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 to D) next to the question number (1.1.1 to 1.1.10) in your ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which ONE of the following CORRECTLY matches a visual defect with its corrective treatment?

A Short-sightedness – biconvex lens
B Cataracts – biconcave lens
C Astigmatism – biconcave lens
D Long sightedness – biconvex lens

1.1.2 The results of offspring obtained in an investigation into the inheritance of wing length in fruit flies are shown in the table below.

WING LENGTH	NUMBER OF FLIES
Long	182
Short	61

Which of the following are the genotypes of the parents?

A LL x ll
B LL x Ll
C Ll x Ll
D Ll x ll

1.1.3 A fragment of DNA has a total of 120 nitrogenous bases and 42 of these bases are thymine.

What is the percentage of cytosine in this fragment?

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

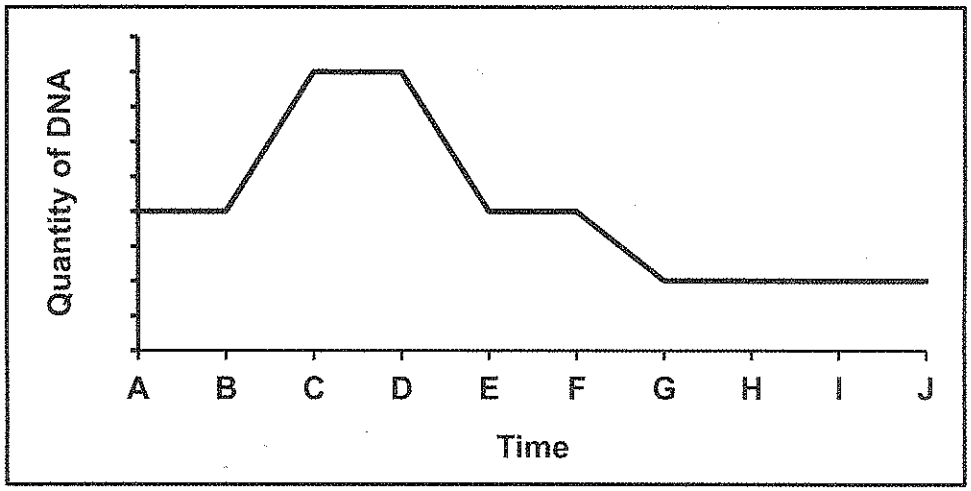
1.1.4 Which combination of reproductive strategies below, applies to birds?

A External fertilization and vivipary
B External fertilization and ovipary
C Internal fertilization and ovipary
D Internal fertilization and ovovivipary

1.1.5 Which one of the following is a DNA nucleotide?

A Deoxyribose, phosphate and uracil
B Deoxyribose, phosphate and adenine
C Ribose, phosphate and guanine
D Ribose, phosphate and thymine

1.1.6 The graph below shows the amount of DNA present in a cell during the process of cell division.



During which time period did meiosis I occur?

A A to D
B C to E
C C to F
D F to J

1.1.7 Study the list of functions below.

(i) Controls voluntary muscle movements
(ii) Controls higher thought processes
(iii) Regulates breathing rate
(iv) Interprets information from the receptors in the skin
(v) Controls involuntary actions

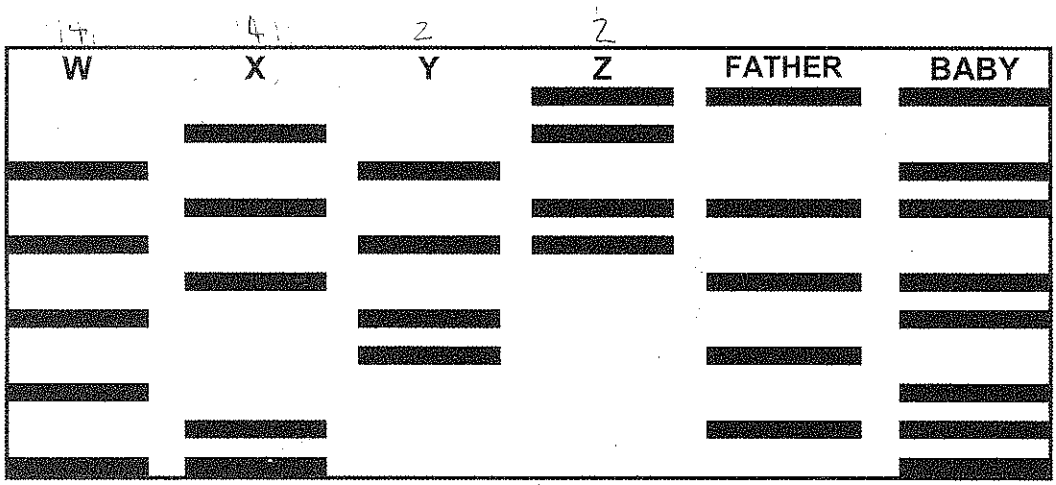
Which ONE of the following combinations of functions applies to the cerebrum?

