Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2018

LIFE SCIENCES

MARKS: **150**

TIME: **2½ hours**

* J L F S C E *

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 your 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.
12. Round off all calculations to two decimals after the comma.

SECTION A

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question numbers (1.1.1–1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which ONE of the following best describes nucleic acids and nucleotides?

A Nucleic acids are monomers nucleotides
B Nucleotides are monomers of nucleic acids
C Nucleotides are large molecules and nucleic acids are small molecules
D Nucleic acids are acids and nucleotides are bases

1.1.2 If 10% of the bases in a molecule of DNA are adenine, what is the ratio of adenine to guanine in the same molecule?

A 4 : 1
B 1 : 3
C 1 : 1
D 1 : 4

1.1.3 Which ONE of the following hormones causes the development of secondary sexual characteristics in males during puberty?

A Follicle stimulating hormone
B Testosterone
C Oestrogen
D Luteinising hormone

1.1.4 Which ONE of the following male reproductive structures serve as a temporary storage for sperms?

A Vas deference
B Seminal vesicle
C Epididymis
D Penis

1.1.5 Which ONE of the following is a function of the medulla oblongata?

A Controls voluntary muscular activities
B Processing all sensory information
C Balance and co-ordination
D Controls heartbeat and breathing

1.1.6 A patient experiences slight visual and speech disturbance after a serious head injury. Which section of the brain has possibly been damaged?

A Cerebrum
B Cerebellum
C Hypothalamus
D Medulla oblongata

1.1.7 The microscopic space that separates an axon and a dendrite of another neuron is a/an …

A synapse.
B ganglion.
C intercellular space.
D node of Ranvier.

1.1.8 Which ONE of the following is part of the autonomic nervous system?

A Cerebellum
B Cerebrum
C Sympathetic nerves
D Spinal cord

1.1.9 A genetic cross between two F1-heterozygous pea plants having yellow seeds will yield what percentage of green-seeded plants in the offspring? Yellow seeds are dominant to green.

A 0%
B 25%
C 75%
D 100%

1.1.10 The data below represents the results of an investigation used to determine how the thickness of the lens changed as a pencil was moved away from the eye.

DISTANCE FROM EYE (cm)	THICKNESS OF LENS (mm)
10	4,0
20	3,6
30	3,2
50	2,9
100	2,6
150	2,6
200	2,6

A general conclusion that can be made from the data is that …

A as the distance from the eye increased up to 100 cm, the thickness of the lens increased, after which it remained constant.
B as the distance from the eye decreased, the thickness of the lens remained constant.
C as the distance from the eye increased up to 100 cm, the thickness of the lens decreased, after which it remained constant.
D the thickness of the lens increased with an increase in distance from the eye.

(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 (1.2.1–1.2.10) in the ANSWER BOOK.

