KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

CURRICULUM GRADE 10-12 DIRECTORATE NCS (CAPS)

LIFE SCIENCES

LEARNER SUPPORT DOCUMENT

GRADE 12

WINTER CLASSES

2025

CONTENTS

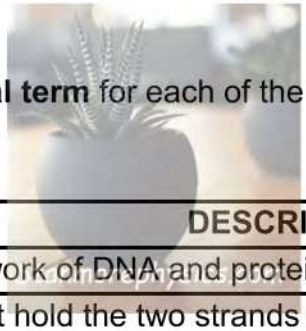
TOPIC: DNA CODE OF LIFE

DIAGNOSTIC ANALYSIS

Common Errors and misconceptions	Possible Solutions
• Many learners lost marks due to poor spelling of biological terms e.g., Genosome instead of gonosome, peptile instead of peptide, chromatid/chromatic instead of chromatin. • Some terms were incorrectly identified e.g., *Double stranded* instead of *double helix* and *co-dominance* instead of *incomplete dominance* as well as *chromatin* on its own, rather than *chromatin network*. • Used the terms DNA profile and DNA profiling interchangeable	✓ Teachers must assess terminology regularly as part of daily assessment. ✓ Teachers must apply the principles of spelling when marking formal and informal assessments. ✓ Teachers should clearly unpack the descriptions of terms
• Learners were unable to link the role of a gene to the production of proteins • Teachers do not emphasise that the portion of DNA that undergoes transcription during protein synthesis is actually a gene that codes for the production of a specific protein • Described DNA replication instead of transcription	✓ The process of Protein synthesis must be taught using diagrams. The DNA strand that undergoes transcription must be identified as a gene/portion of a gene. ✓ This must be followed up, and reinforced, by teaching the effect of a gene mutation on the formation of a protein, also with the aid of diagrams. ✓ Teachers should not try to be creative, but rather use what is in the Exam guidelines to the process
• When given the changes in DNA sequences in an extract, learners failed to explain the effect of this mutation on the formation of the protein mentioned (Warfarin). • They could not work out and write down the changes in the actual codons and amino acids (given in a table) as a result of this mutation. • Many candidates wrote down what the codons changed *to* without mentioning what they changed *from*. They also failed to state that the *sequence* of amino acids changed.	✓ Teachers must use diagrams, together with appropriate tables containing amino acids, when teaching the effect of mutations on the formation of proteins. ✓ This will improve conceptual understanding. Learners must be taught to be accurate in their descriptions of changes that occur during gene mutations.
• Learners lost marks when they quoted information from the extract when asked to explain the effect of the mutation • Using free nucleotides instead of free RNA nucleotide in the description of transcription	✓ Teachers must include explanations in daily assessment tasks. Learners must be taught to apply the cause-and-effect

	principle when explanations are required, in the context of the question ✓ Beginning stages of replication and transcription. The term double helix means that DNA has two strands which are twisted and spiral configuration

Question 1

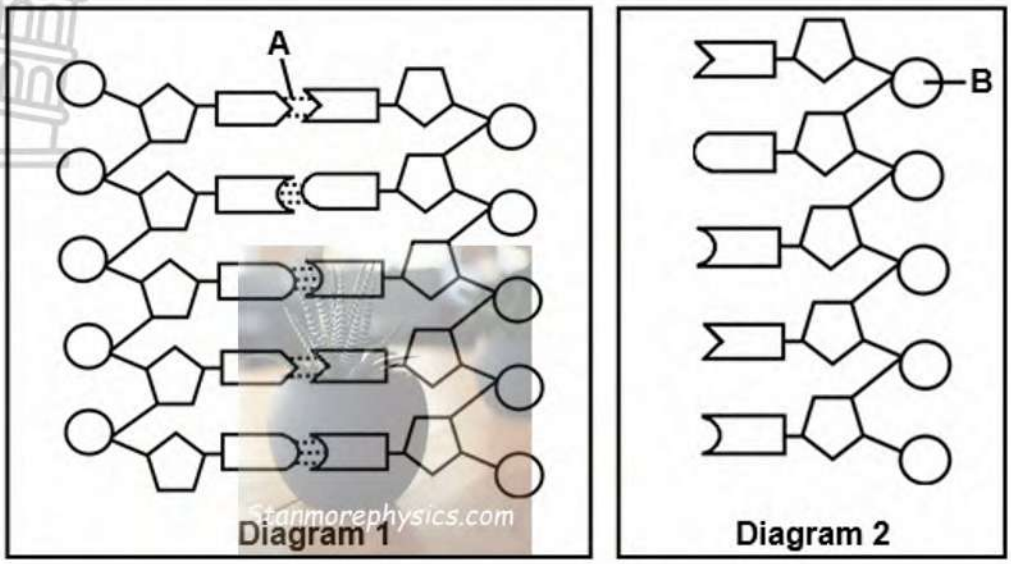


Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION	TERM
1.1	A tangled network of DNA and protein located within the nucleus	
1.2	The bonds that hold the two strands of a DNA molecule together.	
1.3	The sugar found in DNA	
1.4	The analysis of DNA samples to identify individuals that may be related	
1.5	The process whereby DNA makes an exact copy of itself	
1.6	The monomers of nucleic acids	
1.7	The natural shape of a DNA molecule	
1.8	Sections of DNA that carry hereditary information	
1.9	The sugar that forms part of a nucleotide in RNA	
1.10	The process whereby mRNA is formed from DNA	
1.11	Base triplets found on mRNA	
1.12	The cell organelle to which mRNA attaches during protein synthesis	
1.13	The process of arranging amino acids according to the sequence of bases on mRNA	
1.14	The organelle in a cell where translation occurs	
1.15	The triplet of bases found on a tRNA molecule	
1.16	The type of RNA containing anticodons	
1.17	Bonds that join amino acids together	
	17x1	**(17)**

Question 2

2. The diagrams below represent two types of nucleic acids.



2.1 Identify the nucleic acid shown in diagram **1**. (1)

2.2 Identify:

(a) A (1)

(b) B (1)

2.3 Name the type of sugar found in the nucleic acid represented in diagram **2**. (1)

2.4 Which diagram (**1** or **2**) represents a nucleic acid that is used for:

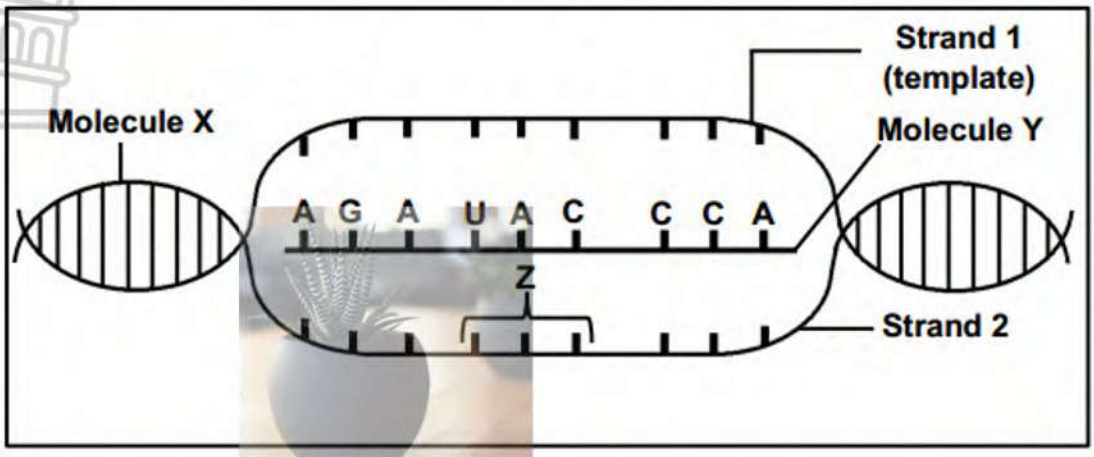
(a) Tracing of human ancestry (1)

(b) Paternity testing (1)

(6)

Question 3

The diagram below represents a certain stage of protein synthesis. (The sequence of bases is read from left to right.)



3.1 Identify molecule Y (1)

3.2 Describe the process that resulted in the formation of molecule **Y**. (6)

3.3 Give ONE structural difference between molecule **X** and molecule **Y.** (2)

3.4 Give the sequence of bases at triplet **Z** on strand **2.** (1)

3.5 The table below shows some amino acids coded for by codons on molecule **Y**.

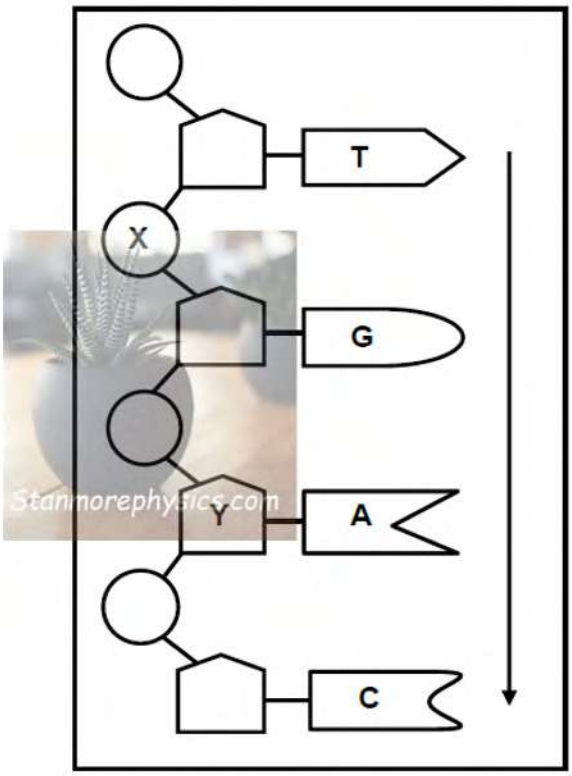
CODON	AMINO ACID
AGA	Arginine
UCU	Serine
CCA	Proline
UAC	Tyrosine
GGU	Glycine

Identify the first and last amino acids coded for by this section of molecule **Y**. (2)

(12)

Question 4

The diagram below represents some nucleotides in a single strand of DNA.



4.1 Give the LETTER of the part that represents a:

(a) Sugar molecule (1)

(b) Phosphate molecule (1)

4.2 How many nucleotides are represented in the diagram? (1)

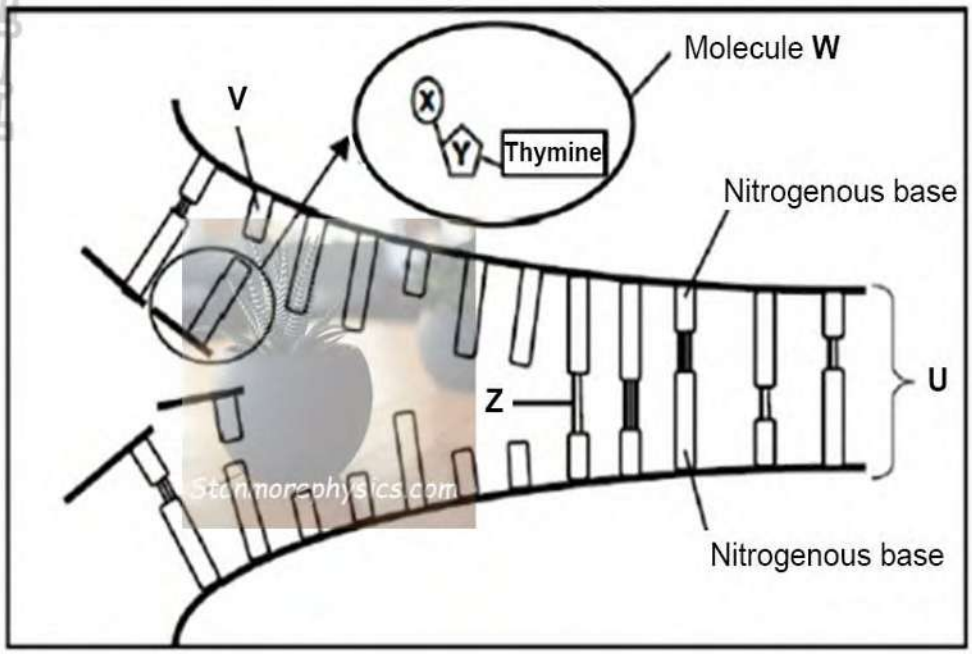
4.3 Write down the nitrogenous bases (from top to bottom as indicated by the arrow) of the complementary DNA strand of this molecule. (1)

4.4 Name TWO processes that require the two strands of a DNA molecule to separate into single strands as shown in the diagram. (2)

(6)

Question 5

5. The diagram below represents DNA Replication.



5.1 Identify the following:
- (a) Molecules **W** and **U**. (2)
- (b) Parts of molecule **W** labelled **X** and **Y**. (2)
- (c) Bond **Z**. (1)
- (d) Nitrogenous base **V**. (1)

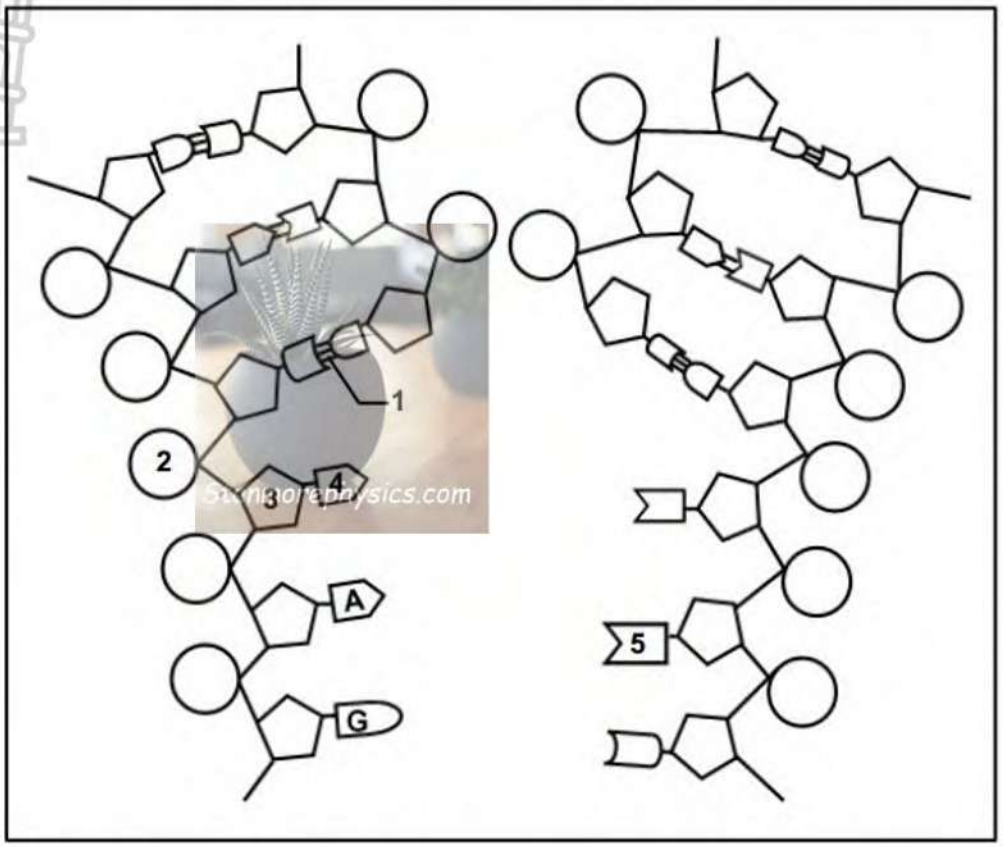
5.2 Where in the cell does this process take place? (1)

5.3 Name the phase of the cell cycle where replication takes place. (1)

(8)

Question 6

The diagram below represents a DNA molecule undergoing an important biological process.



6.1 Identify the :

(a) Process shown in the diagram (1)

(b) Chemical bond labelled 1 (1)

6.2 Give the :

(a) Collective name for the parts labelled 2,3 and 4 (1)

(b) Full name of nitrogenous base labelled 5 (1)

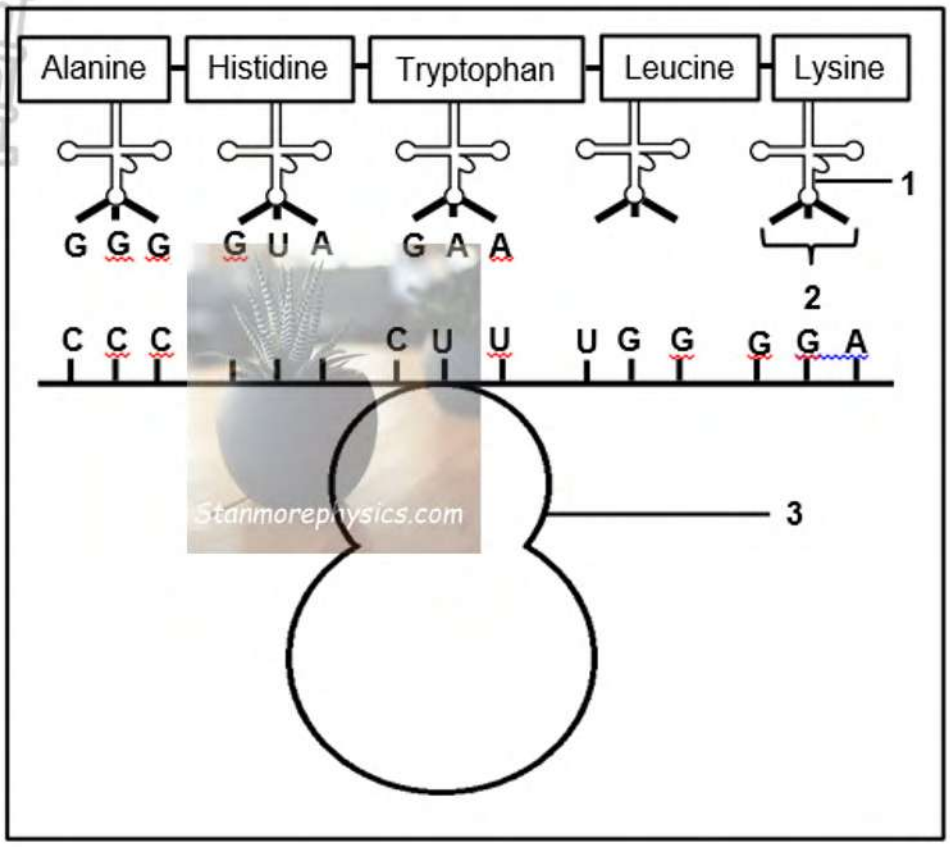
6.3 During which phase of the cell cycle does this process take place? (1)

6.4 Where in the cell does the process occur? (1)

(6)

Question 7

7. The diagram below represents a stage during the synthesis of a certain protein.



7.1 Identify organelle **3**. (1)

7.2 Describe the role of molecule **1** during this stage of protein synthesis. (2)

7.3 Give the sequence of nitrogenous bases:

(a) At **2** (1)

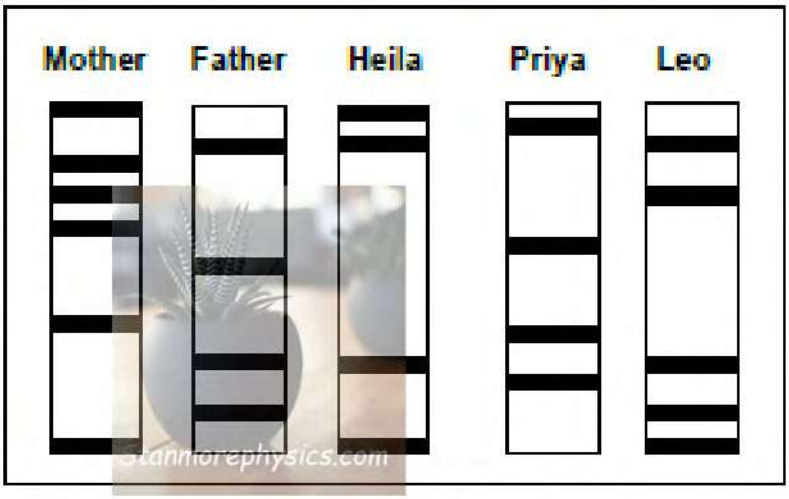
(b) On the DNA molecule that coded for histidine (2)

7.4 During the synthesis of the same protein, there was a change in the amino acid sequence because alanine was replaced by tryptophan.

