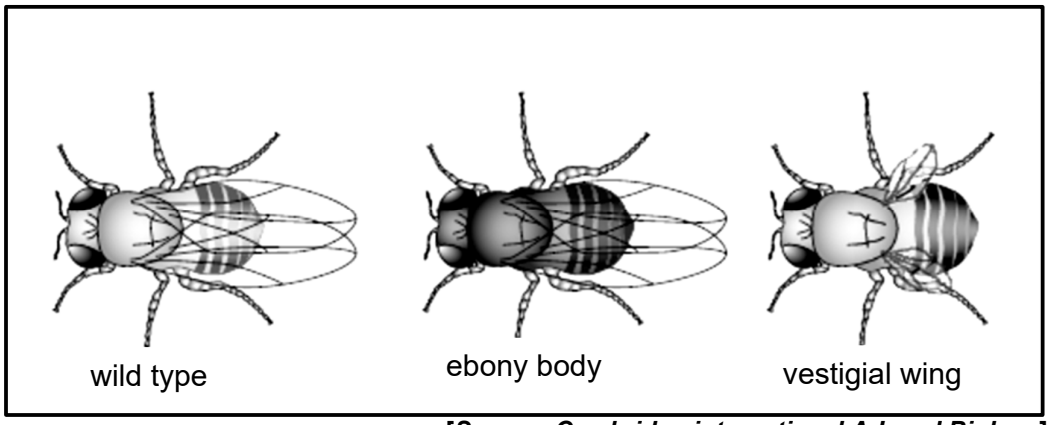
The gene for black fur is dominant over the gene for brown fur. (2)

3.3.3 Draw a bar graph to show the phenotypic results of the F_2 generation for each breeding pair. (6)
(10)

3.4 The fruit fly: *Drosophila melanogaster*, feeds on sugars found in damaged fruit. A fruit fly with normal features is call a 'wild type', and it has a grey striped body with wings longer than its abdomen.

There are mutant variations of the *D. melanogaster*, such as an ebony (dark) body, or presence of vestigial (small) wings. The three types are shown in the image below.

The diagram shows three phenotypes of D. melanogaster.



[*Source: Cambridge international A-Level Biology*]

The 'wild type' features are coded for by dominant alleles:

G for 'wild type' body colour.
L for 'wild type' wings size.

3.4.1 Define the term *allele*. (1)

3.4.2 Some mutant variations of the *D. melanogaster* were a result of differing numbers of chromosomes in their genotype.
Name this type of mutation. (1)

3.4.3 When two fruit flies with 'wild type' body colour were crossed, some of the F_1 generation had an ebony body colour. Use a monohybrid genetic cross to show the percentage chance of the offspring having an ebony body. (6)

3.4.4 Name the type of cross which would compare body colour and wing size at the same time. (1)

3.4.5 A particular fly has the genotype Ggll. Identify its phenotype. (2)
(11)
[50]

TOTAL SECTION B: 100

TOTAL: 150