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

1.1.8 Which part of the reflex arc is probably damaged if the person can feel the stimulus but cannot respond?

A The axon of the motor neuron
B The axon of the sensory neuron
C The dendrite of the sensory neuron
D The cell body of the sensory neuron

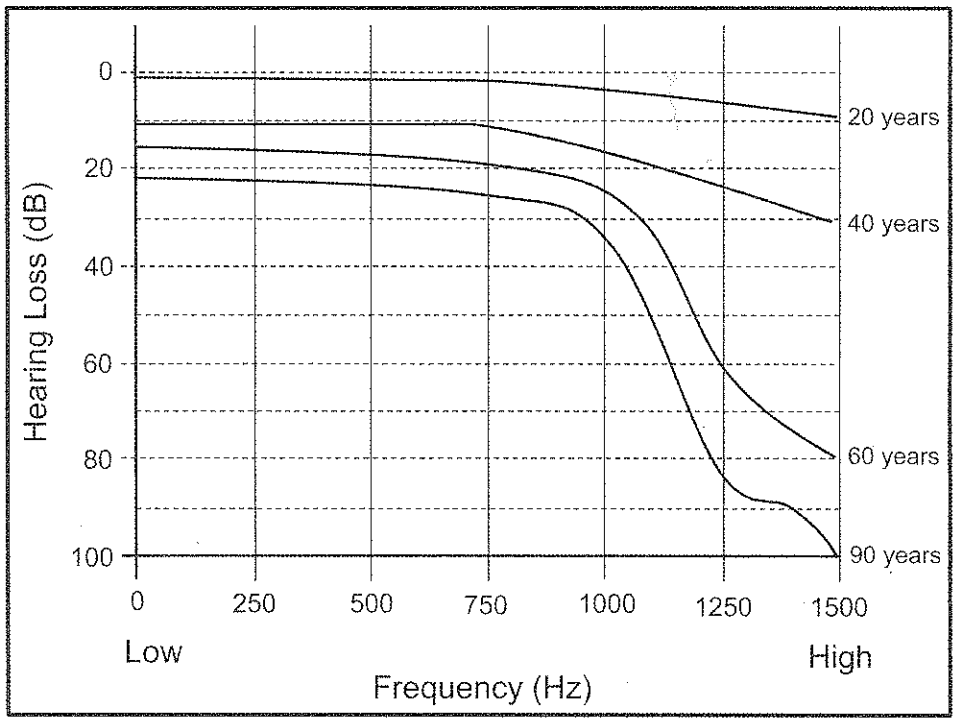
1.1.9 Four women (**W**, **X**, **Y** and **Z**) claim to be the mother of a baby. As part of the investigation, the DNA profiles of all four women, the father and the baby were produced and are provided below.



Based on the DNA profiles, which woman is the mother of the child?

A Woman **W**
B Woman **X**
C Woman **Y**
D Woman **Z**

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

1.2.1 The type of bond between the nitrogenous bases of DNA

1.2.2 The organelle involved in the process of translation

1.2.3 The phase during cell division when DNA replication occurs

1.2.4 The division of the cytoplasm during cell division

1.2.5 An egg in which the embryo is protected by a shell

1.2.6 The failure of chromosomes to separate during meiosis

1.2.7 The natural shape of the DNA molecule **(7)**

1.3 Indicate whether each of the statements in COLUMN 1 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	Condition causing the lens of the eye to be cloudy	(A) Cataracts B: Astigmatism
1.3.2	Small tube inserted into the tympanic membrane to drain excess fluid	(A) Eustachian tube B: Grommet
1.3.3	Adult birds catch prey and take it back to the nest for their chicks to eat	A: Precocial deelopment (B) Parental care
1.3.4	Allele that determines the phenotype when in a heterozygous condition	(A) Dominant B: Recessive

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

1.4 The size and colour of seeds in a single species of plant varies.

The allele for big seeds (**B**) is dominant to the allele for small seeds (**b**).
The allele for green seeds (**y**) is recessive to the allele for yellow seeds (**Y**).