Explain the possible reason for this. (3)
(9)

Question 8

8. The diagram below represents the DNA profiles of three children and their parents. Only two of their children and one is adopted.



8.1 Identify the TWO biological children. (2)

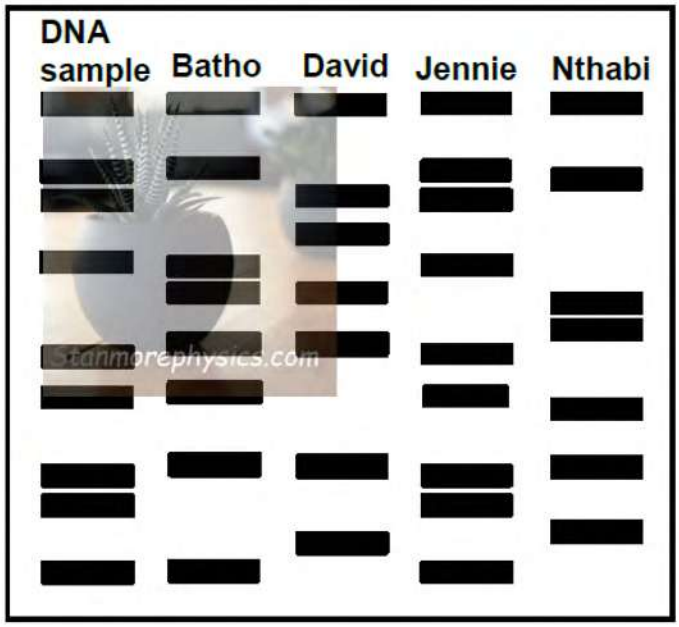
8.2 Explain your answer to QUESTION 8.1 (2)

8.3 State THREE other uses of DNA profiling (3)

(7)

Question 9

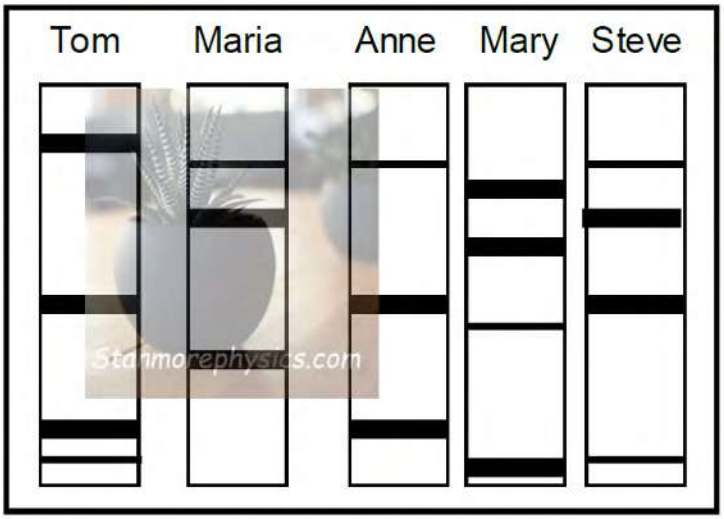
Detectives were investigating a crime scene and found blood on a broken window. They suspected that the blood was that of the criminal. To identify the criminal, they analysed a DNA sample from the blood and compared it to that of four suspects.
The diagram below was produced:



9.1 Name the technique that was used to identify the criminal. (1)
9.2 Who is the possible criminal? (1)
9.3 Explain your answer to QUESTION 9.2. (2)
9.4 State ONE other use of the technique identified in QUESTION 9.1. (1)
9.5 Give TWO views against the use of the technique identified in QUESTION 9.1. (2)
(7)

Question 10

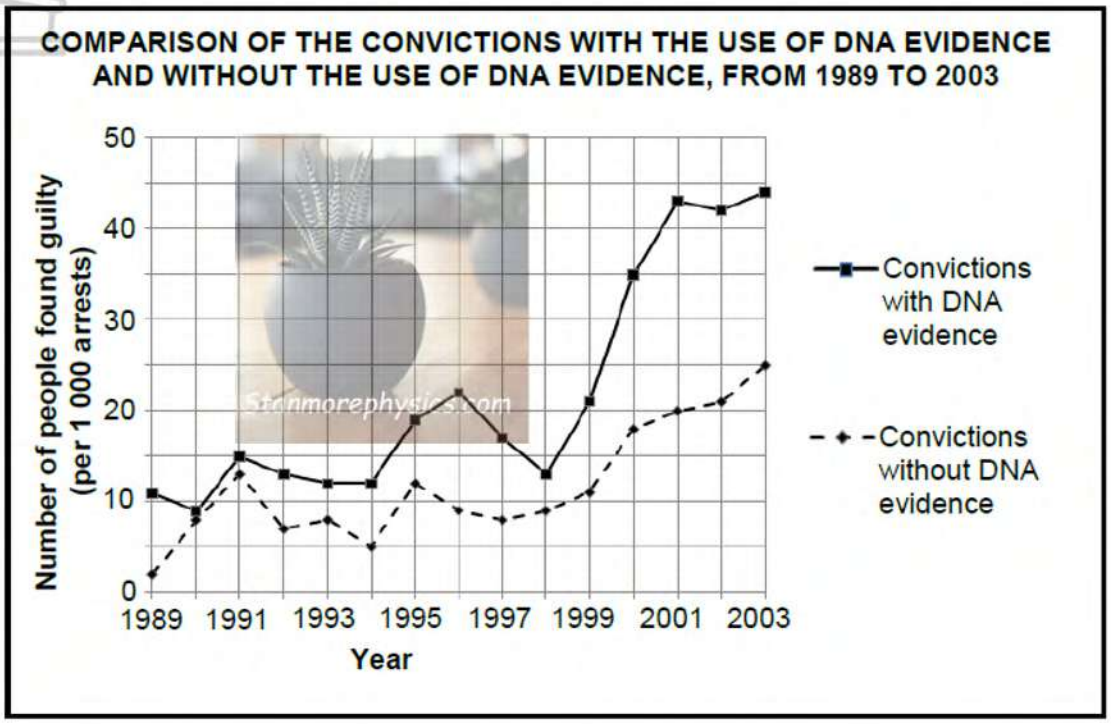
Tom and Maria have three children. One of the three children was adopted. A DNA profile for each member of the family was prepared to determine if Tom is the father of all three children (Anne, Mary and Steve).
The DNA profiles are given below



10.1 Which ONE of the children has been adopted? (2)
10.2 Explain your answer to QUESTION 10.1. (2)
(4)

Question 11

The graph below represents the results of an investigation which compares the conviction (number of people found guilty) of criminals with the use of DNA evidence and without the use of DNA evidence from 1989 to 2003.



11.1 State the dependent variable in this investigation. (1)

11.2 How many more successful convictions per 1 000 arrests were made in 2003 with the use of DNA evidence? Show ALL calculations. (2)

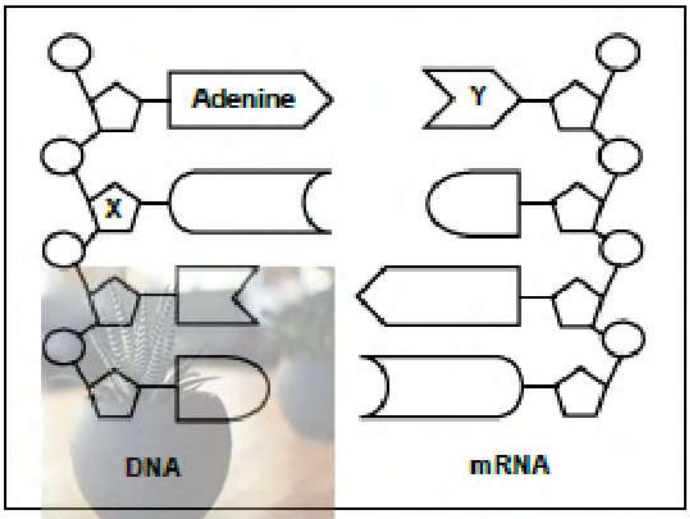
11.3 A DNA database is a collection of the DNA profiles of all the citizens of a country.

Explain how you would use the information in the graph to convince the government to create a DNA database. (4)

(7)

Question 12

The diagram below represents transcription during protein synthesis.



12.1 Name the part of the cell where this process occurs (1)

12.2 Identify:

(a) Sugar X (1)

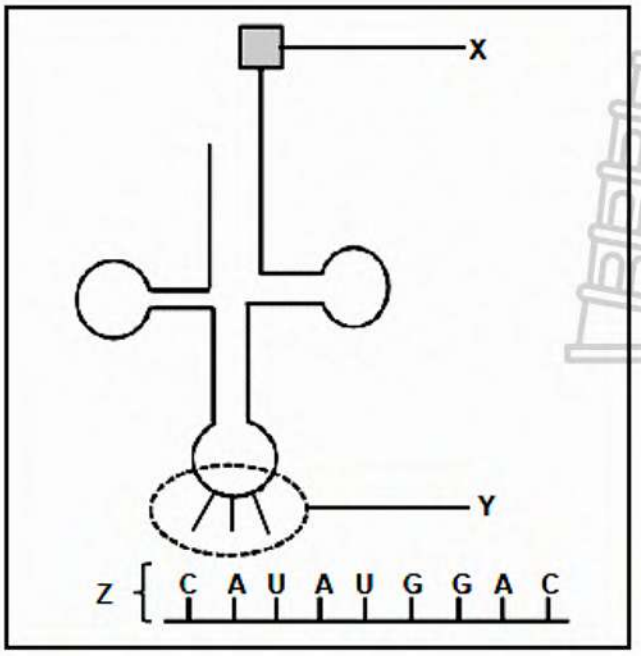
(b) Nitrogenous base Y (1)

12.3 Tabulate TWO differences between transcription and DNA replication (5)

(8)

Question 13

The diagram below represents a process that occurs during protein synthesis.



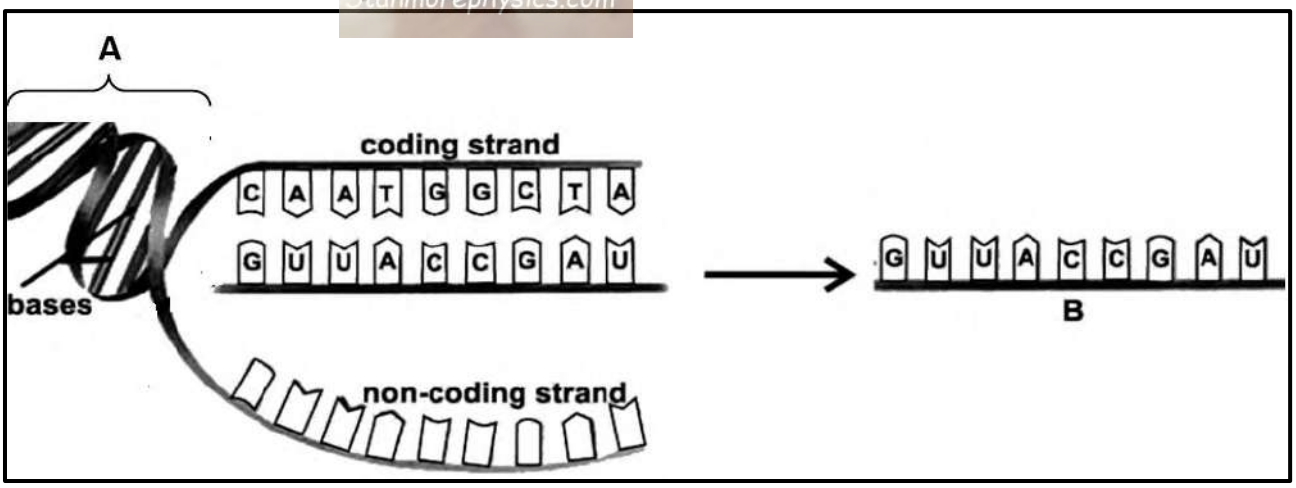
13.1 Identify molecule:
(a) X (1)
(b) Z (1)

13.2 Give the nitrogenous base sequence of:
(a) The DNA base triplet complementary to the middle codon on molecule Z. (2)
(b) Y (1)

13.3 Name and describe the process shown in the diagram during the formation of a protein. (7)
(12)

Question 14

14. The diagram below shows parts of Protein synthesis.



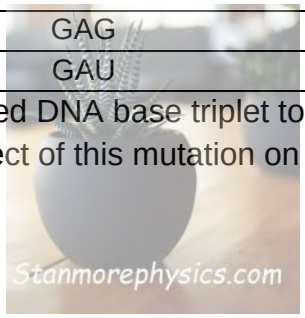
d14.1 Name the process shown in the diagram above. (1)
14.2 Identify molecule **B**. (1)
14.3 State TWO functions of molecule **A**. (2)
14.4 Tabulate TWO observable differences between molecules **A** and **B**. (5)
14.5 Describe the process that is responsible for the formation of molecule **B**. (6)
14.6 Explain how the protein molecule would be affected if codon GUU is changed to GUC on molecule **B**. (3)
(18)

Question 15

The table below shows the codons that code for some amino acids.

mRNA codon	Amino acid
AUG	Methionine
CAU	Histidine
CUA	Leucine
GUA	Valine
GAC	Aspartic acid
GAG	Glutamic acid
GAU	Aspartic acid

15.1 A mutation caused DNA base triplet to change from CTG to CTA
Describe the effect of this mutation on the protein formed. **(4)**



Question 16

A mutation had occurred on a section of mRNA molecule as shown below.

Original sequence	AUG GAA AUA CCG CCA GGA
Mutated sequence	AUG GAA AUA CUG CCA GGA

16.1 Name the mutation that has occurred (1)
16.2 Give a reason for your answer to QUESTION 16.1 (1)

16.3 The table below show some mRNA codons and the amino acids that they code for.

mRNA codon	Amino acid
AUA	Isoleucine
AUG	Methionine
CCA	Proline
CCG	Proline
CUG	Leucine
GAA	Glutamic acid
GGA	Glycine

(a) State the number of different amino acids coded for by the original sequence of the mRNA molecule given above. (1)
(b) Give the anticodon on the tRNA molecule that carries the amino acid isoleucine. (1)
(c) Use information in the table to describe the effect of the mutation on the protein formed (4)
(8)

Question 17

Read the information below.

> A gene, VKORC1, codes for a blood-clotting factor in humans. This gene is made up of 163 amino acids.
> A mutation occurred that affected amino acid 128 and 139, the sequence CTG changed to CAG and the TAT became TCT. This mutation has been transmitted as an autosomal dominant characteristic through the generations.
> The mutation has resulted in resistance to Warfarin drugs in humans. Warfarin is used in the treatment of thrombosis. Thrombosis results in the formation of a blood clot in the artery. Warfarin causes the thinning of blood to break down the blood clot.

17.1 Give ONE piece of evidence from the information that shows that the mutation for this gene occurred in the DNA molecule. (1)

17.2 How many nitrogenous bases code for the VKORC1 gene? (2)

17.3 Describe what is meant by an *autosomal dominant allele*. (3)

17.4 The table below shows the amino acids and their corresponding codons.

CODONS	AMINO ACIDS
GAC	Leu
UCU	Ser
AUA	Try
GUC	Gln
AGA	Arg
ACA	Trp
CAG	Gln
UAU	Phe

Explain:

(a) How the mutation on the VKORC1 gene resulted in resistance to Warfarin in humans (5)

(b) The effect of this mutation on humans with thrombosis. (3)

(14)

Question 18

Haemoglobin is a protein found in blood that carries oxygen to all the cells of the body. A portion of this protein is called a beta chain. If the sequence of amino acids in this chain changes, then a different form of haemoglobin, called haemoglobin S, is formed. Haemoglobin S cannot transport oxygen as efficiently as normal haemoglobin.

Position of amino acids in the beta chain	1	2	3	4	5	6	7
Normal haemoglobin	Val	His	Leu	Thr	Pro	Glu	Glu
Haemoglobin S	Val	His	Leu	Thr	Pro	Val	Glu

The table below shows the DNA base triplets coding for some amino acids.

DNA BASE TRIPLET	AMINO ACID
CAC	Val
GTG	His
GAC	Leu
TGA	Thr
GGA	Pro
CTC	Glu

18.1 Give the:
(a) DNA base triplet for amino acid **3**. (1)
(b) mRNA codon for amino acid **4**. (2)

18.2 What is a change in the sequence of DNA base triplets called? (1)

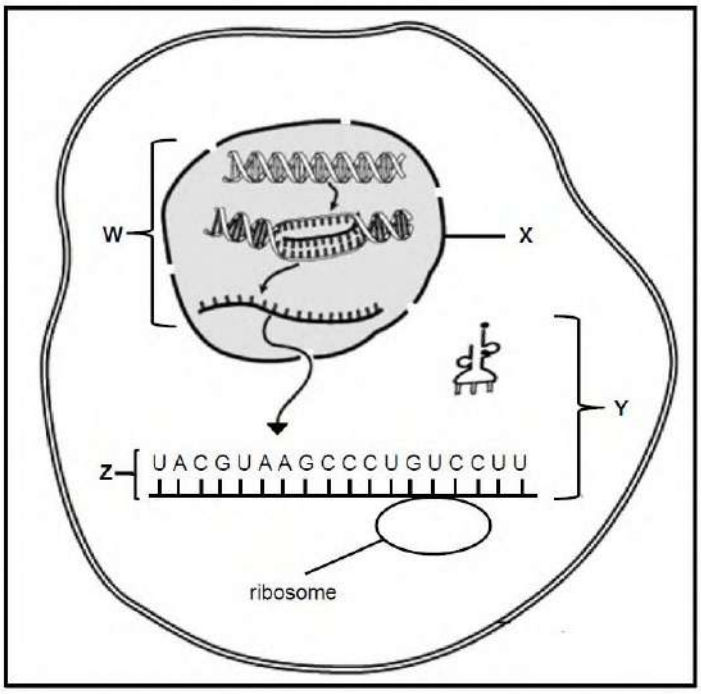
18.3 Use the information in the tables to explain how a change in the sequence of the DNA base triplets results in the formation of haemoglobin S, rather than normal haemoglobin. (4)

18.4 Describe how a person with haemoglobin S would be affected. (2)

(10)

Question 19

19.1 The diagram below represents the process of protein synthesis in a cell.



19.1 Name the process which occurs at:
(a) **W**. (1)
(b) **Y** (1)

19.2 Identify:
(a) Organelle **X**. (1)
(b) Molecule **Z** (1)

19.3 State TWO locations of DNA in a cell, other than in the nucleus. (2)

19.4 Describe the process at
(a) **W** (7)
(b) **Y** (6)

The table below shows some tRNA anticodons with their corresponding amino acids.

tRNA ANTICODON	AMINO ACID
CAG	Valine
GAA	Leucine
AUG	Tyrosine
GGA	Proline
UCG	Serine
CAU	Valine

19.5 Name the:
(a) DNA base triplet that codes for serine (1)
(b) First TWO amino acids coded for by molecule **Z** in the diagram (the molecule is read from left to right). (2)

19.6 What is the change in the sequence of nitrogenous bases in a DNA molecule called? (1)

19.7 The codon CUU (last codon) on molecule **Z** changed to CCU.
Explain the effect it would have on this particular protein molecule. (3)
(26)

TOPIC: MEIOSIS

Diagnostic Analysis

Common errors and misconception	Possible Solutions
• Learners struggled with correct spelling of terms – wrote: 'sprindle'/spingle' instead of 'spindle • Used colloquial terms like 'side' or 'ends' instead of referring to the 'poles' of a cell	✓ Teachers must assess terminology regularly as part of daily assessment. ✓ Teachers must apply the principles of spelling when marking formal and informal assessments
• Learners wrote interphase I and interphase II	✓ Learners should be taught that interphase is a preparatory stage of meiosis and mitosis, it is incorrect to refer to interphase 1 and interphase 11
• Learners were unable to identify correct phases	✓ Learners must be given classwork and homework exercises that enable them to use features of a meiosis diagram to identify the specific phases
• Learners cannot differentiate between *pairs* of chromosomes at the equator vs *single* chromosomes at the equator during metaphase I and mitosis, respectively. • Instead, most candidates wrote homologous chromosomes at the equator in Metaphase I without mentioning that they were in pairs.	✓ Diagrams must be used to emphasize the differences in the position and arrangement of chromosomes when differentiating between the phases of meiosis as well as between meiosis and mitosis.
• Learners did not apply the information provided in a diagram when answering a question on non-disjunction. Most candidates provided a generic account of the process of non-disjunction leading to Down Syndrome. They failed to identify the correct number of chromosomes in the daughter cells at the end of meiosis, based on the number of chromosomes shown in the diagram. They also did not include the number of cells formed at the end of meiosis in their answers.	✓ Abnormal meiosis and non-disjunction must be taught as a concept on its own, using diagrams and examples with different numbers of chromosomes. Emphasis must be placed on the number of chromosomes formed in each daughter cell, using the actual number of chromosomes and daughter cells that are specified by the question. ✓ Informal assessment on non-disjunction must not be restricted to Down syndrome only.