1.2.1 The connecting tube between the middle ear and the pharynx

1.2.2 The layer in the human eye in which rods and cones are present

1.2.3 A group of nerve cell bodies of neurons that form a swelling outside the spinal cord

1.2.4 A zygote, having a pair of homologous chromosomes, both with recessive characteristics

1.2.5 A point where the exchange of genetic material occurs during crossing over

1.2.6 Phase in meiosis in which chromosomes line up at the equator in pairs

1.2.7 The two strands that make up a chromosome

1.2.8 The liquid secreted by the testes and associated glands containing sperm cells

1.2.9 A technique of determining an individual's DNA characteristics

1.2.10 The structure that holds two strands of the chromosome together

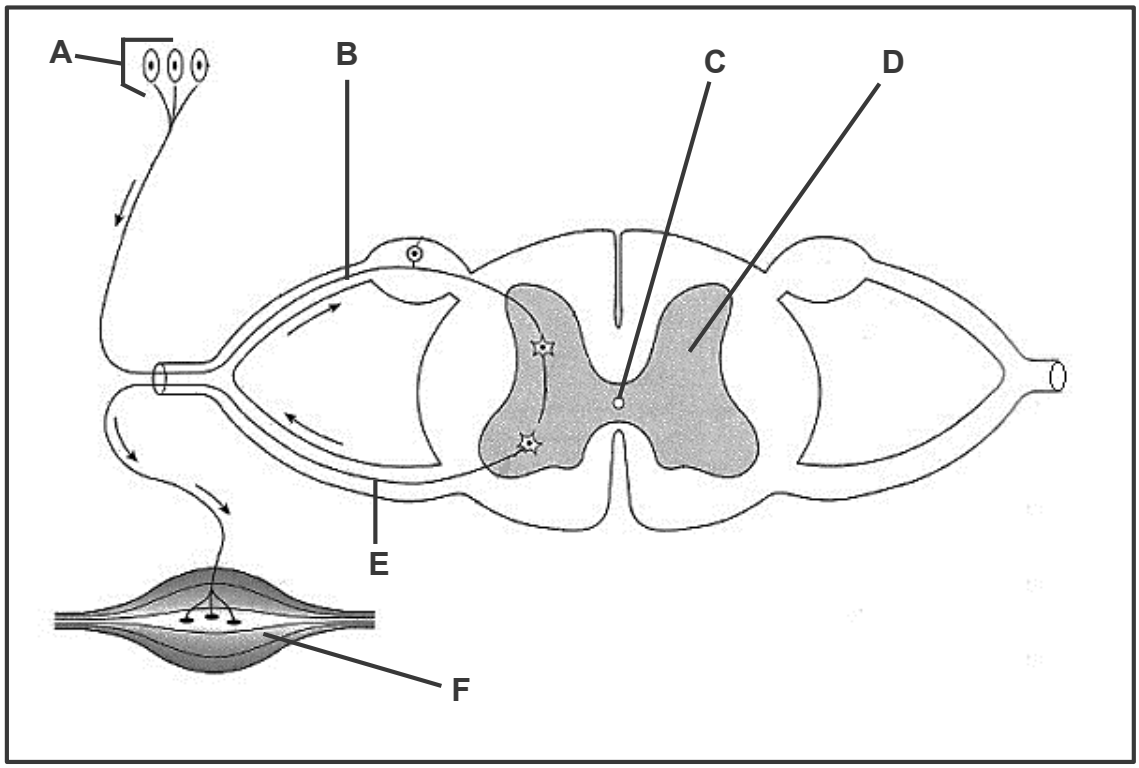
(10 x 1) (10)

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 paper (1.3.1–1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Presence of umbilical cord	A B	Vivipary Ovipary
1.3.2	The abiotic component essential for external fertilisation	A B	Sunlight Water
1.3.3	Stores waste produced by the embryo in an amniotic egg	A B	Chorion Amnion

(3 x 2) (6)