Plant **A**, heterozygous for both seed size and colour, was crossed with a Plant **C** which had small, green seeds.

1.4.1 Name the type of genetic cross occurring between plants **A** and **C**. (1)

1.4.2 Write down the genotype of Plant **A**. (1)

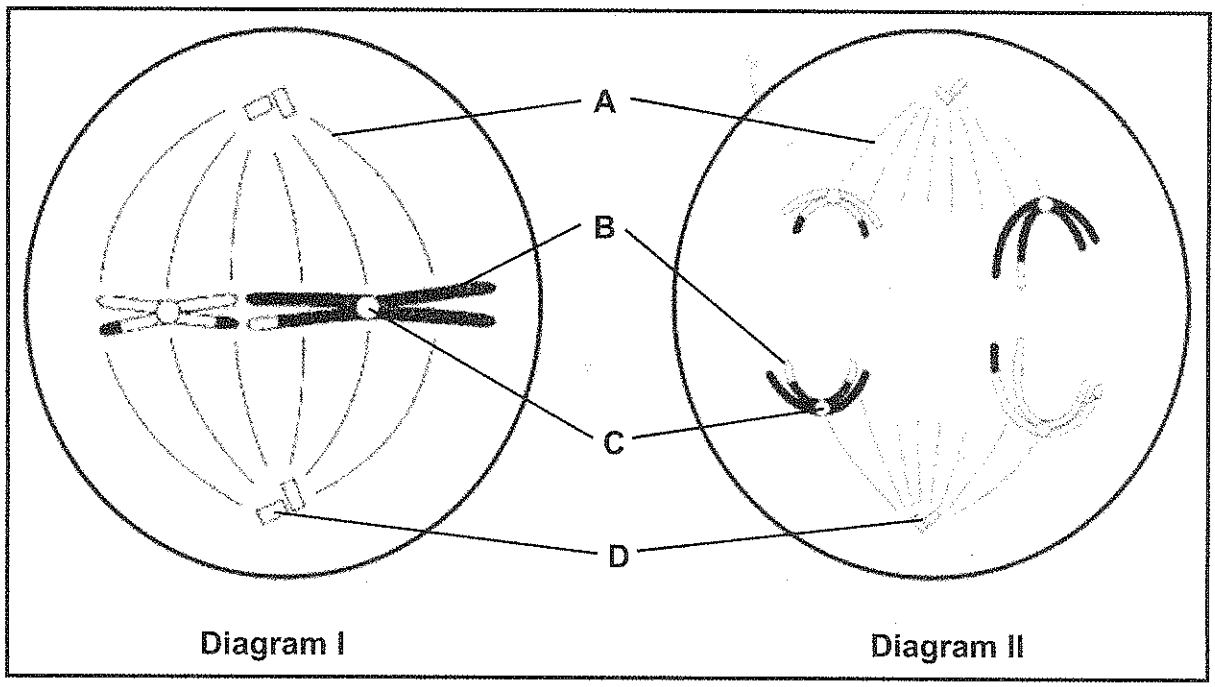
1.4.3 List the genotypes of ALL the possible gametes that could be produced by plant **A**. (2)

1.4.4 What percentage of the offspring from the cross between plant **A** and plant **C** will produce plants with seeds that are small and green? (2)

1.4.5 Give the phenotypic ratio of the offspring if plant **A** is self-pollinated. (2)

1.4.6 Which law of Mendel states that parents can pass on characteristics to their offspring in different combinations? (1)
(9)

1.5 The diagrams below represent phases of meiosis in a cell.



1.5.1 Name the part labelled:

(a) **B** (1)

(b) **C** (1)