QUESTION 1

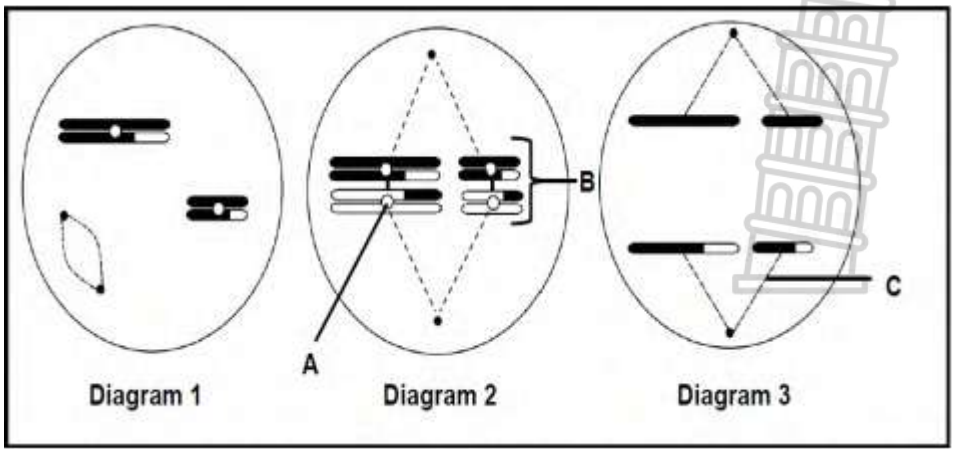
Give the correct biological term for EACH of the following descriptions.
Write only the term next to the question numbers (2.1 to 2.12) in the ANSWER BOOK.

1.1	None sex chromosomes in humans	
1.2	The part of the plant where the male gametes are produced	
1.3	The structure that holds the two chromatids of a chromosome together	
1.4	The chromosome condition of a cell that has a single set of chromosomes	
1.5	The phase of meiosis where paired chromosomes are arranged at the equator	
1.6	The division of the cytoplasm of a cell during a cell division	
1.7	The structure formed by the centrioles during cell division	
1.8	A genetic disorder caused by having an extra copy of chromosome number 21	
1.9	The failure of chromosome pairs to separate during meiosis	
1.10	The phase in the cell cycle during which the cell growth occurs to doubles the genetic material	

1×10 **(10)**

Question 2

The diagram below represents different phases of meiosis in the diagram.

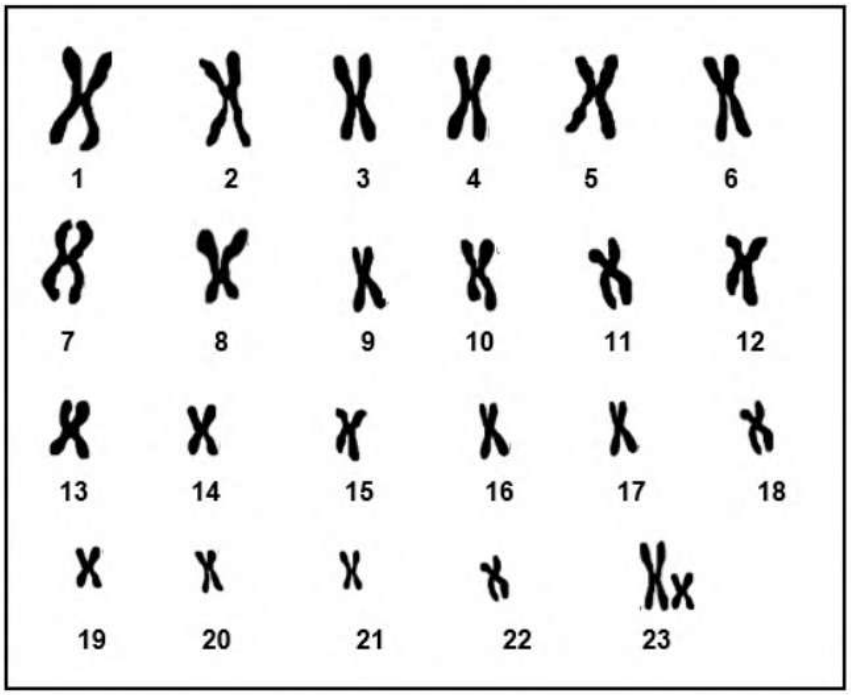


2.1 Identify:
(a) A (1)
(b) B (1)
(c) C (1)

2.2 Identify phase represented in Diagram 3 (1)
2.3 Write down the numbers of the diagrams to show the sequence in which the phases occur. (2)
2. 4 State ONE difference between metaphase I and metaphase II (2)
(8)

Question 3

The diagram below shows the karyotype of a gamete of an individual.



3.1 Name the type of mutation that occurred during the production of this gamete. (1)

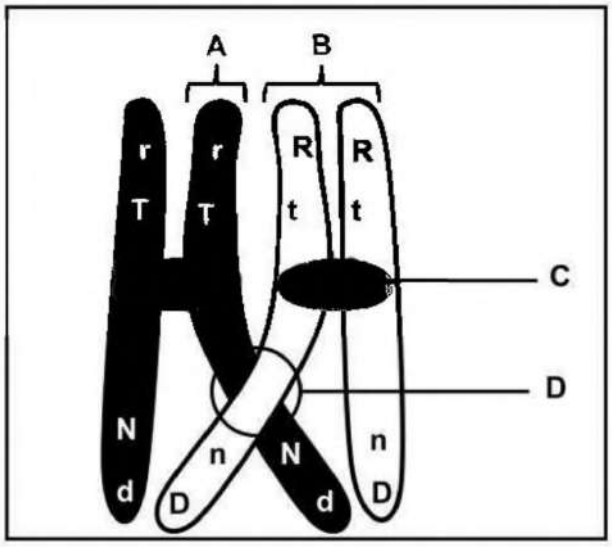
3.2 What type of gamete is represented in the karyotype? (1)

3.3 In this gamete, give the number of:
(a) Autosomes (1)
(b) Gonosome (1)

3.4 This gamete fuses with a normal gamete.
Using X and Y representation, write the sex chromosomes of the offspring. (2)
(6)

Question 4

The diagram below shows a process during meiosis. The letters represent the alleles of genes in the chromosomes.



4.1 Name the:
(a) Process shown in the diagram (1)
(b) Phase of meiosis represented above (1)

4.2 Identify:
(a) Point D (1)
(b) Part B (1)

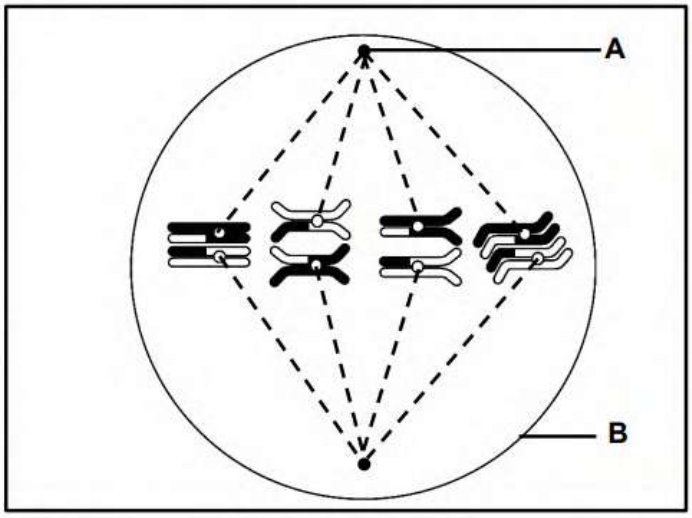
4.3. Write down the LETTER and NAME of the part that join together two chromatids (2)

4.4 Write down the genotype of the resulting chromatid A after the process named in QUESTION 4.1 (a) (1)

4.5 State how many:
(a) Characteristics are represented in the diagram above? (1)
(b) Different genes are represented by the alleles in the diagram (1)
(9)

Question 5

The diagram below represents metaphase I of meiosis.

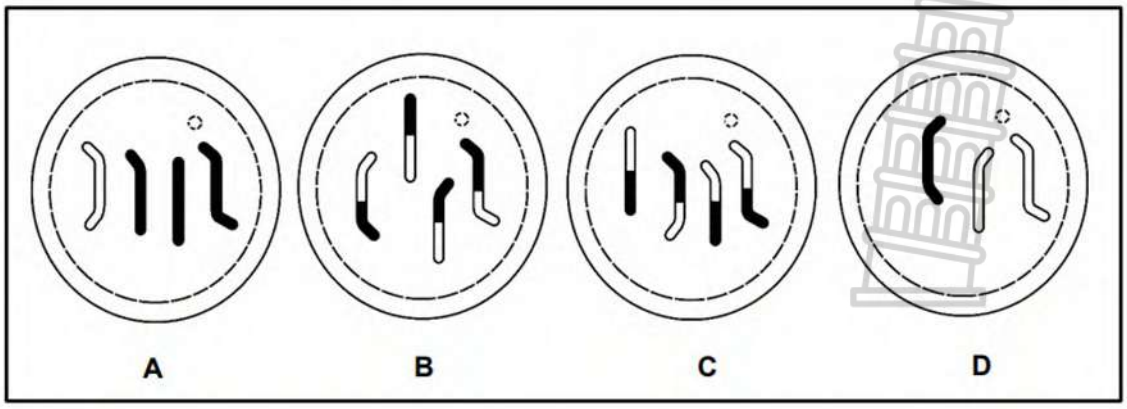


5.1 Identify part B. (1)
5.2 State ONE function of A (1)
5.3 Explain the appearance of chromosomes in the diagram (3)
5.4 What are homologous chromosomes (2)

The total amount of DNA is 12 arbitrary units in each daughter cell at the end of this cell division.

5.5 How much DNA (in arbitrary units) was in the parent cell at the beginning of the cell division? (2)

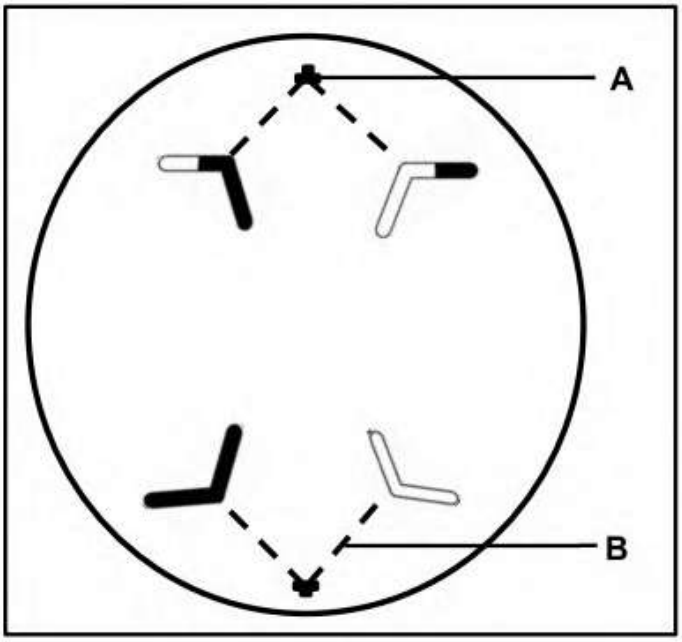
The diagram below shows four possible daughter cells formed at the end of this meiosis.



5.6 Draw cell D, including the missing 4th chromosome (3)
(12)

Question 6

The diagram below represents a phase of meiosis II



6.1 Identify the phase of meiosis shown (1)

6.2 State ONE difference between the phase shown in the diagram above and the same phase in meiosis I (2)

6.3 Identify structure

(a) A (1)

(b) B (1)

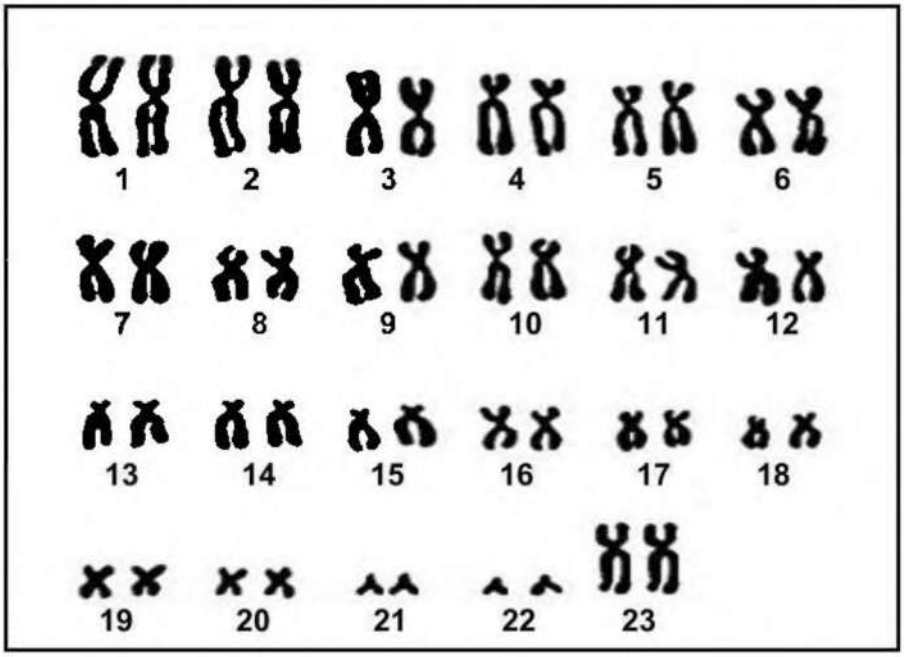
6.4 Describe the role of structure B during cell division (2)

6.5 Draw a labelled diagram representing the cell above as it would have appeared in metaphase II (5)

(12)

Question 7

Colour blindness (b) occurs when there is a problem with the pigments in certain nerve cells of the photoreceptors in the retina. Parents pass down the red-green colour vision deficiency to the offspring.
The diagram below represents the human somatic cell



7.1 Identify the diagram above (1)
7.2 Name the type of photoreceptors referred to in information above. (1)
7.3 Give the collective name for the type of chromosomes in pair number 23 (1)
7.4 State three characteristics of the autosomal homologous chromosome pairs. (3)
7.5 Give ONE reason why this diagram represents the human somatic cell. (1)
(7)

Question 8

Scientist performed the investigation using a specific ethnic group from a hospital in a particular area in South Africa.
The following table shows the number of babies with the genetic disorder in women of different ages have given birth to.

Age of mothers in years	Number of babies born with the genetic disorder
25	1 in 1250
32	1 in 378
40	1 in 100
45	1 in 30

8.1 Identify the independent variable in this investigation (1)
8.2 Give the age of mother when this genetic disorder is most prevalent. (1)
8.3 State ONE reason why this genetic is most prevalent with the age mentioned in QUESTION 8.2 (1)
8.4 Identify TWO planning steps when conducting this investigation. (2)
8.5 Give ONE way in which the reliability of the results of this investigation can be improved. (1)
8.6 Name ONE factor that was considered when selecting the participants for this investigation. (1)
8.7 Calculate the percentage chance of babies born with the genetic disorder in the mothers aged 25 (2)
8.8 State the conclusion of this investigation that one can draw from the data in the table above (2)
(11)

TOPIC: REPRODUCTIVE STRATEGIES AND HUMAN REPRODUCTION

DIAGNOSTIC ANALYSIS

Common errors and misconceptions	Possible solutions
• Not being able to differentiate between Vivipary and ovipary, Urethra and , Ureter, Choroid and chorion, Chorion and Chorionic villi, Chorionic villi and placenta. • Incorrect spelling e.g. *epidermis* instead of *epididymis*	✓ Highlight the distinction between terms that look or sound similar so that candidate may apply that knowledge judiciously in the paper
• failing to understand text in reproductive strategies in relation to the diagram • confusing the concepts 'increasing chances of fertilisation' with 'reproductive success	✓ Candidates practice sections where extract or scenarios are provided. ✓ Expose candidates to variety of questions so that they will be able to read questions with understanding.
• Unable to distinguish that *oogenesis* produces 1 mature gamete (ovum) and 3 polar bodies while *spermatogenesis* produces 4 mature gametes (sperm cells	✓ Clear distinction must be made between the process of oogenesis and spermatogenesis
• giving the description 'fertilised ovum' instead of the term *zygote*	✓ when asked for a biological term learners should give the correct term and not a description of the term
• Failing to present their responses in a cause-and-effect way by stating the effect without the cause.	✓ Responses that need a cause and effect must be explained to learners by giving examples (informal tasks with extracts). Why frog's eggs do not survive on land. Since they have no shells (cause) they will dry out (effect).
• Giving a description instead of an explanation e.g. prostate gland *Neutralises the acidity in the vagina* without stating why it is able to carry out this function	✓ Fluid is alkaline (cause) to neutralize the acidic conditions (effect) of the vagina Fluid contains nutrients (cause) to supply sperm with energy (effect). ✓ A clear cause and effect must be linked.
• Failing to explain the negative feedback mechanism involving FSH and progesterone, differentiate between Pituitary and Ovarian hormones, uterine and ovarian cycle	✓ These negative feedback mechanisms must be linked to given data

Question 1

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION	TERM
1.1	A reproductive strategy where the young receives nutrients through the placenta	
1.2	The duct that transports semen and urine to the outside of the body	
1.3	The structure that serves as a micro-filter during pregnancy	
1.4	The part of the male reproductive system which temporarily stores sperm until they mature	
1.5	The fusion of the sperm and egg outside the body	
1.6	The development of the embryo inside an incubated egg that is laid.	
1.7	The development of the embryo in the uterus and the young are born alive.	
1.8	The complete development of the embryo inside an egg in the female body.	
1.9	The development of the embryo in which very little energy is used and parental care is required.	
1.10	The development of the embryo in which a lot of energy is used and the young are able to move directly after hatching.	
1.11	Structure that provides nutrition to the embryo in the amniotic egg	
1.12	Fluid filled bag around embryo	
1.13	Structure in the sperm cell that contains enzymes used to penetrate the ovum	
1.14	The liquid that surrounds the human embryo	
1.15	A hollow ball of cells into which the fertilised ovum develops	
1.16	The lining of the uterus which is richly supplied with blood vessels	
1.17	Coiled tubular structure outside the testis that stores sperms	
1.18	The part of the female reproductive system in which fertilisation takes place	
1.19	The name given to the embryo after it reaches 12 weeks	
1.20	The hormone produced by the pituitary which controls growth of the Graafian follicle	
1.21	Layer within the ovary that is responsible for formation of ova through meiosis	
1.22	Another name for the period of pregnancy	
1.23	The process by which the embryo becomes attached to the uterine wall	
1.24	The hormone which converts the ruptured follicle into a corpus luteum	
1.25	Type of cell division by which sperms are produced	
1.26	The 28-day reproductive cycle in females involving changes in the ovary and uterus	
1.27	Tearing away of the endometrium lining of the uterine wall, accompanied by the loss of blood	
1.28	The cell division by which the zygote becomes multicellular	
1.29	Production of ova by meiosis	