1.4 The diagram below represents a reflex arc.



1.4.1 Identify part:

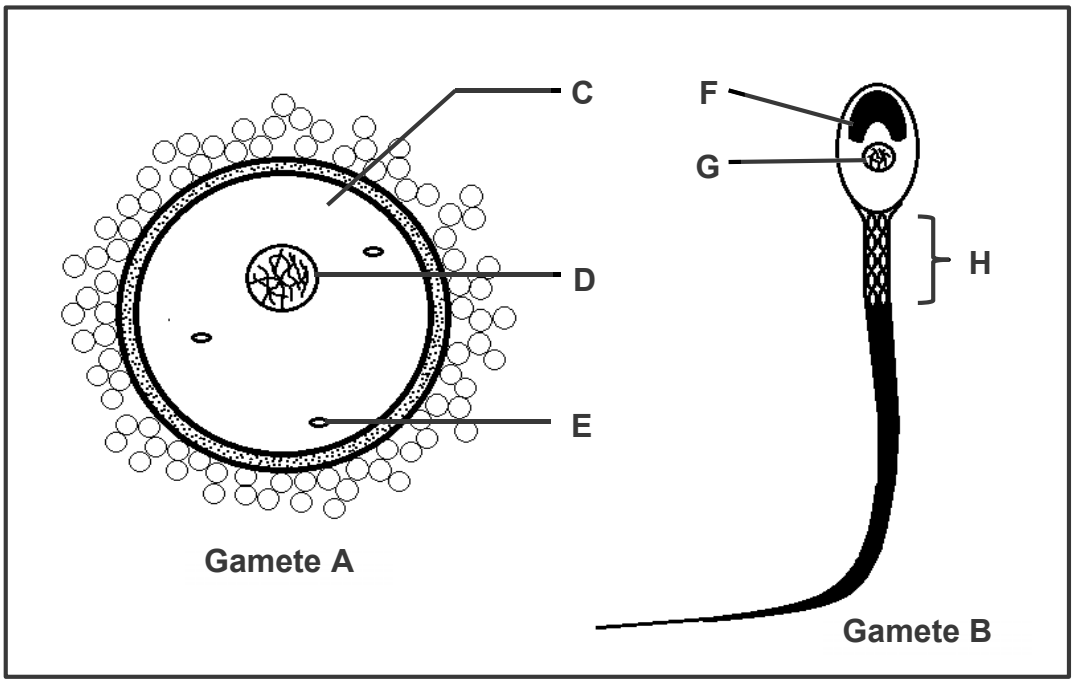
(a) **A** (1)

(b) **D** (1)

1.4.2 Give the LETTER and NAME of the part that contains cerebrospinal fluid. (2)

1.4.3 Which labelled part has been damaged when a person can feel pain, but cannot respond to the stimulus? (1)

1.5 The diagram below represents two different human gametes.



1.5.1 Which ONE of the above gametes (**A** or **B**) may consist of:

(a) 22 autosomes and one X chromosome (1)

(b) 22 autosomes and one Y chromosome (1)

1.5.2 Give the LETTER and NAME of the part that:

(a) Releases powerful enzymes to penetrate the ovum (2)

(b) Contains many mitochondria to generate energy for the forward movement (2)

1.5.3 Name the:

(a) Cell formed when **G** fuses with **D** (1)

(b) Process mentioned in QUESTION 1.5.3 (a) (1)

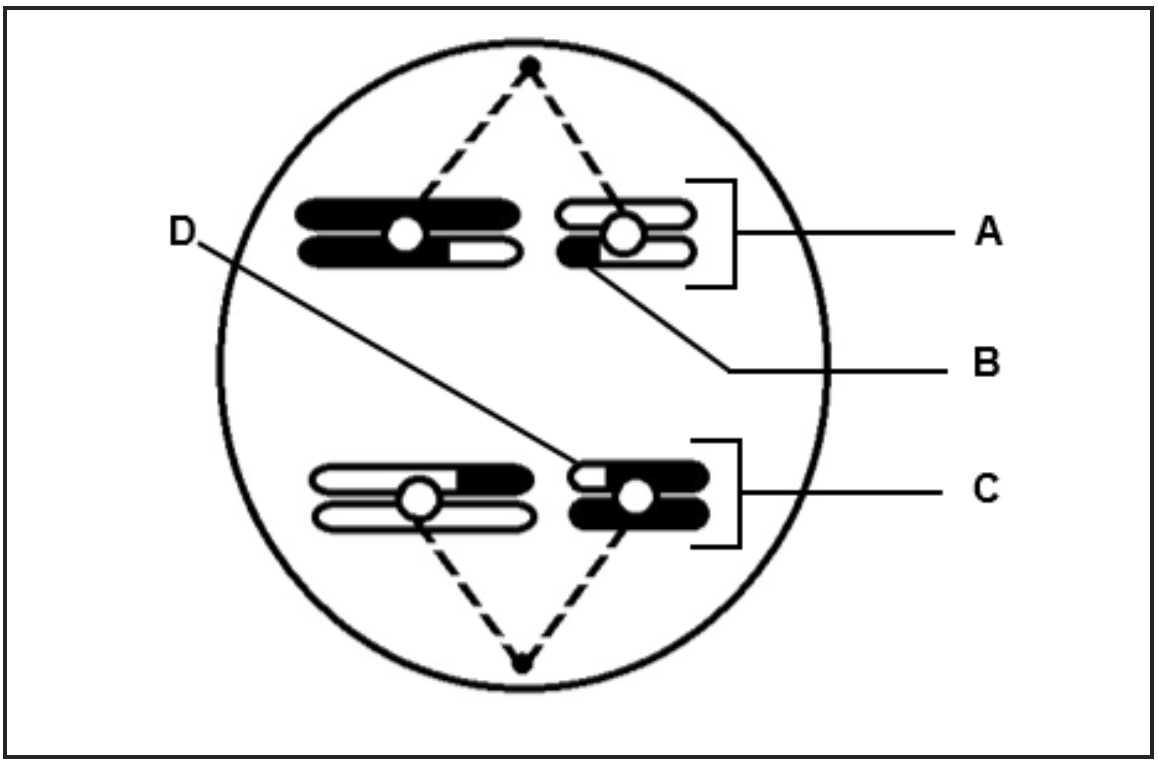
1.5.4 Which of the gametes (**A** or **B**), contributes mitochondria to the cell mentioned in QUESTION 1.5.3 (a)? (1)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents a certain phase in meiosis.