1.5.2 Name the phase of meiosis represented in Diagram **I**. (1)

1.5.3 Give ONE visible reason for identifying the phase in Diagram **II** as being a part of meiosis I. (1)

1.5.4 What evidence suggests that crossing over has occurred in this cell? (1)

1.5.5 How many chromosomes will be present in the gametes formed from the cell in Diagram **II**? (1)
(6)

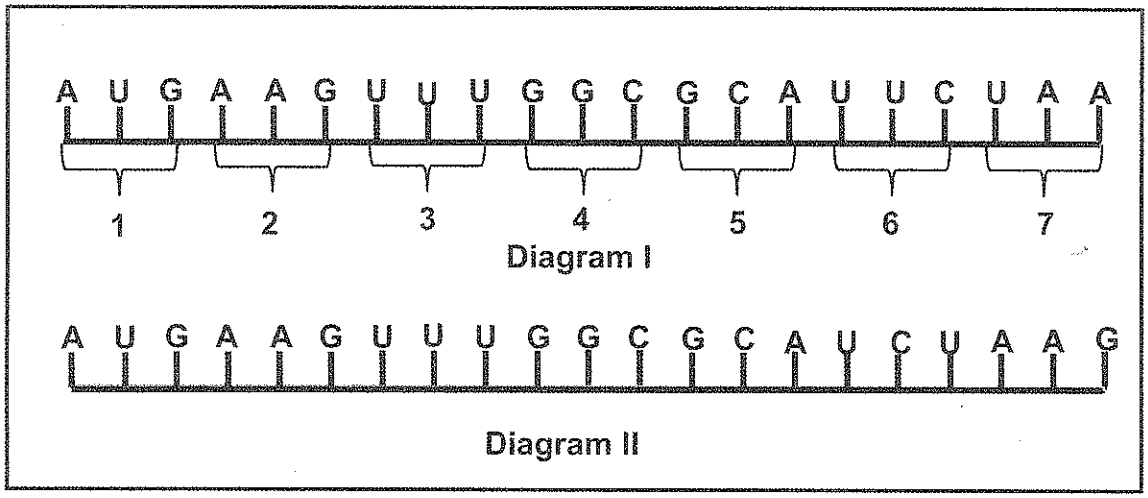
TOTAL SECTION A: [50]

SECTION B

QUESTION 2

2.1 Diagram I below shows the coding pattern on a section of mRNA.

Diagram II shows the same section of mRNA after a mutation has occurred where one nitrogenous base was deleted.



2.1.1 Describe the role of DNA in protein synthesis. (4)

2.1.2 Give each of the following:

(a) DNA base sequence for codon **1**. (1)
(b) Number of the codon where the the deletion occurred. (1)

2.1.3 The table below is an anticodon table for amino acids.

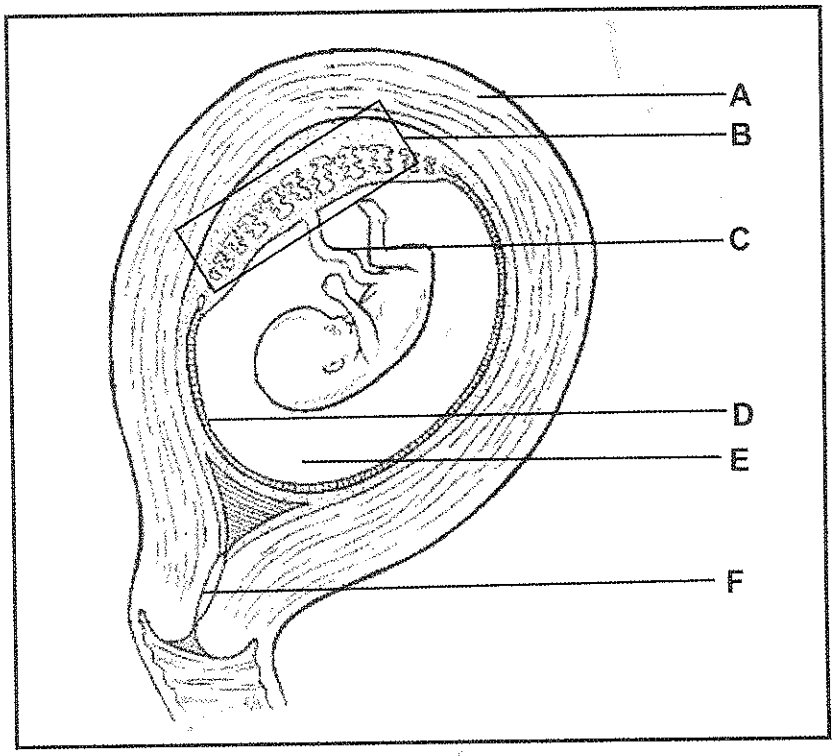
AMINO ACID	ANTICODON	AMINO ACID	ANTICODON
Leucine	CUU; CUC; CUA; CUG	Isoleucine	AUU; AUC; AUA
Histidine	CAU	Glycine	GGU; GGC; GGA; GGG
Lysine	AAA; AAG	Methionine	AUG
Arginine	AGA; AGG	Serine	UCU; UCC; UCA; UCG
Alanine	GCU; GCC; GCA; GCG	Phenylalanine	UUU; UUC