1.30	The hormone which starts the preparation of the lining of the uterus for attachment of the fertilised ovum	
1.31	Process by which an ovum is released from the ovary in humans	
1.32	Gland in the brain that produces FSH and LH	
1.33	Combination of foetal and maternal tissue responsible for gas exchange, nutrition and excretion	
1.34	Hormone that maintains pregnancy	
1.35	The stage when sexual maturity is reached in males and females	
1.36	Production of spermatozoa by meiosis	
1.37	Hormone responsible for secondary sexual characteristics in males	
1.38	A hollow, rope-like tube which attaches the embryo to the placenta	
1.39	The blood vessel that carries nitrogenous waste from the foetus to the placenta	
1.40	The blood vessel that carries oxygenated blood from the placenta to the foetus	
1.41	The structure where testosterone is produced	
1.42	Sac-like structure that contains testes	
1.43	A gland that lubricates end of penis	
1.44	Common tube for sperm and urine	
1.45	A gland that produces alkaline medium of semen	
1.46	A gland that provides nutrients for the sperms	
1.47	A tube that transfers sperms to the urethra	
1.48	Finger-like projections that develop from the outer membrane of an embryo after implantation	
1.49	The fluid that protects the developing foetus against mechanical injury	
1.50	The organelles found in large quantities in the neck region of a sperm cell	
1.51	The type of development in birds in which the young is born fully developed and able to move and feed itself	
1.52.	The structure in the sperm that contains enzymes to dissolve the outer layer of the ovum	
1.53	A blood vessel that transports carbon dioxide from the foetus to the placenta	
		(53x 1) **(53)**

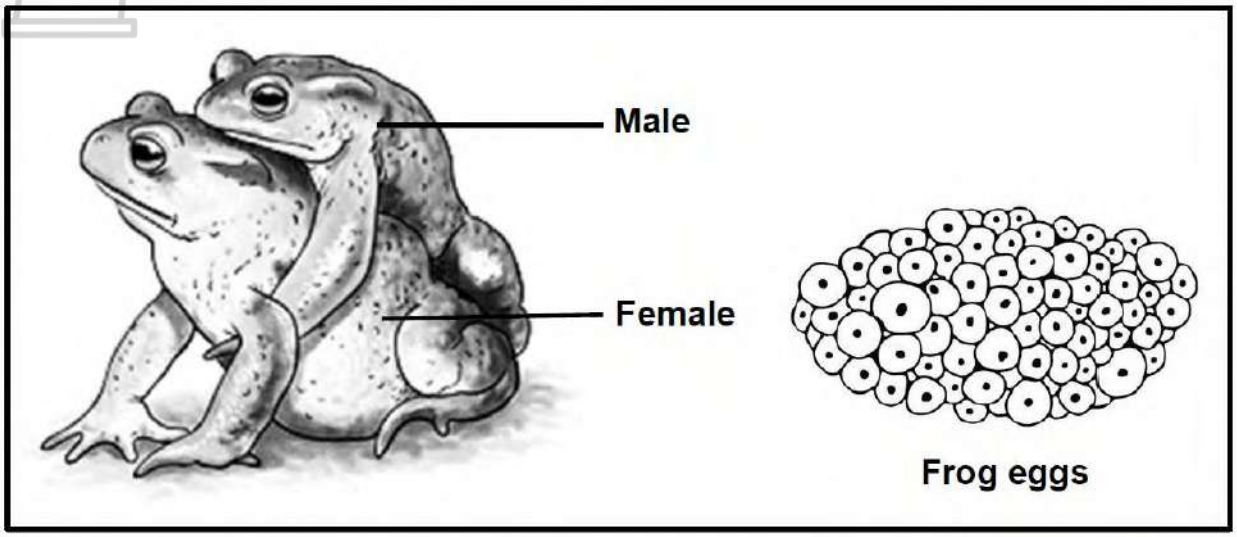
Question 2

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 number.

	COLUMN I		COLUMN II
2.1	Nutrition provided by the egg	A B	Ovipary Ovovivipary
2.2	A process that produces four mature gametes in humans from a single diploid cell	A B	Oogenesis Spermatogenesis
2.3	Unfertilised eggs are released from the female's body	A B	Asexual reproduction External fertilisation
2.4	The blood vessel that transports oxygenated blood from the placenta to the foetus	A B	Umbilical vein Umbilical artery
2.5	The young develop and is nourished in an amniotic egg that is retained in the mother	A B	Ovipary Vivipary
2.6	Eggs incubated in a nest	A B	Ovipary Ovovivipary
2.7	Gestation period required	A B	Ovipary Vivipary
2.8	Offspring are born small and helpless	A B	Altricial Precocial
2.9	Functions in gas exchange	A B	Chorion Allantois
2.10	Serves as a source of nutrition	A B	Amnion Yolk sac
2.11	Leads to wastage of a large number of sperm	A B	Internal fertilization External fertilisation
2.12	Forms the placenta	A B	Chorionic villi Endometrium
2.13	The production of ova by meiosis	A B	Menopause Ovulation
2.14	A hollow ball of cells into which fertilised ovum develops	A B	Amnion Chorion
2.15	The reproductive structures where meiosis occurs	A B	Testes Ovaries
2.16	Place where fertilisation occurs in humans	A B	Cervix Fallopian tube
2.17	Outer jelly-like layer of the ovum	A B	Cytoplasm Shell
2.18	Hormones secreted by the pituitary gland/hypohysis	A B	Thyroxin FSH
2.19	Stimulates the formation of the Graafian follicle	A B	Progesterone Oestrogen
2.20	An extra-embryonic membrane found in the amniotic egg	A B	Chorion Allantois
2.21	A structure that transports semen out of the body	A B	Scrotum Urethra
			(21 x 2) **(42)**

Question 3

In some frog species, during mating, the male climbs onto the back of the female and grasps her with his front legs. During this time, the female will release about 6 000 ova, while the male releases sperm onto them. This mating behaviour is called amplexus.



3.1 Name the type of fertilisation that occurs during reproduction in frogs. (1)

3.2 Explain why the fertilised eggs of these frogs do not survive on land. (2)

3.3 Explain how amplexus increases the chances of fertilisation in frogs. (2)

3.4 From the information above, explain ONE other strategy that contributes to the reproductive success of the frog species. (2)

(7)

Question 4

The passage below describes the breeding habits of vultures.

Vultures are birds of prey that feed on the flesh of dead animals.

A female vulture lays only one to two fertilized eggs, which are then protected by both parents during incubation. Incubation is the period from the time an egg is laid up to the time it hatches. Vultures have a short incubation period of 32 to 45 days. This short incubation period is typical of birds displaying altricial development. After hatching, the parents feed the young chicks as often as 20 times a day.

4.1 Give ONE reason from the passage why vultures:
(a) Are considered as oviparous (1)
(b) Have a high survival rate even though few eggs are laid (1)

4.2 Fertilisation in vultures takes place internally.
State TWO advantages of internal fertilisation. (2)

4.3 State TWO characteristics of chicks that display altricial development. (2)

4.4 Explain why birds with altricial development would have short incubation periods. (2)

(8)

Question 5

Describe how the developing embryo is protected and nourished in ovoviviparous organisms

(7)

Question 6

Read the extract below.

> The bluefin tuna, the great white shark and the bottlenose dolphin are three aquatic species that are found in the Indian Ocean.
>
> An adult bluefin tuna releases up to 540 000 000 eggs into the water annually, while the great white shark female produces 2 to 12 offspring through ovovivipary every two years. A bottlenose dolphin female, being a mammal, is viviparous and produces one offspring every two to three years.

6.1 Name the type of fertilisation that takes place in the bottlenose dolphin. (1)

6.2 Explain how TWO of the reproductive strategies of the great white shark increase its reproductive success. (4)

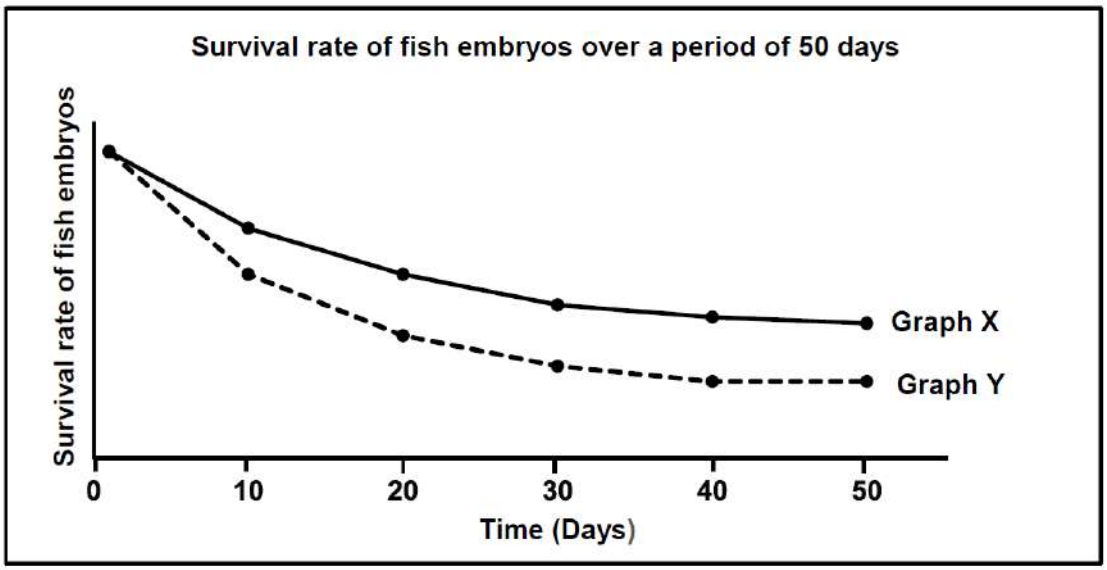
6.3 Explain ONE reason why the Bluefin tuna releases a large number of eggs. (2)

(7)

Question 7

Read the extract below.

> Anchovy is a type of fish found in the Pacific Ocean. During the breeding season, the females and males gather in large groups and release ova and semen into the water. Once fertilised, the eggs float in the water and embryonic development occurs until hatching.
>
> The northern pike fish is found mainly in rivers. During the breeding season, the female releases thousands of ova and the male releases semen allaround the female. The fertilised eggs attach to vegetation near the riverbed, where embryonic development occurs until hatching.
>
> The graph below shows the survival rate of both fish species.



7.1 Name the type of fertilisation that takes place in both fish species. (1)

7.2 Explain why both fish species are oviparous. (2)

7.3 Describe TWO ways in which the chances of fertilisation are increased in the northern pike fish. (2)

7.4 Which graph (**X** or **Y**) represents the survival rate of the northernpike fish? (1)

7.5 Explain your answer to QUESTION 7.4 (3)

(9)

Question 8

Frogs can survive in water and on land. Most frogs, however, need water for reproduction. During the breeding season, male and female frogs release millions of gametes into the water.

8.1 Name the type of fertilisation described above. (1)

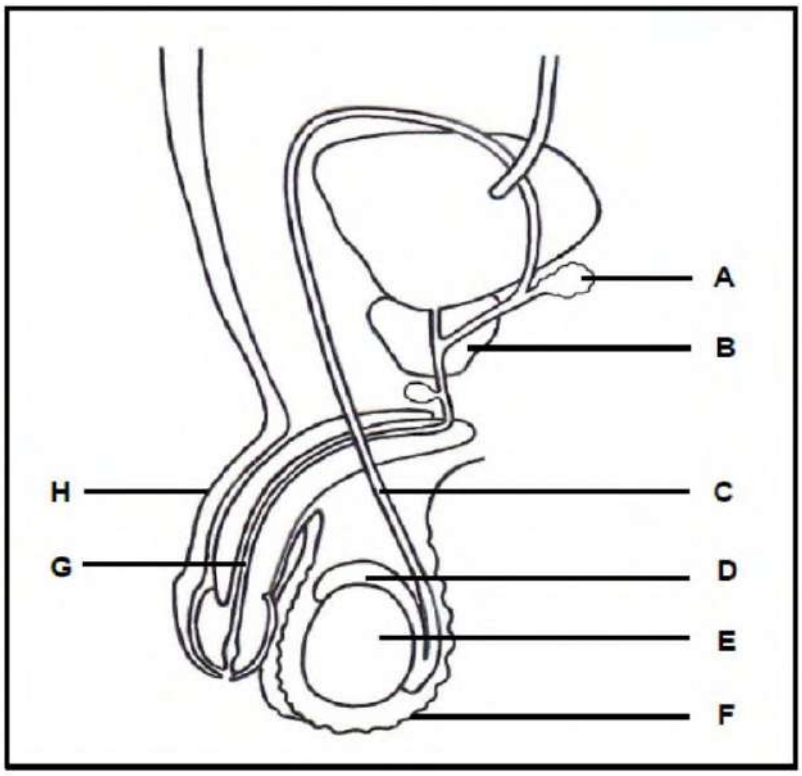
8.2 Explain why millions of gametes are released. (3)

8.3 State why the reproduction in frogs is an example of ovipary. (1)

(5)

Question 9

The diagram below shows the parts of the male reproductive system.



9.1 Identify part:

(a) C (1)

(b) F (1)

(c) H (1)

9.2 Give the LETTER and NAME of the part that:

(a) Stores sperm temporarily (2)

(b) Transports both semen and urine (2)

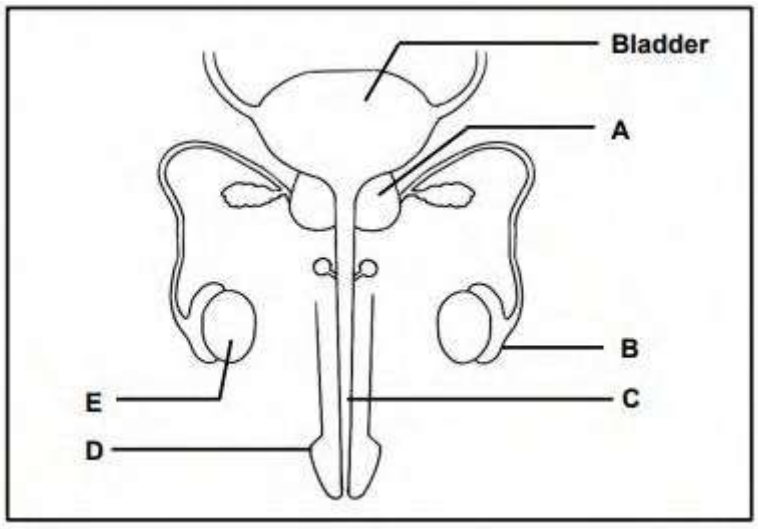
(c) Produces testosterone (2)

9.3 Give the LETTERS of TWO parts that contribute to the formation of semen. (2)

(11)

Question 10

The diagram below represents the front view of the human male reproductive system



10.1 Give the LETTER and NAME of the structure that:

(a) Forms part of both the urinary and reproductive systems (2)

(b) Stores sperm temporarily (2)

(c) Secretes testosterone (2)

10.2 Identify:

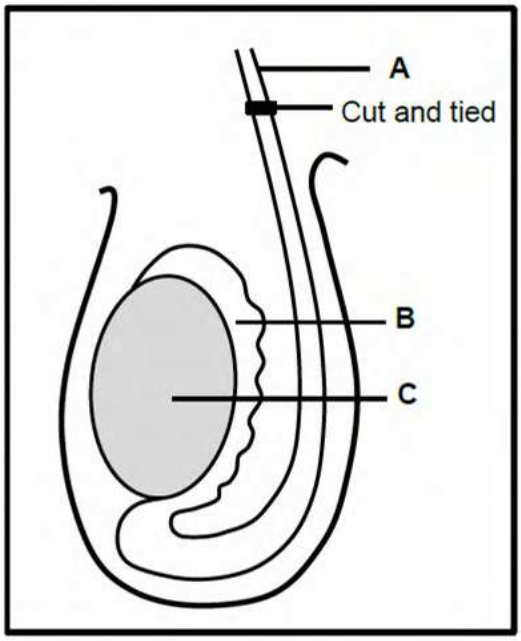
(a) Part A (1)

(b) The type of gametogenesis that takes place in part E (1)

(8)

Question 11

The diagram below shows part of the male reproductive system.



11.1 Identify part A. (1)

11.2 State ONE function of part B. (1)

11.3 During a vasectomy, part A is cut and tied as shown in the diagram. Semen will still be released during copulation.

Explain the composition of the semen after a vasectomy. (3)

11.4 In some rare cases, males are born with part C located inside the body because it failed to descend into the scrotum.

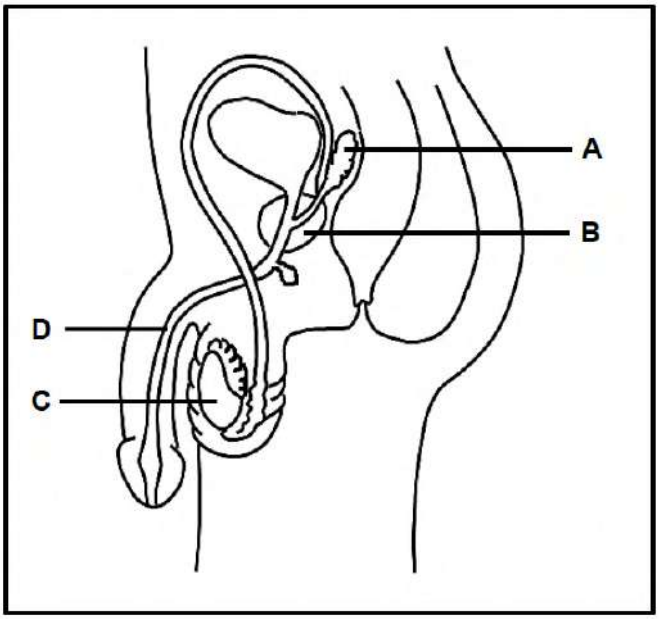
Explain how this condition may affect male fertility. (3)

11.5 Describe the process of spermatogenesis. (4)

(12)

Question 12

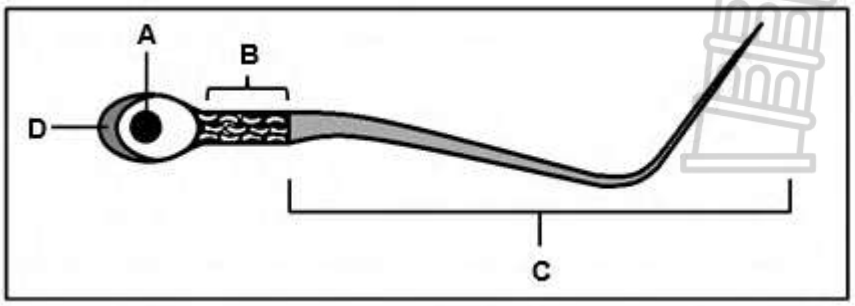
The diagram below represents the human male reproductive system.



12.1 Identify structure A. (1)
12.2 State ONE function of part D in reproduction. (1)
12.3 Give TWO reasons why structure B is NOT considered to be an endocrine gland. (2)
12.4 Name the type of gametogenesis that occurs in part C. (1)
12.5 Explain how the secretions of structures A and B improve the chances of fertilisation. (4)
(9)

Question 13

The diagram below shows the structure of a sperm cell.