2.1.1 Identify the phase shown in the above diagram. (1)

2.1.2 Give a reason for your answer in QUESTION 2.1.1. (1)

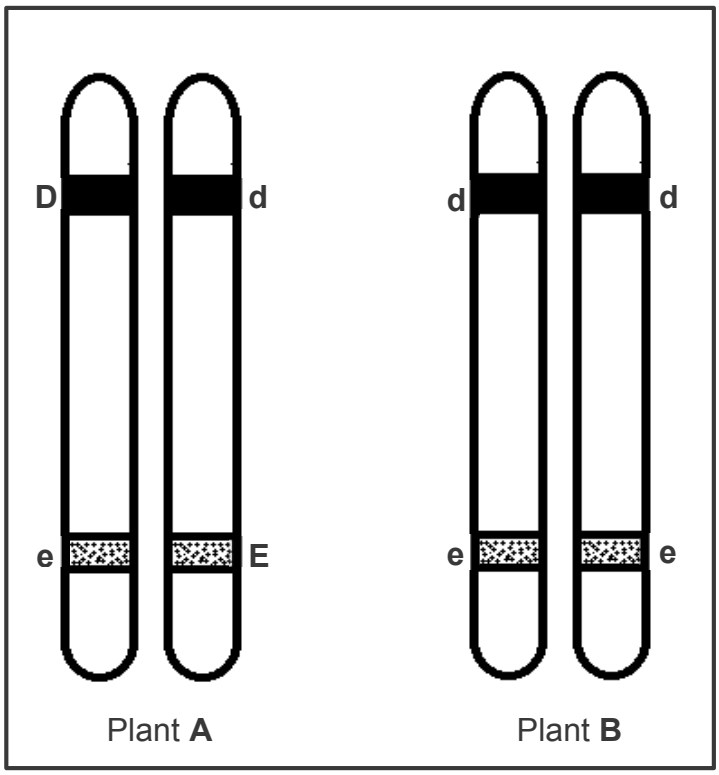
The chromosomes **A** and **C** are genetically different from each other.

2.1.3 (a) What was the collective name given to chromosomes **A** and **C** in the previous phase? (1)

(b) Name the process that resulted in genetic variation between parts **B** and **D.** (1)

2.1.4 Describe the events which take place during the phase shown above and explain the significance of the phase for sexual reproduction. (3)

2.2 In a certain type of plant, the genes that determine the shape of the pollen grains and the colour of the flowers are linked on the same chromosome. The pollen grains could either be long (**D**) or round (**d**) and the flowers could either be purple (**E**) or red (**e**). The diagram below represents the arrangement of linked genes on the chromosomes in plants **A** and **B**.
In a dihybrid investigation, plant **A** is crossed with plant **B**.