(a) Give the codon for histidine. (1)

(b) Tabulate TWO ways in which the amino acid chain produced by the molecule in Diagram **II** will differ from the one produced by the molecule in Diagram **I**. (5)

(c) State any THREE genetic disorders you studied which are caused by mutations. (3)
(15)

2.2 The diagram below shows a developing foetus inside the uterus of a human female.

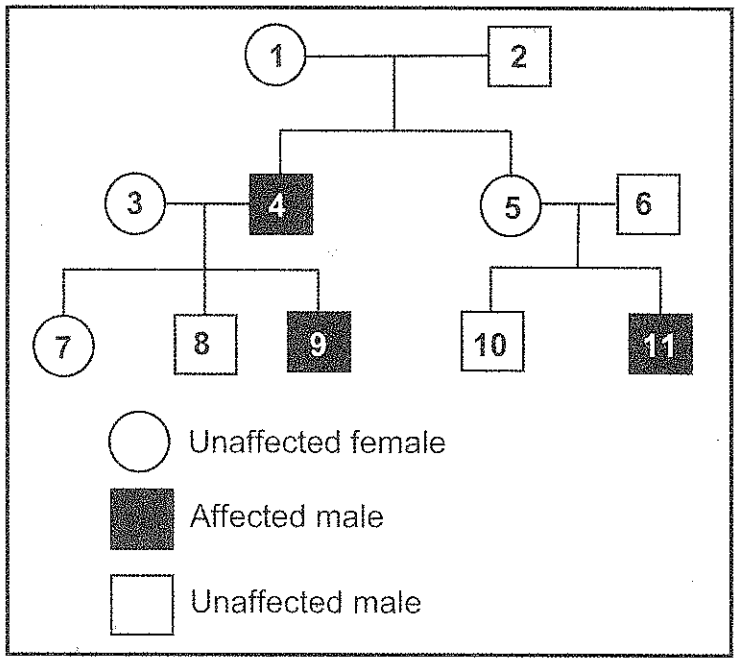


2.2.1 Identify parts **A**, **B**, **E** and **F**. (4)

2.2.2 Describe the feedback mechanism that exists between FSH and the hormone produced by structure **B**. (3)

2.2.3 State why structure **C** must remain attached to the foetus until the baby is born. (3)
(10)

2.3 The pedigree diagram below shows the inheritance of a sex-linked disorder, Icthyosis. Icthyosis is a genetic disorder characterised by dry, scaling skin. Having normal skin (**N**) is dominant to having dry, scaling skin (**n**). A person who has normal skin but who carries the recessive allele is called a 'carrier'.



2.3.1 How many generations of this family are represented in the pedigree diagram? (1)

2.3.2 Give the genotype of:

(a) Individual **4** (2)

(b) Individual **7** (2)

2.3.3 Individual **11** marries a woman who is homozygous for normal skin.

What are the chances that any of their children will be affected by the disease? (2)

2.3.4 Explain why males CANNOT be carriers of the disorder. (3)
(10)

2.4 Coat colour in Agouti rodents is controlled by a single gene with two alleles. The alleles code for brown or white hair. A rodent that is heterozygous has yellow hair.

Investigations into the inheritance of coat colour in these rodents were conducted and the researchers expected to see offspring with brown (**B**), yellow and white (**W**) hair.

The results of the investigation are provided in the table below.