13.1 Name:
(a) The organelles found in large numbers in part B (1)
(b) Part D (1)
13.2 Name the part of the testes where spermatogenesis takes place. (1)

13.3 Explain the role of the following parts during fertilisation:

(a) A (2)

(b) D (2)

13.4 Describe the functional relationship between the organelles in part B and structure C during reproduction (2)

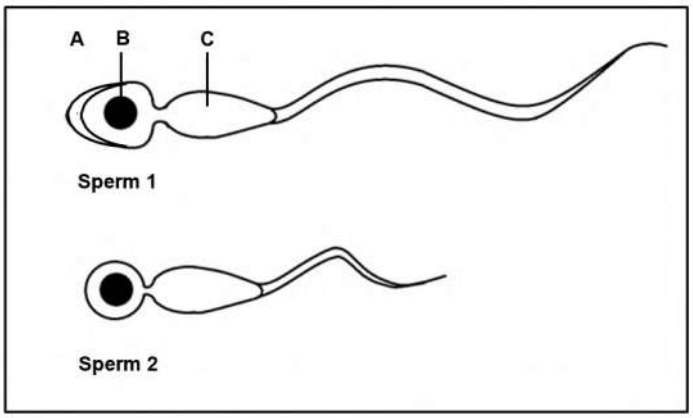
13.5 On average a sperm moves at a speed of 5 mm per minute inside the female reproductive system and it takes approximately 45 minutes for a sperm to reach the ovum for fertilisation

Calculate the distance (in mm) that a sperm needs to move to reach the ovum. Show ALL workings (2)

(11)

Question 14

The diagrams below show the structure of a normal and an abnormal sperm. (The diagrams are drawn to scale.)



14.1 Identify part A. (1)

14.2 Describe the role of structure B during fertilisation. (1)

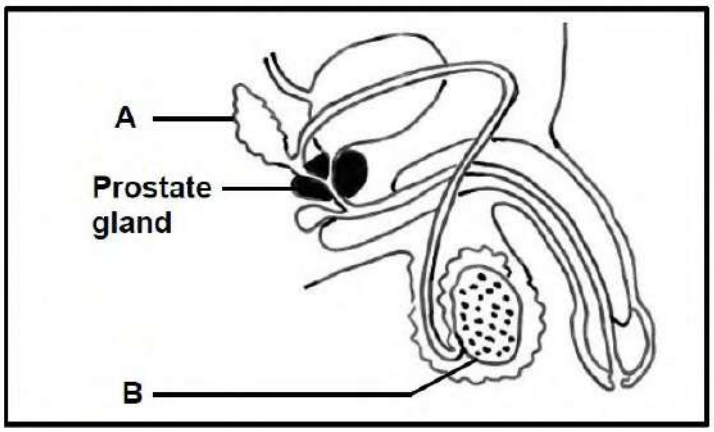
14.3 Explain the role of the organelles found in large numbers in part C. (2)

14.4 Explain TWO reasons why sperm 1 is structurally better suited for fertilisation than sperm 2. (4)

(8)

Question 15

The diagram below represents the male reproductive system.



15.1 Name

(a) Part A (1)

(b) The hormone secreted by B (1)

15.2 Explain ONE function of the fluid secreted by the prostate gland during reproduction. (2)

15.3 Prostate cancer is one of the most common types of cancer among men.

The table below shows the number of men per 100 000 men of different age groups that were diagnosed with prostate cancer in a certain country over a period of 14 years.

AGE GROUP	NUMBER OF PROSTATE CANCER CASES (PER 100 000 MEN)
<49	5
50–54	135
55–59	288
60–64	488
65–69	720
70–74	764
75–79	693
>80	473

(a) According to the table, which age group of men is most likely to develop prostate cancer? (1)

(b) Draw a histogram to represent the data for men from the age group 60–64 to the age group 75–79. (6)

(11)

Question 16

Male hormone contraceptive (birth control) pills have been in development for over 50 years. The pills contain a substance called TU, which inhibits the secretion of testosterone. There is, however, no product available on the market yet, mainly due to many side effects associated with the product.

An investigation was done to determine how TU affects male fertility.

The procedure was as follows:

- 308 healthy, male volunteers were selected.
- A sperm count for each volunteer was done initially.
- Each volunteer was given 500 mg of TU monthly over a period of 12 months.
- During the period of the investigation, the volunteers were asked to wear loose-fitting trousers and underwear made of the same light fabric.
- A sperm count was done weekly over a period of 24 months.
- The average sperm count was calculated per volunteer.

NOTE: Sperm count refers to the total number of healthy sperm per ml of Semen and is an indication of male fertility.

16.1 Identify the dependent variable in the investigation. (1)

16.2 State how the dependent variable in QUESTION 16.1 was measured. (1)

16.3 Name TWO other factors that should be considered when selecting volunteers. (2)

16.4 Explain how TU reduces fertility. (2)

16.5 Explain why wearing tight-fitting trousers will decrease male fertility. (2)

16.6 Suggest ONE reason for doing the sperm count for an additional 12 months after stopping the TU treatment. (1)

16.7 The contraceptive options that are currently available for men are limited to condoms and vasectomy. Vasectomy involves the cutting and tying of both the vas deferens.

Explain how a vasectomy prevents pregnancy. (2)

(11)

Question 17

Scientists conducted an investigation to determine the relationship between age and fertility in men.
This investigation was done from 1999 to 2017 using 1 294 healthy men from the age group 16–65.
Men with occupations (working in environments) involving exposure to excessive heat were excluded during the selection of participants.

Men with occupations (working in environments) involving exposure to excessive heat were excluded during the selection of participants.

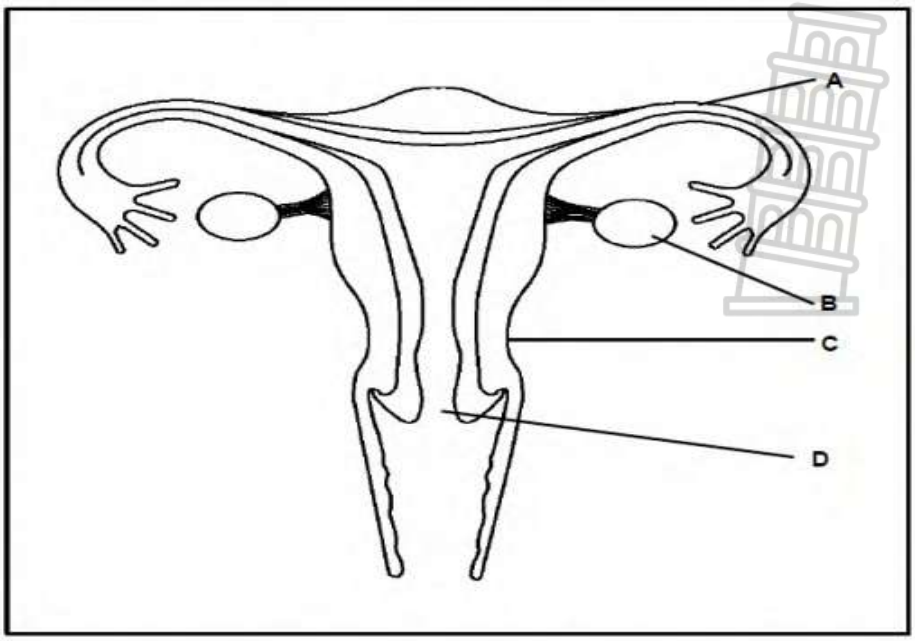
The procedure was as follows:

- Semen was collected after 5 days of no sexual activities.
- A specialised microscope was used to determine the sperm count (number of normal sperm per mℓ of semen) and progressive motility (ability of sperm to swim effectively in a straight line).
- An electron microscope was used to determine sperm necrosis (immature/dead sperm per fresh semen sample).

17.1 Identify in this investigation the:
(a) Independent variable (1)
(b) Dependent variable (1)
17.2 State THREE ways in which the dependent variable was determined (3)
17.3 Give TWO reasons why the investigation can be considered to be reliable (2)
17.4 Explain why men with occupations involving exposure to excessive heat were excluded from the investigation (3)
(10)

Question 18

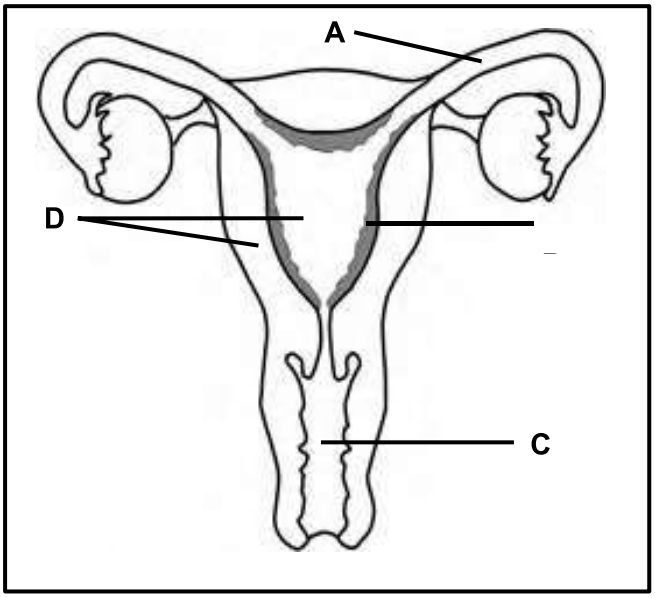
The structure below represents a part of the female reproductive system.



18.1 Identify part **D**. (1)
18.2 State ONE function of part **A**. (1)
18.3 Describe the process of oogenesis as it occurs in part **B**. (4)
18.4 State ONE way in which structure **C** is suited for its function during pregnancy. (1)
18.5 A person undergoes a surgical operation to remove part **B** on both sides. Explain why this person will not menstruate. (3)
(10)

Question 19

The diagram below represents the female reproductive system.



19.1 Identify part **B**. (1)
19.2 Name the process that takes place in part **A** that leads to zygote formation. (1)
19.3 Describe the process named in QUESTION 19.2 (1)
19.4 Describe the development of the zygote until implantation occurs. (4)
19.5 Explain TWO ways in which part **D** is structurally suited for gestation. (4)
19.6 Describe how the secretion of the prostate gland provides protection for the sperm from the conditions in part **C.** (2)
(13)

Question 20

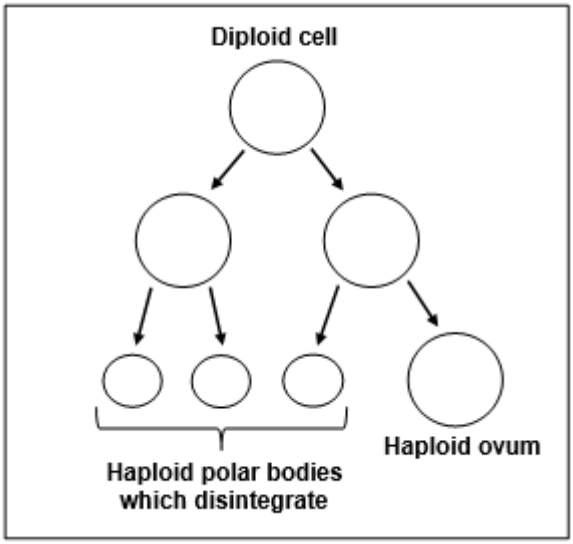
Describe the process of *spermatogenesis*. **(4)**

Question 21

Scientists reported that a female crocodile in a zoo laid an egg with a developing embryo. There were no male crocodiles in the zoo for 16 years. This form of reproduction is called parthenogenesis.

During parthenogenesis, a haploid ovum fuses with one of the haploid polar bodies to form a zygote.

The diagram below shows the process of formation of an ovum in vertebrates



21.1 Name the type of meiotic division shown in the diagram above. (1)
21.2 Name the type of egg that was laid by the crocodile. (1)
21.3 Crocodiles lay their eggs on land.

Explain ONE way in which the type of egg named in QUESTION 21.2 is structurally suited to survive the conditions on land. (2)
21.4 Explain ONE advantage of parthenogenesis. (2)
(6)

Question 22

The FSH test is sometimes used to determine the cause of infertility in females. The levels of FSH usually indicate the number of follicles in the ovaries. If the number of follicles is low or depleted, the pituitary gland will secrete more FSH.

An investigation was conducted to compare the average FSH levels in 4 different age groups.

The procedure was done as follows:

- 1 000 females were asked to participate (250 in each of the four age groups).
- The females were all healthy and not using any hormone-based contraceptives.
- Their blood FSH levels were measured on day 3 of the menstrual cycle for 5 cycles.
- The average FSH levels in their blood were calculated per age group.

The results are shown in the table below.

AGE GROUP	AVERAGE FSH LEVELS
20–32	7,0
33–35	7,8
36–40	8,0
41–50	8,5

22.1 State TWO factors, regarding the females that should have been kept constant during the investigation. (2)

22.2 State TWO ways in which the reliability of the results was ensured. (2)

22.3 State ONE conclusion that can be drawn from the results. (2)

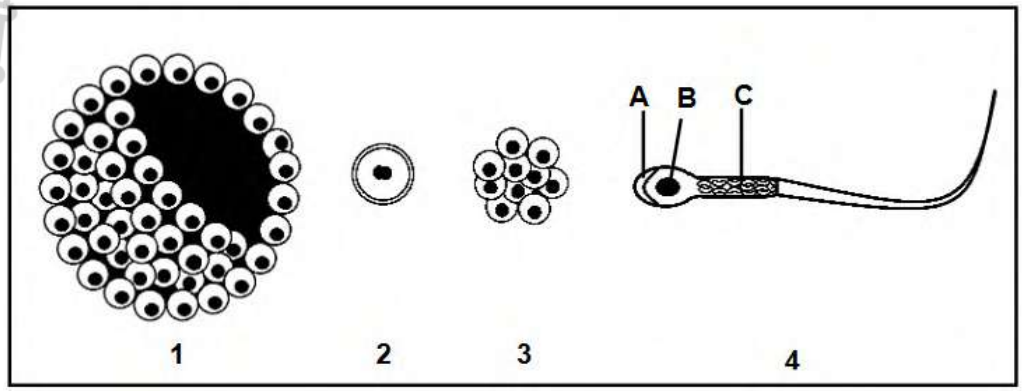
22.4 Explain why the oestrogen levels may remain low in the blood of the females in the 41-50 age group. (3)

22.5 Explain why females that were using progesterone-based pills were excluded from the investigation. (3)

(12)

Question 23

The diagrams below show structures formed during human reproduction



23.1 Identify part **A**. (1)

23.2 Name the organelle found in large numbers in part **C**. (1)

23.3 Give the NUMBER **(1, 2, 3 or 4)** only of the diagram that represents the following:

(a) Morula (1)

(b) Structure that will implant in the uterus (1)

(c) Blastula/Blastocyst (1)

23.4 Give the LETTER and NAME of the part that will enter the ovum during fertilisation. (2)

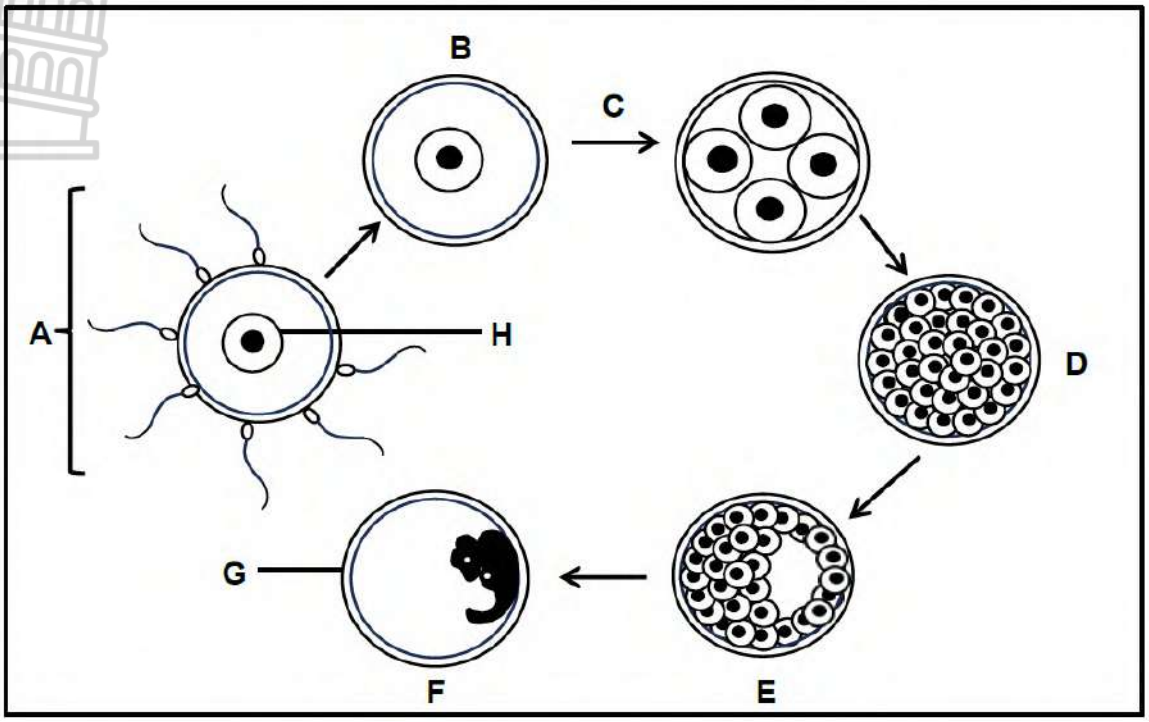
23.5 Name the type of cell division that occurred to produce the structure in diagram **3**. (1)

23.6 Describe the development of the placenta and umbilical cord from the time of implantation. (6)

(14)

Question 24

The diagram below shows events that may take place inside a human female body.