2.2.1 From the above diagram, determine the genotype and phenotype of:

(a) Plant **A** (2)

(b) Plant **B** (2)

2.2.2 How many gametes with different genotypes can possibly be produced by: (Assume that there is no crossing over in meiosis when the gametes are formed.)

(a) Plant **A** (1)

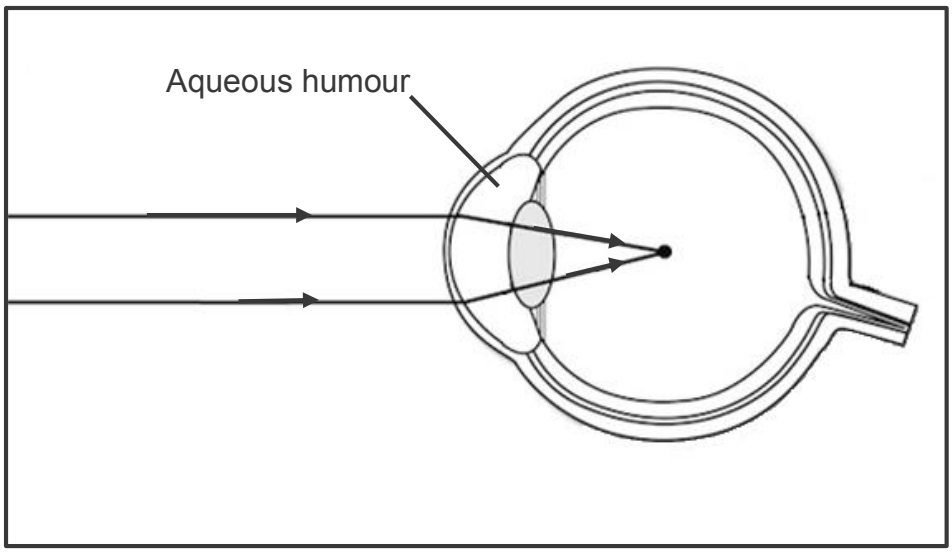
(b) Plant **B** (1)

2.2.3 What are the genotypes of the gametes produced in:

(a) Plant **A** (2)

(b) Plant **B** (1)

2.3 The diagram below represents an eye defect.



2.3.1 Identify the eye defect represented in the above diagram. (1)

2.3.2 Give ONE observable reason for the answer in QUESTION 2.3.1. (1)

2.3.3 Explain the cause for the eye defect mentioned in QUESTION 2.3.1. (3)

2.3.4 How does this eye defect affect the visual ability of the person? (1)

2.3.5 State how this eye defect can be corrected. (1)

2.3.6 Glaucoma is an eye defect caused by the poor drainage of the eyeball's aqueous humour. Pressure builds up in the eyeball and the optic nerve is damaged.

Explain why a person who suffers from glaucoma may either become partially blind or fully blind. (3)

2.4 Use a genetic cross to show the possible blood types of the offspring of a cross between individuals who are type AB and type O. (Blood type O is recessive) (6)

2.5 The table below represents a female individual's hormone levels as measured during the menstrual cycle. The data include the complete cycle of this woman.