Cross number	Colour of parents	Number of offspring
1	Yellow x Yellow	106 brown : 212 yellow
2	Brown x Yellow	98 brown : 100 yellow
3	Brown x Brown	All brown

2.4.1 Name the type of dominance that occurs in Agouti rodents with regards to coat colour. (1)

2.4.2 Give the genotype of the yellow rodents. (1)

2.4.3 Lethal alleles are alleles that cause the death of the organism that carries them.

Using the results obtained, explain how the investigators came to the conclusion that the allele for white coat is a lethal allele. (2)

2.4.4 Give the phenotypic ratio of cross number **1**. (1)
(5)

[40]

QUESTION 3

3.1 Two women, Mrs Ngcobo and Mrs Radebe, gave birth to their babies in a hospital on the same day. The nursing staff were unsure which baby belonged to which mother. The blood groups of all the individuals involved were determined and are given in the table below.

Individual	Blood Group
Baby 1	O
Baby 2	AB
Mrs Ngcobo	A
Mr Ngcobo	B
Mrs Radebe	A
Mr Radebe	O

3.1.1 How many alleles control the blood phenotypes? (1)

3.1 2 Give the possible genotype/s of:

(a) Mrs Ngcobo (2)

(b) Baby 2 (1)

3.1.3 Mrs Ngcobo is homozygous for her blood group and Mr Ngcobo is heterozygous.

(a) What are the possible phenotypes of their children? (2)

(b) What is the percentage chance that their next child will have the same blood type as Mrs Ngcobo? (1)

3.1.4 Mrs Radebe is heterozygous for her blood group.

Use a genetic diagram to show that Mr and Mrs Radebe cannot be the parents of Baby 2 but can be the parents of Baby 1. (6)

3.1.5 Explain ONE disadvantage of using blood groups to determine paternity. (2)
(15)

3.2 The extract below provides information about cochlear implants.

> A cochlear implant is an electronic device that is surgically placed under the skin behind the ear. It provides a sense of sound to a person who is profoundly deaf or severely hard of hearing by bypassing the damaged cochlea and sending sounds electronically to the brain. Cochlear implants were designed for people who obtain little or no benefit from hearing aids.

Adapted from: http://www.earinstitute.co.za

3.2.1 Describe the role of the cochlea in hearing. (5)

3.2.2 Normal hearing aids amplify the sound.

Explain why normal hearing aids will not benefit a person whose cochlea is damaged in each ear. (3)

3.2.3 Explain the benefit of cochlear implants for a deaf person. (2)
(10)

3.3 Dr Manzini, a local optometrist, helped Sipho with his school project. Sipho wanted to determine the effect of different light intensities on the diameter of the pupil in the eye.

They carried out the following procedure in the examination room:

Step 1 - Sipho sat on a chair with the light switched off for one minute.
Step 2 - The diameter of the pupil of his eye was measured.
Step 3 - The light was switched on at a specific light intensity for one minute.
Step 4 - The diameter of the pupil of his eye was measured again.

Steps 3 and 4 were repeated five more times at different light intensities in no particular order.

The results of the investigation are shown in the table below.

LIGHT INTENSITY	THE DIAMETER OF PUPIL (mm)
Darkness	5
Level **A**	3.5
Level **B**	2
Level **C**	2.5
Level **D**	3
Level **E**	3,2
Level **F**	4

3.3.1 State the following in this investigation:

(a) The independent variable (1)
(b) The dependent variable (1)

3.3.2 State TWO factors that should should be kept constant in this investigation. (2)

3.3.3 State TWO ways in which the results of this investigation can be made more reliable. (2)

3.3.4 Describe the changes that occurred in the eye to bring about the change in pupil diameter from level **C** to level **D**. (2)

3.3.5 Explain how we can conclude that the light intensity was the greatest at level **B**? (2)

(10)

3.4 Describe the changes that occur in the eye when a distant object approaches a person (near vision). **(5)**

[40]

SECTION C

QUESTION 4

Describe the development and release of an ovum in the ovary under the influence of hormones and how the zygote that forms after fertilization develops into a foetus with it's extra-embryonic membranes.

Content: 17
Synthesis: 3

NOTE: **NO marks will be awarded for answers in the form of flowcharts, tables or diagrams.**

TOTAL SECTION C: (20)

TOTAL MARKS: [150]