24.1 Identify structure:

(a) B (1)

(b) D (1)

(c) E (1)

24.2 Name the:

(a) Process taking place at A (1)

(b) Inner wall of the uterus where structure **E** implants (1)

24.3 State the type of cell division that takes place at **C**. (1)

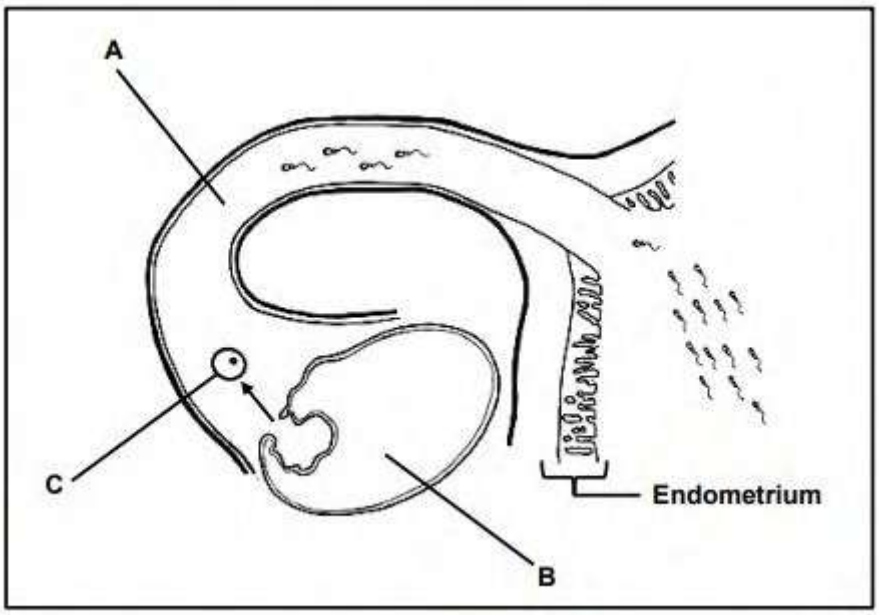
24.4 How many chromosomes are normally found in **H**? (1)

24.5 Identify the extra-embryonic membrane **G**.. (1)

(8)

Question 25

The diagram below represents a part of the female reproductive system



25.1 Identify part:

(a) **A** (1)

(b) **B** (1)

25.2 Give TWO:

(a) Characteristics of the endometrium that make it suitable for implantation (2)

(b) Visible reasons why there is an increased chance of fertilisation in this female (2)

25.3 Identify and describe the type of gametogenesis that leads to the formation of structure C (6)

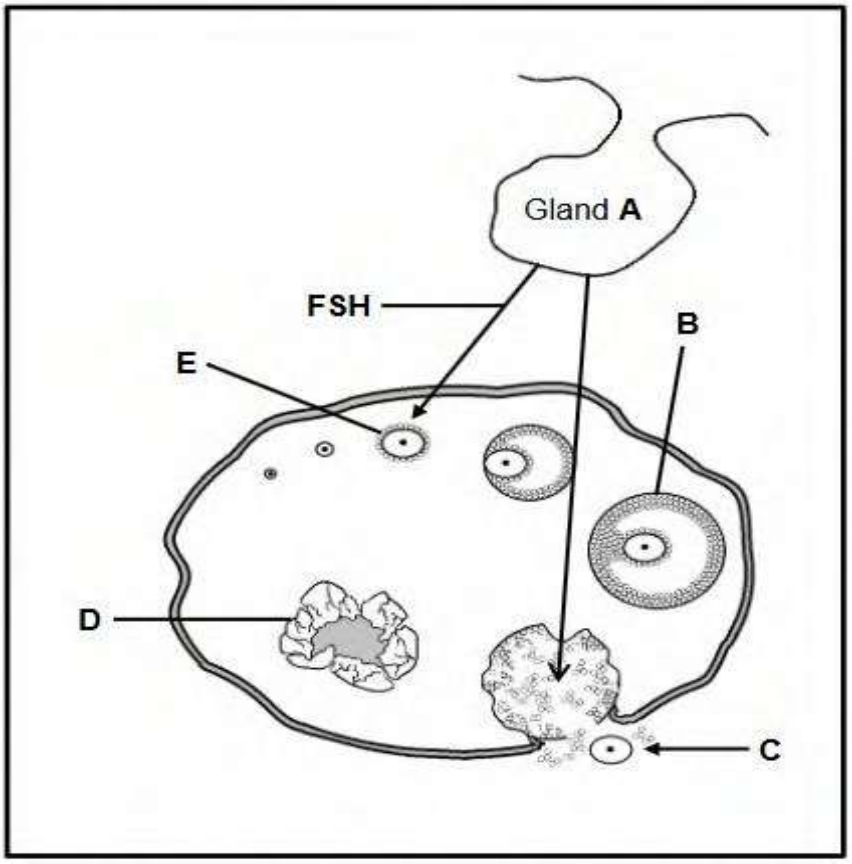
25.4 In an ectopic pregnancy, the fertilised ovum can become implanted in part A. This normally results in the death of the embryo and may endanger the mother's life.

Explain why an ectopic pregnancy may result in the death of an embryo. (3)

(15)

Question 26

The diagram below represents an endocrine gland **A** and the events that take place in the ovary during the menstrual cycle in humans,



26.1 (a) Gland **A** (1)
(b) Structure **B** (1)
(c) Process **C** (1)
(d) Structure **D** (1)

26.2 State the effect on the oestrogen levels in the blood if gland A stops secreting FSH (1)

26.3 State ONE function of LH (1)
(6)

Question 27

The table below shows the levels of two hormones during the menstrual cycle of a healthy human female.

DAY OF MENSTRUAL CYCLE	OESTROGEN LEVEL (pg/mℓ)	PROGESTERONE LEVEL (ng/mℓ)
4	55	0,23
8	70	0,03
10	280	0,03
12	300	0,03
14	140	3,0
16	110	12,5
20	80	15,0
24	70	5,0
28	65	0,8

27.1 On which day of this menstrual cycle is the level of progesterone the highest? (1)

27.2 Name the reproductive hormone that will begin to increase from day 24 of this female's menstrual cycle. (1)

27.3 Use data from the table to explain your answer to QUESTION 27.2. (2)

27.4 Calculate the percentage increase in the oestrogen level from day 8 to day 10. Show ALL your working. (3)

27.5 How would the progesterone level differ after day 20 if this female was pregnant? (1)

27.6 Explain what causes the change in the progesterone level stated in QUESTION 27.5. (2)

(10)

Question 28

Read the extract and study the diagram below.

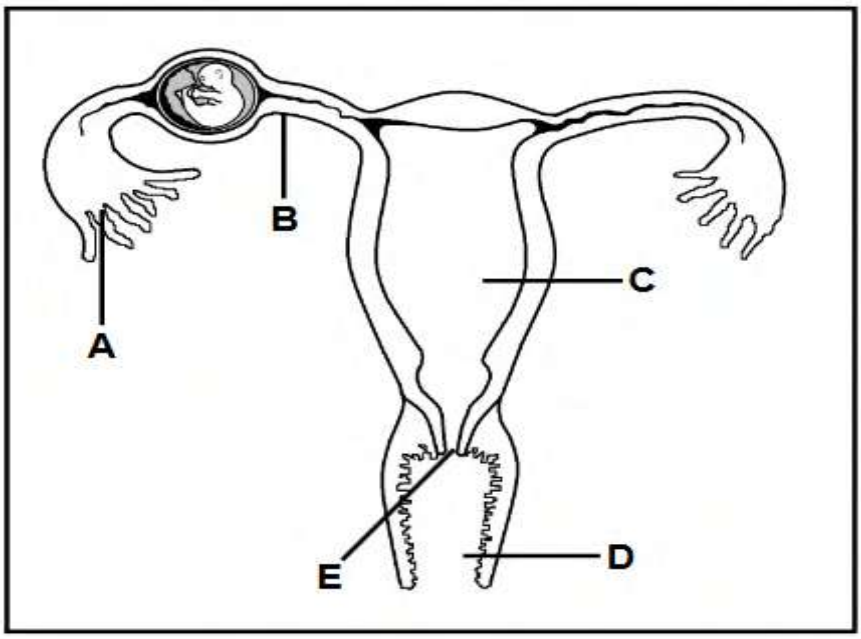
ECTOPIC PREGNANCIES

An ectopic pregnancy is a problem in which the embryo attaches outside the uterus. In most cases the embryo implants in the Fallopian tubes but implantation can also occur on the ovaries, in the cervix or in the abdominal cavity. An ectopic pregnancy cannot proceed normally. The embryo usually cannot survive.

Ectopic pregnancies are caused by one or more of the following:

- An infection or inflammation of the Fallopian tubes
- The development of scar tissue from a previous infection or a surgical procedure in the Fallopian tubes
- Previous surgery in the pelvic area

In most cases, the Fallopian tube where the ectopic pregnancy occurs, has to be removed surgically to save the woman's life.



28.1 Give only the LETTERS of the TWO parts in the diagram where implantation of the embryo may occur during an ectopic pregnancy. (2)

28.2 Explain why women who have had surgery on their Fallopian tubes have a greater risk of experiencing an ectopic pregnancy. (3)

28.3 Explain why a woman who had her Fallopian tube removed after an ectopic pregnancy occurred, may still be able to fall pregnant. (2)

28.4 Give TWO reasons why the embryo may not be able to survive during an ectopic pregnancy inside the Fallopian tube. (2)

(9)

Question 29

Read the extract below.

PLASTIC LINKED TO FEMALE INFERTILITY

Several studies indicate that bisphenol A (BPA), a chemical used in the production of many household plastic products, may be linked to female infertility (inability to get pregnant naturally and to deliver a healthy baby). BPA can be ingested or absorbed through the skin when using plastic products.

BPA seems to interfere with the normal secretion of FSH by the pituitary gland and is linked to abnormal menstrual cycles and reduced implantation rates. These studies also show a link between high BPA levels and a decrease in the development and maturation of ovarian follicles.

29.1 State ONE function of FSH. (1)

29.2 Name ONE other hormone in females that is secreted by the pituitary gland during the menstrual cycle. (1)

29.3 Explain how an under-secretion of the hormone in QUESTION 29.2 may lead to infertility (2)

29.4 Explain why a decrease in the maturation of ovarian follicles may lead to reduced implantation rates. (5)
(9)

Question 30

Premature delivery of babies (babies born between weeks 28 to 35 of gestation) has been a concern in many countries. The care of premature babies is very costly. Women with a history of premature delivery are sometimes given a progesterone treatment between weeks 16 to 20 of pregnancy.

However, this treatment is believed to lead to the development of gestational diabetes mellitus in the mother.

An investigation was done to determine if progesterone treatment leads to the development of gestational diabetes mellitus.

The procedure was as follows:

- 300 pregnant women with a history of premature delivery participated in the investigation (those that had pre-existing diabetes mellitus were excluded).
- The women were divided into two equal groups (Group A and Group B).
- The women in Group A were injected once a week with 250 mg of progesterone between weeks 16 and 20.
- Their glucose levels were measured and recorded daily between week 16 and 36 of the pregnancy.
- Group B was the control.

30.1 Why is the injection of progesterone a good treatment to prevent premature delivery? (2)

Identify the:

30.2 (a) Independent variable (1)

(b) Dependent variable (1)

30.3 Describe how the investigators determined whether any of the participants in Group **A** had developed gestational diabetes mellitus. (2)

30.4 State TWO factors that were kept constant when the progesterone was administered in Group **A**. (2)

30.5 Group **B** was the control.
Explain the importance of group **B** in this investigation. (2)
(10)

Question 31

Read the extract below.

OVARIAN CYSTS IN FEMALES

Ovarian cysts are fluid-filled structures that develop inside the ovaries of some women. The two most common types of cysts in women of reproductive age are follicular cysts and corpus luteum cysts.
Follicular cysts develop when a Graafian follicle fails to rupture and release the ovum. The follicle continues to grow because of continued hormonal stimulation.
A corpus luteum cyst develops when the corpus luteum does not degenerate, even when a person is not pregnant.

Women often show no symptoms and the cysts disappear, but in rare cases ovarian cysts keep on increasing in size. A very large cyst can cause intense pain and may rupture, leading to internal bleeding. Such cysts will require surgical removal.

31.1 From the extract, give:

(a) TWO structures in the ovary that may develop into cysts (2)

(b) TWO symptoms associated with very large cysts (2)

31.2 Name the hormone:

(a) Responsible for the growth of the follicle under normal Conditions (1)

(b) That will be high in concentration in the blood of women where follicular cysts develop (1)

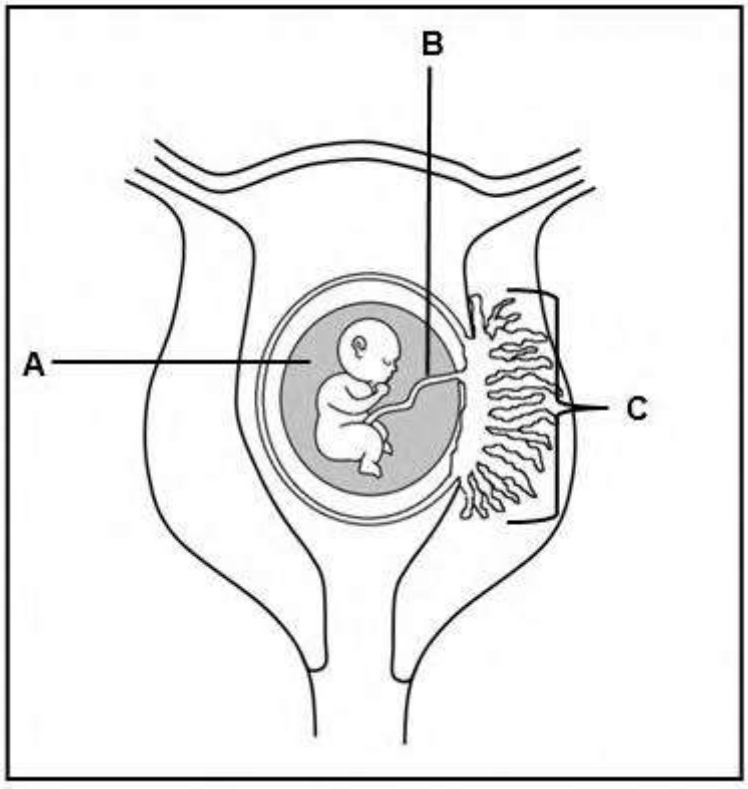
31.3. Give a reason for your answer to QUESTION 31.2(b). (1)

31.4 Explain why a woman will not be able to fall pregnant if she has a corpus luteum cyst that does not disappear. (5)

(12)

Question 32

The diagram below represents a stage in human foetal development.



32.1 Identify:

(a) Fluid **A** (1)

(b) Structure **C** (1)

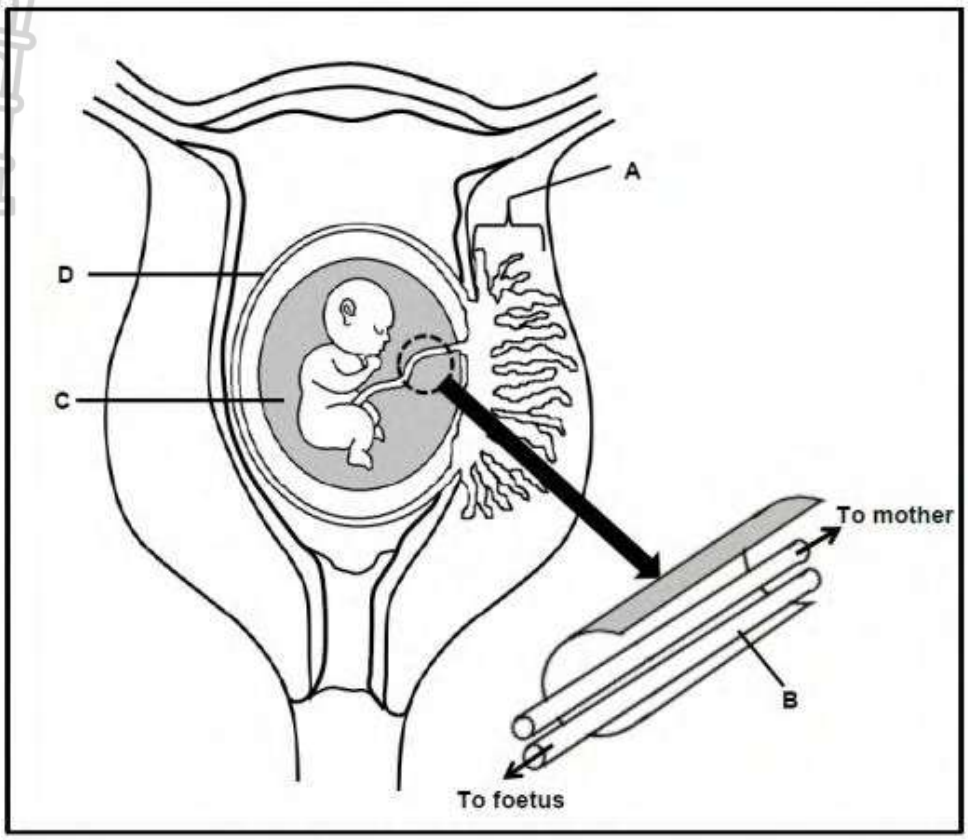
32.2 Name:

(a) The blood vessel in part **B** that transports oxygen to the developing foetus (1)

(b) TWO structures that play a role in the formation of structure **C** (2)

(5)

QUESTION 33



33.1 Identify part **D**. (1)

33.2 State TWO functions of the fluid in part **C**. (2)

33.3 Describe the development of the zygote until implantation occurs. (4)

33.4 State TWO ways in which part **A** functions in protecting the developing foetus. (2)

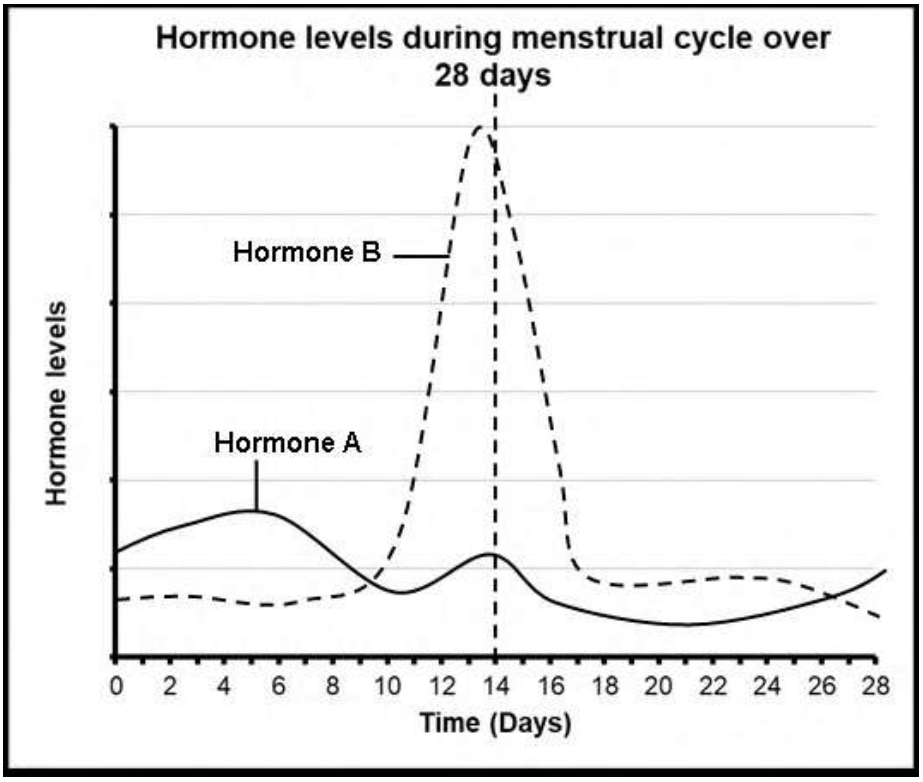
33.5 Identify blood vessel **B**. (1)

33.6 Describe how the nutrition of a human foetus differs from that of oviparous organisms. (3)

(13)

Question 34

The graph below shows the levels of two hormones that are secreted by the pituitary gland during the menstrual cycle.