Days of the cycle	FSH UI/L	LH UI/L	Oestrogen ng/mℓ	Progesterone ng/mℓ
1	6,73	2,58	41,87	0,21
5	5,41	3,5	46,77	0,25
10	3,95	6,15	188,3	0,64
12	3,32	23,71	199,79	1,44
14	3,12	4,26	88,09	5,78
22	2,68	2,63	441,94	18,23
27	4,92	2,29	120,96	0,74

2.5.1 What was the duration of the menstrual cycle of this individual? (1)

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

2.5.3 Give a reason for your answer in QUESTION 2.5.2. (1)

2.5.4 What evidence can be drawn from the table to suggest that menstruation occurred during the first five days of the cycle? (3)

2.5.5 From the table, describe the relationship between the hormones FSH and progesterone during the cycle. (2)

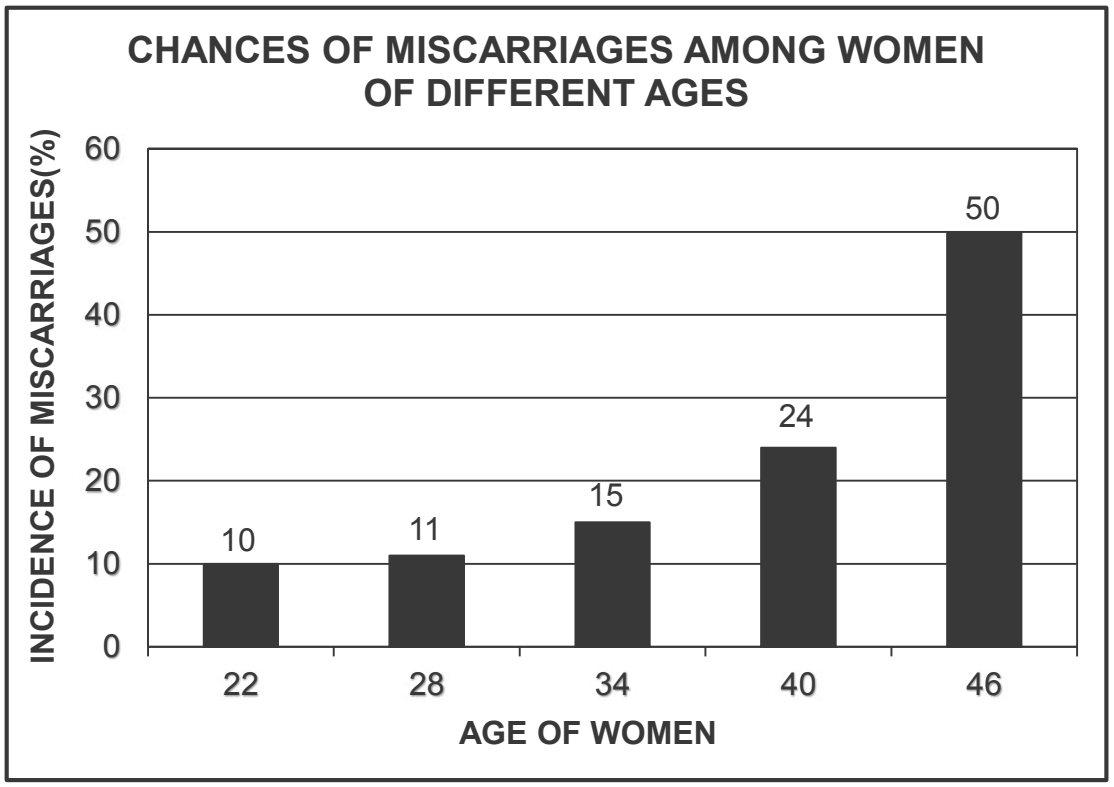
[40]

QUESTION 3

3.1 An investigation was conducted to determine the relationship between the ages of women and the chances of miscarriages. A group of 20 women from each age group and from different racial groups in a specific area were selected randomly.