34.1 State TWO functions of hormone **B**. (2)

34.2 Explain why a female who is struggling to get pregnant:

(a) May be given pills containing hormone **A** as a treatment (3)

(b) Will have her levels of hormone **B** constantly monitored (2)

34.3. Explain how the levels of hormone **A** on days 0 to 5 will differ in apregnant female. (3)

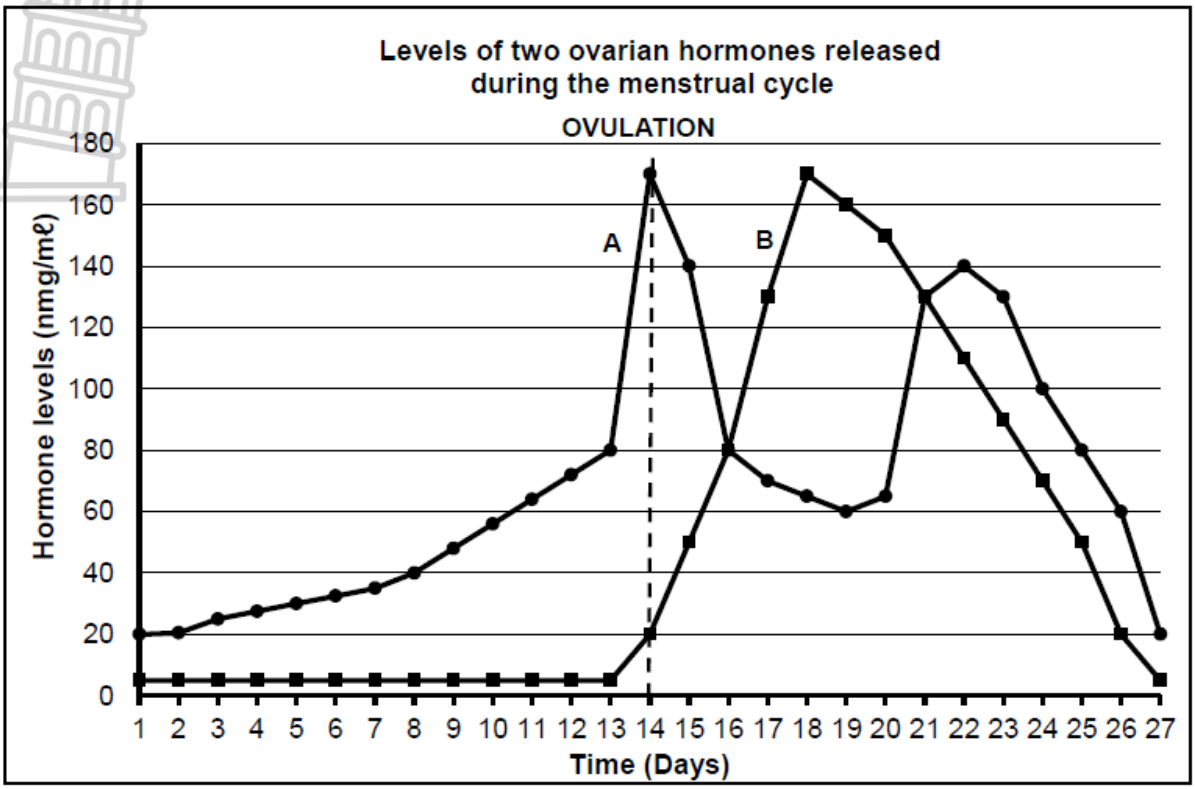
(10)

Question 35

Describe the secretion of the ovarian hormones and their role in the menstrual cycle. **(5)**

Question 36

The graph below represents ovarian hormones.



Identify:

36.1 (a) Hormone **A** (1)

(b) Hormone **B** (1)

36.2 What effect does an increase in hormone A have on the endometrium? (2)

36.3 (a) Define ovulation (2)

(b) On which day did ovulation take place? (1)

(c) Which hormone secreted by the pituitary gland stimulates ovulation? (1)

36.4 Explain why high levels of hormone **B** prevent the development of new follicles. (2)

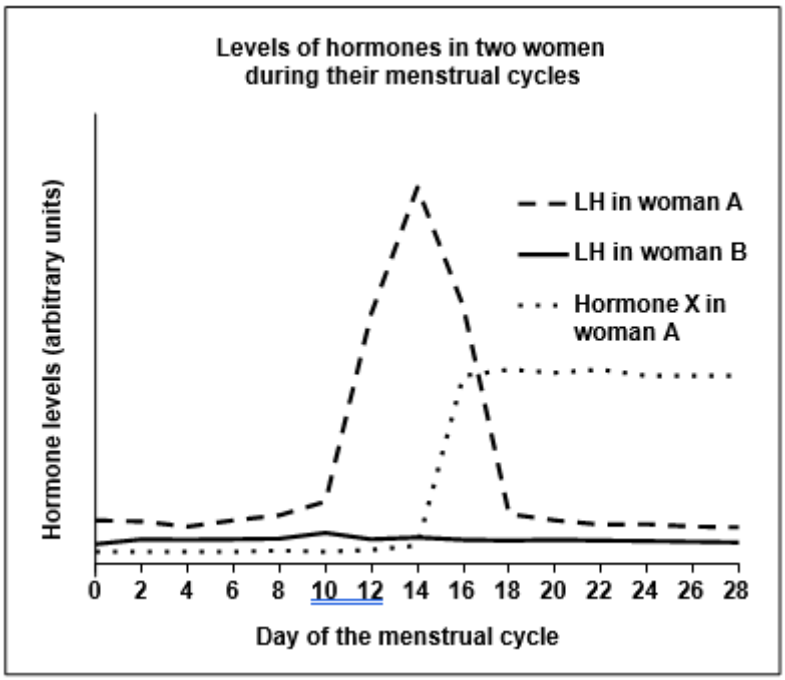
36.5 Explain evidence in the graph that indicates that no fertilisation took place during the menstrual cycle shown above (3)

36.6 Explain the negative feedback mechanism that occurs between Progesterone and FSH. (4)

(17)

Question 37

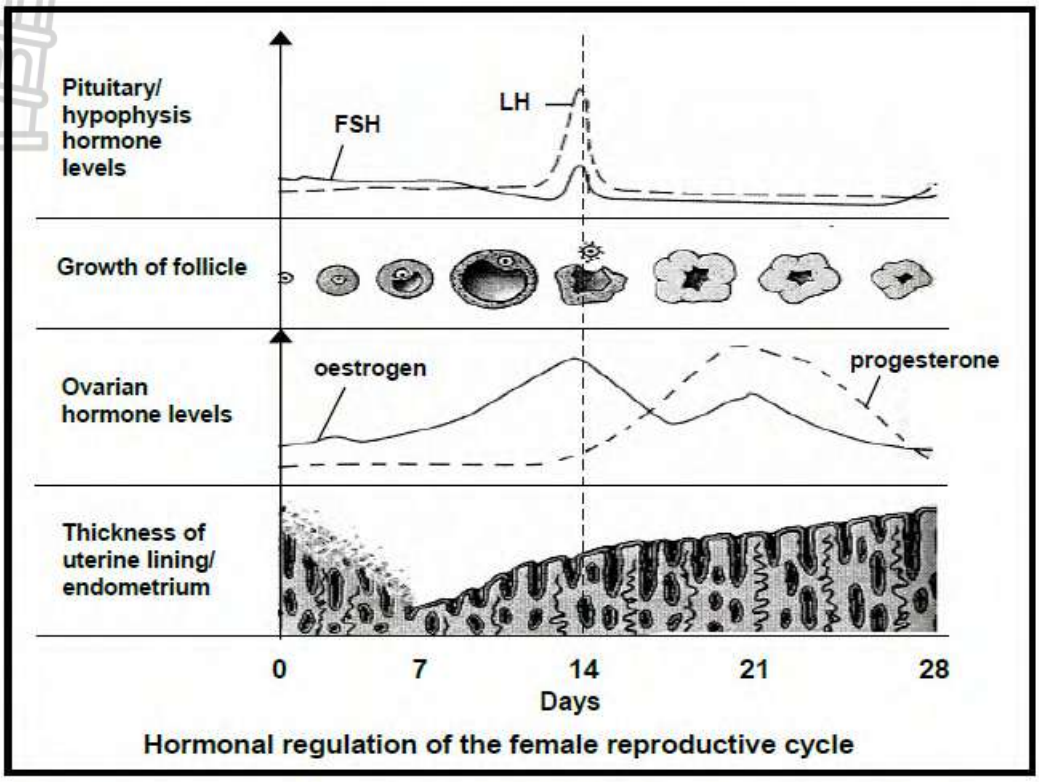
Sheehan's syndrome is a condition that results in females having very low levels of the luteinising hormone (LH).
The graph below shows the hormone levels of two different women during a 28-day menstrual cycle. Woman **A** has normal luteinising hormone (LH) levels while woman **B** suffers from Sheehan's syndrome



37.1 State TWO functions of LH during the menstrual cycle. (2)
37.2 Besides LH, name ONE other hormone that is secreted by the pituitary gland during the menstrual cycle. (1)
37.3 Give the name of hormone **X** (1)
37.4 Use the information in the graph to explain how the level of hormone **X** will be different in woman **B** (4)
37.5 What evidence in the graph suggests that woman **A** is pregnant? (1)
(9)

Question 38

The graph below shows the menstrual cycle and influence of the different hormones on it.



Hormonal regulation of the female reproductive cycle

38.1 On which day does ovulation take place? (1)

38.2 Between which days does menstruation take place? (1)

38.3 State any ONE function of luteinising hormone (LH). (1)

38.4 Describe the changes in the level of LH shown in the graph. (3)

38.5 Describe the relationship between the level of oestrogen and the endometrium from day 7 to day 14. (2)

38.6 Explain why it is necessary for the level of progesterone in the blood to increase after ovulation. (2)

38.7 Did fertilisation take place in the 28-day cycle illustrated in the graph? (1)

38.8 Explain your answer to QUESTION 38.7. (2)

(13)

TOPIC: GENETICS

Diagnostic Analysis

Common Errors and Misconceptions	Possible Solutions
• Biological terms are not assessed regularly, and teachers are not strict on spelling.	✓ Teachers must assess terminology regularly as part of daily assessment.
• Lack of emphasis on that the portion of DNA that undergoes transcription during protein synthesis is actually a gene that codes for the production of a specific protein	✓ The process of Protein synthesis must be taught using diagrams. The DNA strand that undergoes transcription must be identified as a gene/portion of a gene.
• There is a misconception that children with blood groups A and O can only be produced by parents that have Blood group A and O	✓ Teachers must provide learners with all possibilities of offspring that parents of a particular genotype are able to produce, and vice versa.
• Arrangement of chromosomes during phases of mitosis. • Learners do not accurately describe the differences when differentiating between the phases	✓ Diagrams must be used to emphasise the differences in the position and arrangement of chromosomes when differentiating between the phases of meiosis as well as between meiosis and mitosis.
• Learners have a misconception that all examples involving non-disjunction are about Down's syndrome. • Teaching non-disjunction in the context of Down Syndrome.	✓ Abnormal meiosis and non-disjunction must be taught as a concept on its own, using diagrams and examples with different numbers of chromosomes. Emphasis must be placed on the number of chromosomes formed in each daughter cell, using the actual number of chromosomes and daughter cells that are specified by the question.
• Learners do not use the standard notation when writing genotypes.	✓ When teaching genetics, learners must be cautioned not to use descriptions of genotypes when stating phenotypes. The distinction between genotypes of individuals and genotypes of gametes must also be made in both dihybrid and monohybrid crosses.
• Misconception on calculations that involve percentage increase. However, some questions may be	✓ Learners must be taught to read and comprehend the question to perform the calculation required.

about how many times the protein content increased.	
• Artificial selection and genetic engineering	✓ Emphasis must be placed on the difference between the organism being selected and the gene being isolated when differentiating between artificial selection and genetic engineering. Teachers must describe these concepts with appropriate examples.
• Learners could not explain the inheritance of the allele for blood group B from the mother, and the recessive allele (i) from the father. Many learners did not state the genotypes of the man, woman and child thereby losing marks.	✓ Learners must be given practice in explaining concepts such as inheritance of blood groups and sex-linked disorders in genetics, using examples of questions from previous question papers. This must be reinforced through informal assessment
• Inability of learners to provide an explanation of how the presence of recessive alleles on the gonosomes of males and females will result in the inheritance of the disorder. Most only gave the type of gonosomes found in males and females. They failed to state that males only need one recessive allele to have the disorder while females need two recessive alleles. Learners also could not explain the inheritance of the disorder in terms of the masking of the recessive allele.	✓ Learners must be given practice in explaining concepts such as inheritance of sex-linked disorders in genetics, using examples of questions from previous question papers. This must be reinforced through informal assessment.
• Most learners were able to score marks on the genetic diagram except when they failed to use the correct genotypes and phenotypes in determining the cross. They then lost the compulsory mark as well.	✓ Learners must be taught to include both the gender and the given characteristic when describing phenotypes in examples of sex-linked inheritance. They must also answer the question directly so that compulsory marks are not lost.
• Many learners mentioned the benefit of growing Bt maize to the crops rather than the benefit to the farmer. Learners also quoted directly from the passage which earned no credit e.g. 'Maize is toxic to insects'	✓ The benefits of genetic engineering must be discussed with learners and their understanding thereof to be assessed as part of informal assessment. Learners must be cautioned against quoting directly from extracts when it is not required.

Question 1

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION	TERM
1.1	The study of heredity and variation in organisms	
1.2	All the genes that make up an organism	
1.3	Two or more alternative forms of a gene at the same locus	
1.4	The position of a gene on a chromosome	
1.5	The non-sex chromosomes in humans	
1.6	An inherited disorder where blood fails to clot properly	
1.7	The number, shape and arrangement of all chromosomes in the nucleus of a somatic cell	
1.8	A genetic cross involving one gene and its alleles	
1.9	A genetic disorder where blood does not clot	
1.10	The use of living organisms and their biological processes to improve the quality of human life	
1.11	The type of inheritance involving two alleles that are not dominant over one another	
1.12	Characteristics controlled by genes which are located on the sex chromosomes	
1.13	The type of inheritance involving alleles that equally determine the phenotype of heterozygous offspring	
1.14	An allele that is expressed phenotypically only in the homozygous condition	
1.15	The physical and functional expression of a gene	
1.16	The production of a genetically identical copy of an organism using biotechnology	
1.17	The manipulation of the genetic material of an organism to get desired changes	

1.18	A diagram showing the inheritance of genetic disorders over many generations	
1.19	An allele that does not influence the phenotype when found in the heterozygous condition	
1.20	Organisms having two identical alleles at a given locus	
1.21	An allele that is always expressed in the phenotype	
1.22	An individual having two non-identical alleles for a characteristic	
1.23	A segment of a chromosome that codes for a particular characteristic	
1.24	The type of inheritance which produces an intermediate phenotype	
1.25	The position of a gene on a chromosome	
1.26	The type of dominance which results in an intermediate phenotype in the heterozygous condition.	
1.27	The production of a genetically identical copy of an organism using biotechnology	
1.28	Undifferentiated cells in animals that have the potential to become any type of tissue	
1.29	A genetic disorder that results in a person who cannot distinguish between the colours red and green	
1.30	The biotechnological process that produces genetically identical organisms	
		30 x1 = (30)

Question 2

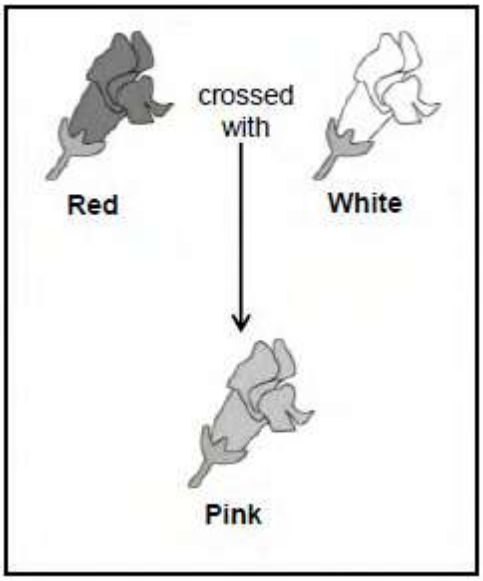
Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number.

	Column I	**Column II**
2.1	An advantage of genetic modification	A: Increases shelf life of food B: Increases resistance to disease
2.2	The genotype for an individual with blood group AB	A: I^A B: I^B
2.3	Inheritance of haemophilia	A: Sex-linked inheritance B: Complete dominance
2.4	Caused by a chromosomal mutation	A: Colour-blindness B: Down syndrome
2.5.	Unspecialised cells that have the potential to develop into any other type of cell in the body	A: Stem cells B: Somatic cells
2.6	An organism possesses two factors which separate so that each gamete contains only one of these factors	A: Law of dominance B: Principle of independent assortment
2.7	A plant with white flowers that is crossed with a plant with red flowers and produces offspring with pink flowers	A: Incomplete dominance B: Complete dominance
2.8	The separation of alleles during gamete formation	A: Law of Dominance B: Principle of Segregation
2.9	A genetic disorder caused by a chromosomal mutation	A: Haemophilia B: Colour-blindness
2.10	The type of dominance in which neither of the two alleles is dominant over each other, resulting in an offspring with an intermediate phenotype	A: Complete dominance B: Co-dominance
2.11	The scientist who proposed the law of segregation	A: Darwin B: Lamarck
		(9x2) **(18)**

Question 3

The diagram below shows the inheritance of flower colour in snapdragon plants.

The two alleles controlling flower colour are red (R) and white (W).



3.1 State the type of dominance shown by the snapdragon plants. (1)

3.2 Give a reason for your answer to QUESTION 3.1. (2)

3.3 A gardener crossed two pink-flowered snapdragon plants.

Use a genetic cross to show the ratio of the expected phenotypes in the offspring.

(6)

(9)

Question 4

4.1 Use a genetic cross to show how gender in human offspring is determined by the sex chromosomes of the parents. (6)

4.2 Using your knowledge of sex chromosomes, explain why the sex of a child is determined by the male gamete. (5)

(11)

Question 5

In humans, short fingers (**F**) and a widow's peak (**H**) are dominant over long fingers and continuous hairline. A man and a woman, both heterozygous for the two characteristics, plan on having a child.

The table below shows the possible genotypes of the offspring.

Gametes	FH	Fh	fH	fh
FH	FFHH	FFHh	FfHH	FfHh
Fh	FFHh	FFhh	FfHh	Ffhh
fH	FfHH	FfHh	ffHH	**Z**
fh	FfHh	Ffhh	ffHh	ffhh

5.1 State the genotype at **Z.** (1)

5.2 Give the:

(a) genotype of the parents (2)

(b) number of genotypes that could result in offspring with short fingers and a continuous hairline (2)

(c) allele for a continuous hairline (2)

(d) phenotype of a child who is homozygous recessive for both characteristics (2)

(7)

Question 6

In tomato plants, tall stems (**T**) are dominant over short stems (**t**) and red fruit (**R**) is dominant over yellow fruit (**r**).

A farmer crossed a homozygous tall, yellow tomato plant with a plant that is heterozygous for both characteristics.

6.1 Name this type of genetic cross. (1)

6.2 Give the genotype of a homozygous tall, yellow tomato plant. (2)

6.3 List the genotypes of ALL the possible gametes for a plant that is heterozygous for both characteristics. (4)

(7)

Question 7

Haemophilia is a genetic disorder caused by a recessive allele on the **X** chromosome.

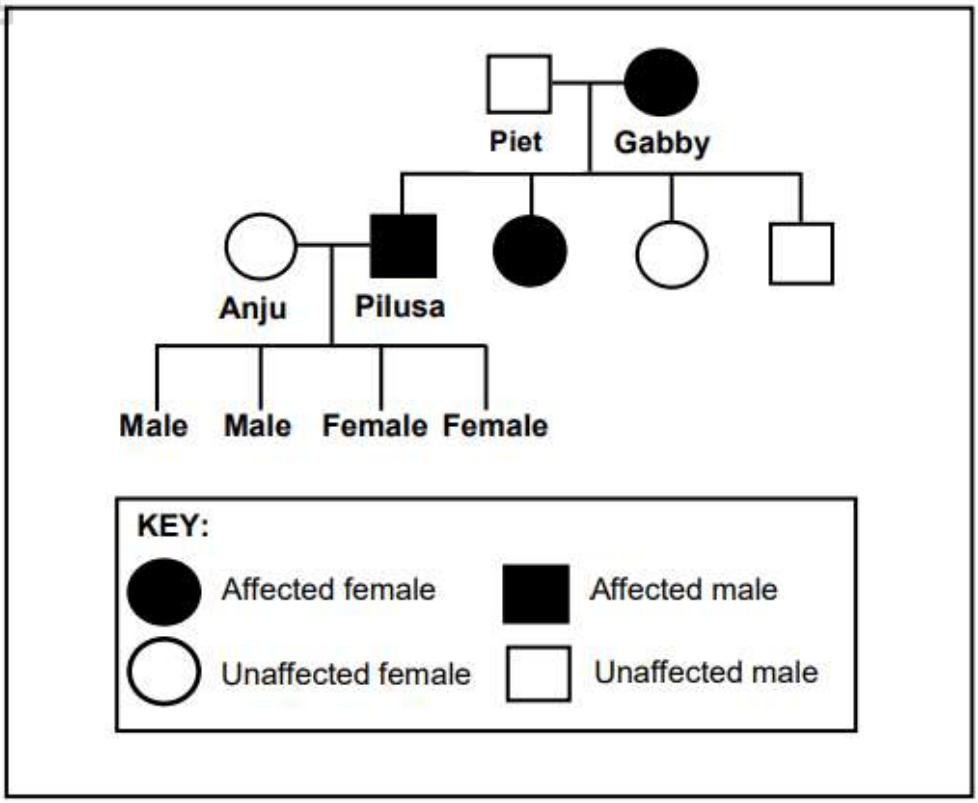
A haemophiliac female marries a normal male. Explain why all their sons will be haemophiliacs

(4)

Question 8

Goltz syndrome is a sex-linked genetic disorder. It is caused by a dominant allele X^G.