- Different groups of women were exposed to similar medical care and similar diets
- Women were encouraged to do similar physical activities
- Different groups were monitored and exposed to similar social environment

The results of the investigation are shown in a graphical form below:



3.1.1 What was the sample size selected for this investigation? (1)

3.1.2 Identify the:

(a) Independent variable (1)

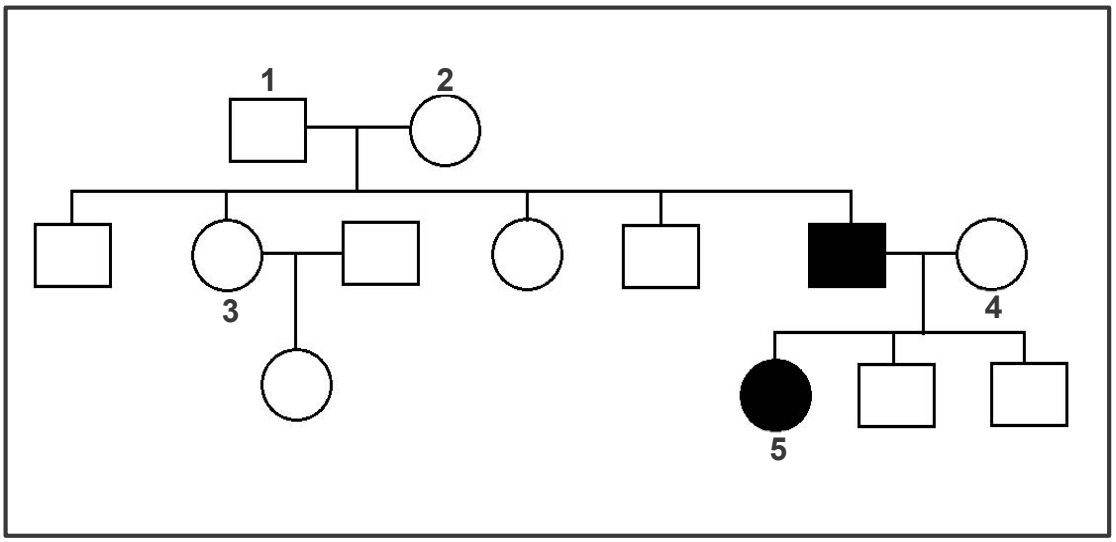
(b) Dependent variable (1)

3.1.3 Describe the relationship that exists between the ages of women and the chances of them miscarrying. (2)

3.1.4 How would you improve the reliability of this investigation? (2)

3.1.5 According to the data obtained, how many of the women sampled who are 46 years old are likely to miscarry? Show ALL working. (2)

3.2 The pedigree diagram below shows the inheritance of colour-blindness in a family. Colour-blindness is a sex-linked disorder caused by a recessive allele (**h**). The ability to see colour normally is caused by a dominant allele (**H**).



3.2.1 How many of the male offspring of parents **1** and **2** were normal? (1)

3.2.2 State the genotype of:

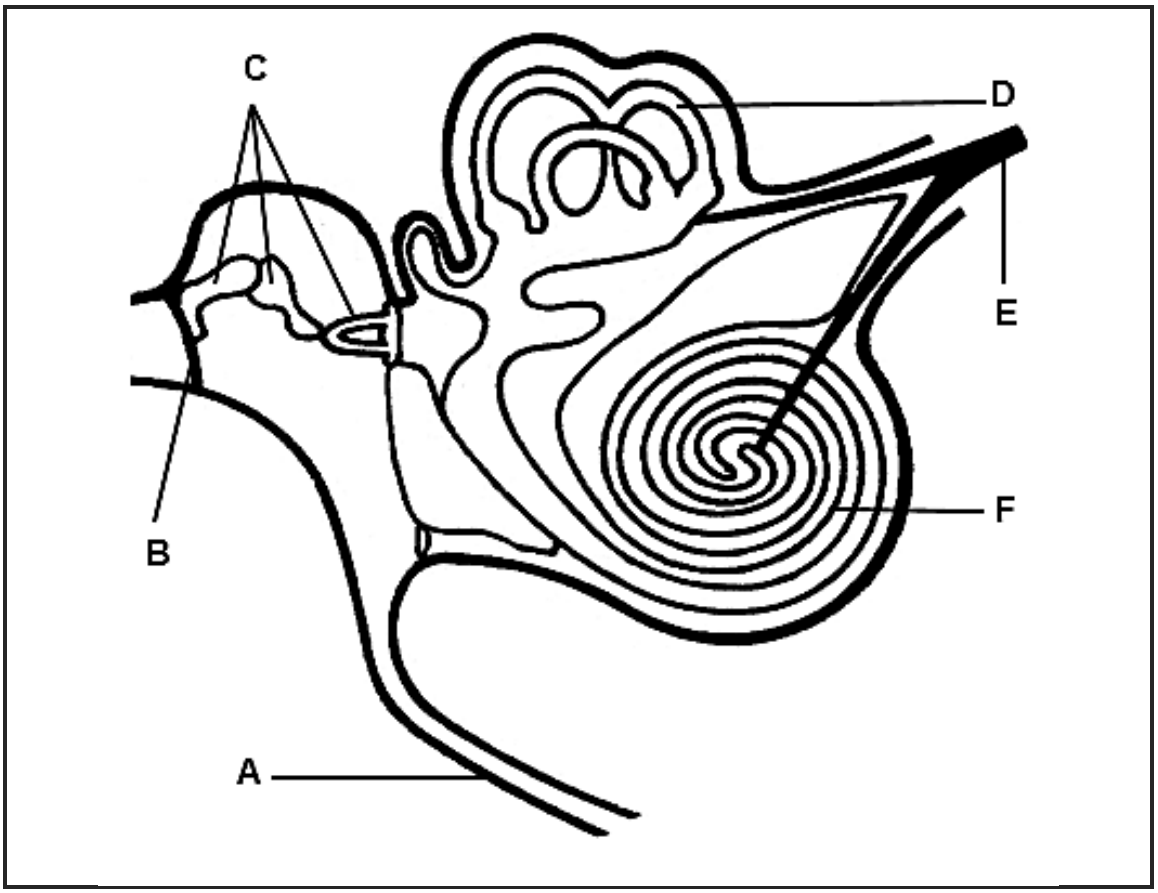
(a) Individual **2** (2)

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

3.2.3 A person with a recessive allele for colour-blindness may not be colour-blind. Explain why males with an allele for colour-blindness are always colour-blind. (4)

3.2.4 If individual **5** marries a normal male, what percentage of their daughters will have an allele for colour-blindness, but will NOT be colour-blind? (2)

3.3 The diagram below represents certain sections of the human ear.



3.3.1 Identify parts labelled **B**, **D** and **F.** (3)

3.3.2 State the function of **C**. (1)

3.3.3 Which labelled part encloses sensory cells that convert pressure waves to sensory impulses? (Give the letter only.) (1)

3.3.4 Explain the effect of excessive accumulation of mucus blocking part **A**, due to severe infection. (3)

3.3.5 Explain the consequence of an inflammation of part **E**. (2)

3.4 Study the extract below.

> Cloning in biotechnology refers to processes used to create identical copies of DNA fragments (molecular cloning), cells (cell cloning) or organisms (organism cloning).
>
> Cloning may play a part in animal conservation, by cloning animals that are endangered. Embryo cloning is the production of human embryos for use in stem cell research.
>
> Blood from the umbilical cord and placenta is one of the richest sources of stem cells that can ever be collected.

3.4.1 Define the following terms:

(a) Cloning (1)

(b) Stem cells (1)

3.4.2 State from the extract:

(a) THREE types of cloning used in biotechnology (3)

(b) ONE source of stems cells (1)

3.4.3 Explain why cloning of animals is advantageous to dairy farming. (2)

3.4.4 Explain why embryo-cloning is significant to stem cell research. (2)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Each somatic cell in the human body contains identical DNA. This DNA controls the synthesis of all proteins required for the structure and functioning of the human body.

Describe how DNA controls protein synthesis with the assistance of other nucleic acids found in the human cell. Also describe how DNA is replicated before the start of cell division to ensure that all body cells contain identical genetic information.

Content (17)
Synthesis (3)
(20)

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

TOTAL SECTION C: 20
GRAND TOTAL: 150