The diagram below shows the inheritance of Goltz syndrome in a family.



8.1 Name the type of diagram shown above. (1)

8.2 How many:

(a) females are in this family? (1)

(b) males in the F1-generation have Goltz syndrome? (1)

8.3 Give Gabby's genotype. (2)

8.4 Anju and Pilusa have four children. Give the phenotype of their sons. (2)

8.5 Explain your answer to QUESTION 8.4. (4)

(11)

Question 9

Sickle cell disease is caused by a recessive allele and first appeared in humans as a result of a gene mutation. The table below shows the number of children born with sickle cell disease in some regions in a particular year.

REGION	NUMBER OF CHILDREN BORN WITH SICKLE CELL DISEASE
Democratic Republic of Congo	39 746
United States of America	90 128
Nigeria	91 011
United Kingdom	13 221
Tanzania	11 877
Other	59 750
Worldwide total	**305 733**

9.1 What is a gene mutation? (2)

9.2 Which region had the highest number of children born with sickle cell disease in that year? (1)

9.3 What percentage of the worldwide total of children born with sickle cell disease came from the Democratic Republic of Congo? Show ALL calculations. (3)

9.4 Use the letters **D** and **d** to give the genotype of a person who:

(a) Suffers from sickle cell disease (1)

(b) Carries the allele but does not suffer from the disease (1)

(8)

Question 10

The table below shows the blood groups of the members of a family. Two of the children are biological offspring of the parents and one child is adopted.

FAMILY MEMBER	BLOOD GROUP
Father	A
Mother	AB
Daughter	A
Son 1	O
Son 2	B

10.1 How many:

(a) different phenotypes for blood group appear in this family? (1)

(b) possible genotypes are there for blood group AB? (1)

10.2 Give the genotype of the father. (2)

10.3 Which member of the family:

(a) has the genotype ii? (1)

(b) has co-dominant alleles? (1)

(c) is adopted? (1)

(7)

Question 11

Some horses have straight hair and others have curly hair. A scientist wanted to clone a straight-haired male horse to meet the demand for horses with straight hair.

The scientist used the following procedure:

- The nucleus of a somatic cell was taken from a straight-haired male horse (horse **S**).
- An unfertilised ovum was removed from a curly-haired female horse (horse **T**).
- The nucleus from the somatic cell of horse **S** was placed into the ovum taken from horse **T**.

This ovum was then placed into the uterus of a female surrogate horse (horse **R**).

11.1 Explain why a somatic cell and NOT a sperm cell from horse **S** would provide the nucleus for the procedure. (3)

11.2 Before inserting the nucleus from the somatic cell of horse **S**, the nucleus from the ovum of horse **T** was removed.

Explain the significance of this procedure. (2)

11.3 To which of the three horses (**S**, **T** or **R**) will the cloned offspring be genetically identical? (1)

11.4 State TWO benefits of cloning. (2)

(8)

Question 12

Human blood groups are controlled by multiple alleles.

12.1 Name ALL the alleles that control human blood groups. (3)

12.2 How many of the alleles named in QUESTION 12.1 can any individual inherit? (1)

12.3 Give a reason for your answer to QUESTION 12.2. (2)

12.4 A man has blood group **A** and his wife has blood group **B**. Their first child has blood group **AB** and the second child has blood group **O**.

What can one conclude about the blood groups of their future children? (3)

(9)

Question 13

Mr. and Mrs. Phonela are concerned that their baby girl does not appear to resemble either of them. They suspect that the baby they were given at the hospital was not theirs.

Mr. Phonela is blood type **AB**, Mrs. Phonela is blood type **B** and the baby they were given is blood type **O**.

13.1 Give the possible genotypes of:

(a) Mrs. Phonela (2)

(b) the baby girl (1)

13.2 Explain why the baby girl with blood type **O** cannot be Mr. and Mrs. Phonela's daughter. (3)

13.3 Explain why the use of blood type for paternity testing is not conclusive. (2)

(8)

Question 14

A man with blood group **AB** and a woman who is heterozygous for blood group **B** plan to have children.

14.1 How many alleles control the inheritance of blood groups? (1)

14.2 Describe the type of dominance that occurs in the inheritance of blood group **B** in the woman. (3)

14.3 Use a genetic cross to show all the possible genotypes and phenotypes of their children. (6)

(10)

Question 15

Explain how blood grouping is used in paternity testing. **(6)**

Question 16

The brinjal plant carries edible fruit. Scientists have been studying the inheritance of two genes, one for stem texture and the other for fruit shape.

The stems can be smooth **(N)** or prickly (**n)**, while the fruit shape can be round **(R)** or elongated **(r)**.

16.1 Name the type of cross that studies two characteristics. (1)

16.2 State the:

(a) Dominant characteristic for stem texture (1)

(b) Recessive characteristic for fruit shape (1)

16.3 Give the:

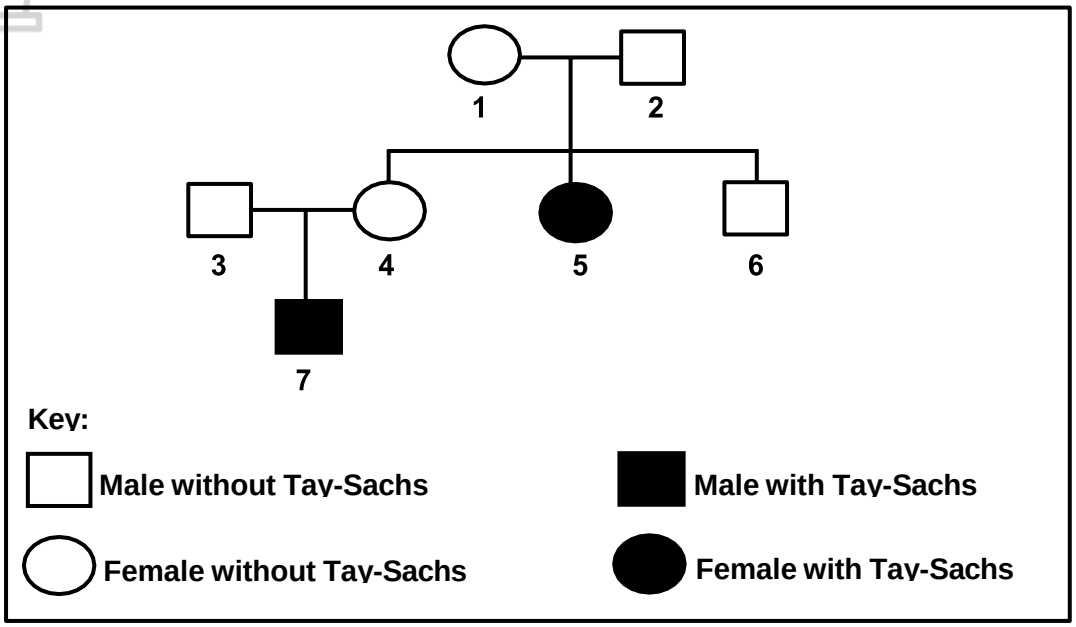
(a) Genotype of a plant with a prickly stem and elongated fruit (2)

(b) Phenotype of a plant with the genotype NnRR (2)

(7)

Question 17

The diagram below shows the inheritance of Tay-Sachs, a rare disease which leads to the destruction of neurons. It is inherited as an autosomal disorder, controlled by two alleles, **(T)** and **(t)**.



17.1 Describe what is meant by an *autosomal disorder*. (2)

17.2 How many sons do individuals **1** and **2** have? (1)

17.3 Using individuals **3**, **4** and **7**, explain why it can be concluded that Tay-Sachs disease is controlled by a recessive allele. (5)

17.4 Individuals **1** and **2** can produce children with three possible genotypes.

List ALL the genotypes that have a 25% chance of being produced. (2)

(10)

Question 18

In humans, haemophilia is caused by a recessive allele on the X-chromosome (X^h). A woman, who is heterozygous for haemophilia, marries a man with haemophilia.

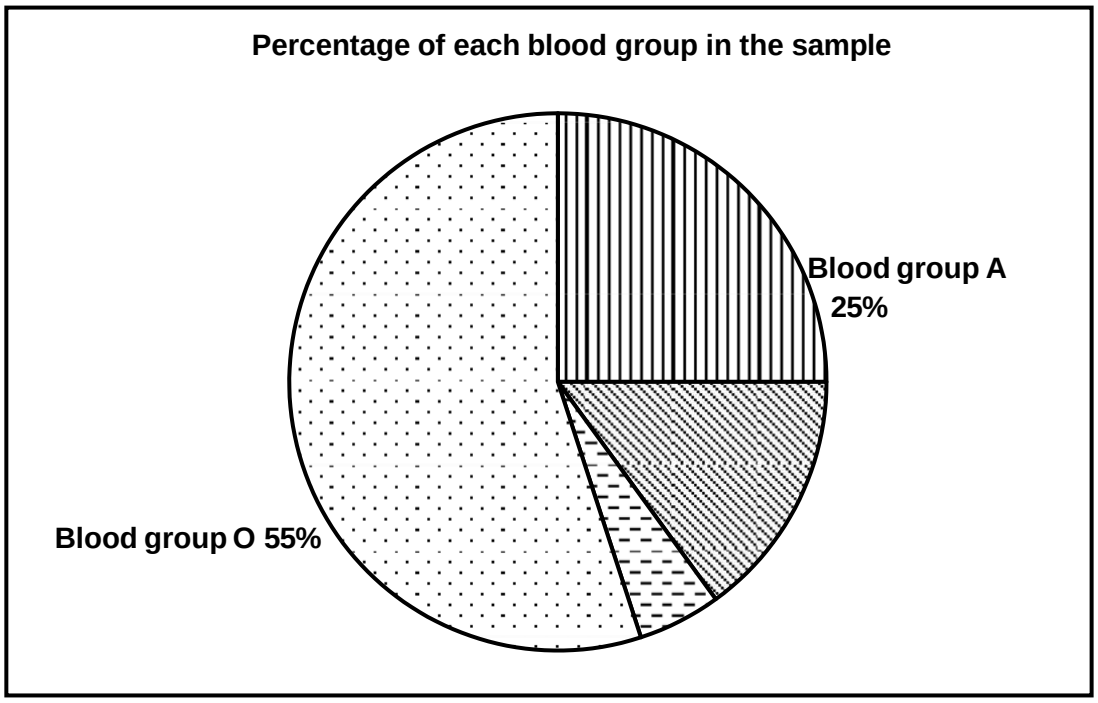
Use a genetic cross to show the percentage chance of the couple having a *daughter* who is homozygous for normal blood clotting.

(7)

Question 19

Learners conducted an investigation to determine which blood group was the most common in their community.

They collected information about the blood groups of 200 blood donors in each of the three blood donor clinics in their community. They did not include first-time donors in the investigation.
The pie chart below shows the results of the investigation.



19.1 State the aim of the investigation. (2)

19.2 Answer the following questions:

(a) State THREE planning steps to consider when conducting this investigation. (3)

(b) State ONE way in which the learners ensured the reliability of the results. (1)

(c) Give ONE reason why they did not include first-time donors. (1)

19.3 Calculate the number of participants that had blood group **B**. Show ALL workings. (3)

19.4 Name the blood group which:

(a) Has only recessive alleles in the genotype (1)

(b) Is a result of co-dominance (1)

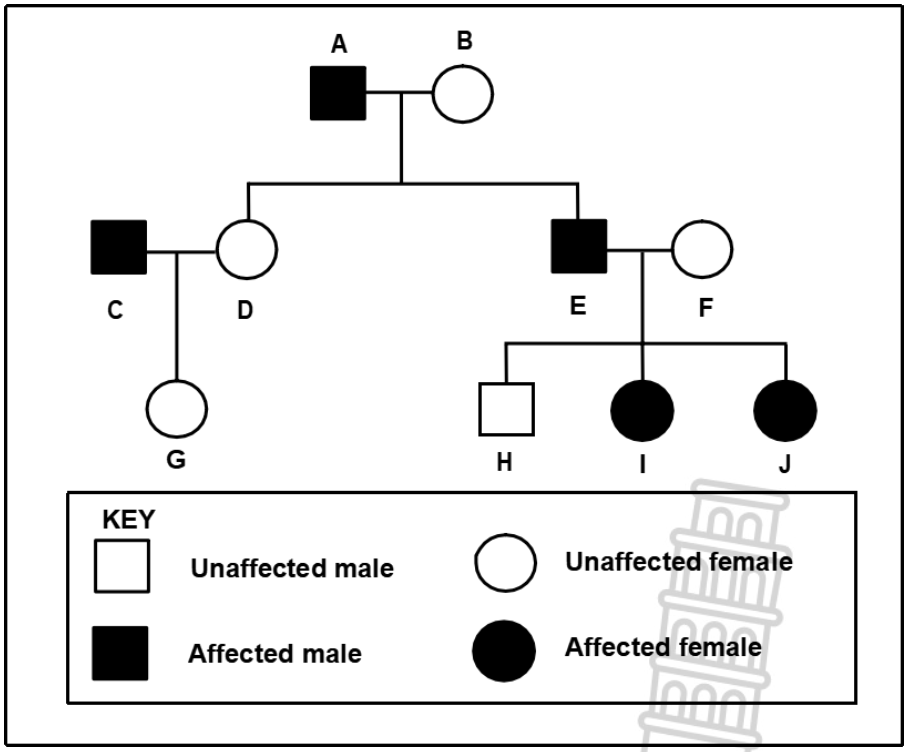
19.5 Give ALL the possible genotypes of the blood group represented by 25% of the donors. (2)

(14)

Question 20

Moyamoya is a disorder caused by a dominant allele (**R**). This disorder damages the arteries supplying blood to the brain.

The pedigree diagram below shows the inheritance of Moyamoya in a family.



20.1 How many generations are represented in the diagram? (1)

20.2 Give the:

(a) LETTER(S) of unaffected males (1)

(b) Genotype of individual **A** (1)

(c) LETTER(S) of individuals not biologically related to **A** and **B** (2)

(5)

Question 21

In rabbits, brown fur (**B**) is dominant to white fur (**b**) and long ears (**E**) is dominant to short ears (**e**). A rabbit, that is heterozygous for both characteristics, is crossed with a white rabbit with short ears.

21.1 Name the type of cross represented. (1)

21.2 Give the:

(a) Phenotype of a rabbit that is dominant for both characteristics (2)

(b) Genotype of the white rabbit with short ears (2)

(c) Genotype of the gametes of a heterozygous brown rabbit with short ears (2)

(7)

Question 22

The table below shows information about blood groups in a certain population.

BLOOD GROUP	**NUMBER OF PEOPLE**	**PERCENTAGE OF THE POPULATION**
O	954 000	53
A	**X**	34
B	180 000	10
AB	54 000	3

22.1 How many people have the genotype ii? (1)

22.2 The population size is 1 800 000.

Calculate the value of **X**. Show ALL working. (3)

22.3 Describe how a child inherits the blood group represented by 3 per cent of this population. (3)

(7)

Question 23

Brown enamel of the teeth is a sex-linked trait. A dominant allele on the **X** chromosome causes brown teeth in humans.

23.1 Explain why more males than females have white teeth. (4)

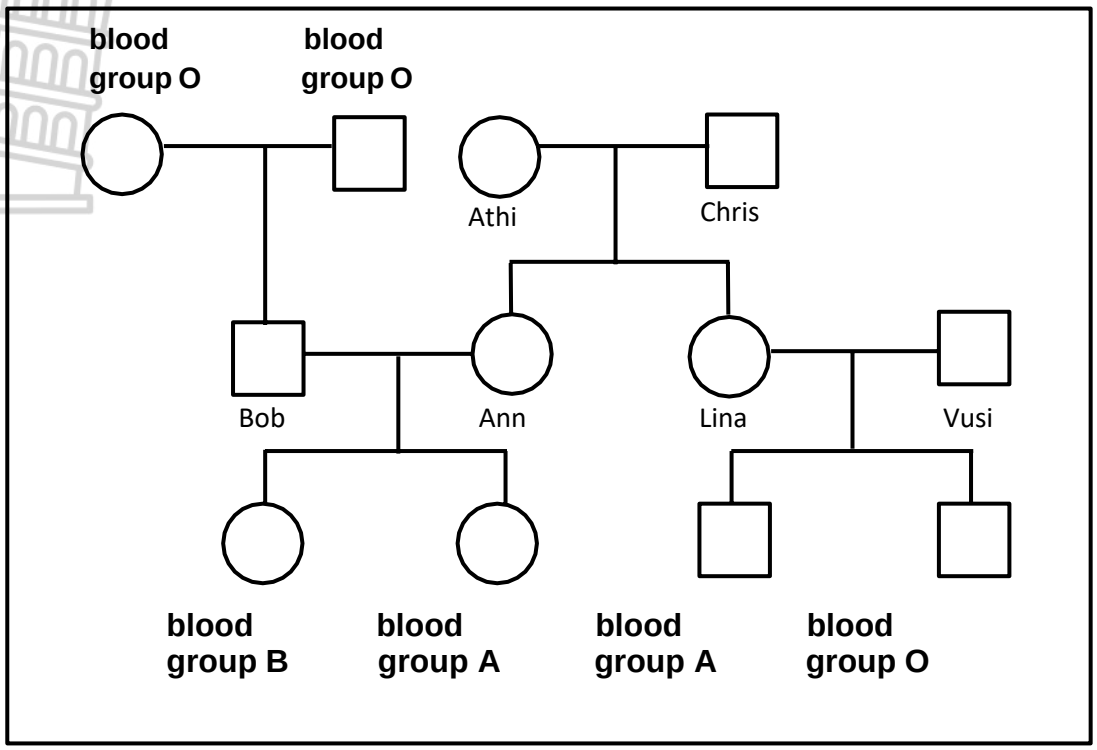
23.2 A man with brown teeth married a woman with white teeth.

Use a genetic cross to show the possible phenotypic ratio of their children. Use $\mathbf{X^B}$ for brown teeth and $\mathbf{X^b}$ for white teeth. (6)

(10)

Question 24

24 The diagram below shows the inheritance of blood groups in a family.



24.1 Name the type of diagram shown. (1)

24.2 Give the number of alleles that control blood groups. (1)

24.3 How many generations are represented in the diagram? (1)

24.4 Lina's genotype is $I^A i$.

State ALL the possible genotypes of Vusi. (2)

24.5 Give the genotype of Bob. (1)

24.6 Give the name of the individual which displays co-dominance. (2)

(8)

Question 25

25 Polydactyly is a condition that leads to extra fingers or toes. It is caused by a dominant allele.

A man who is heterozygous for polydactyly has a wife who is not polydactyl.

Using the letters **R** and **r**, do a genetic cross to show the percentage chance that their children will have polydactyly. **(6)**

Question 26

26 In summer squash plants, white fruit colour **(B)** is dominant over yellow fruit colour **(b)**, and round fruit **(D)** is dominant over oval fruit **(d)**.

A summer squash plant that is homozygous for white and round fruit iscrossed with a plant that is homozygous for yellow and oval fruit.

26.1 State the:

(a) Genotypes of the P_1-parents (2)

(b) Phenotypes of the F_1-generation (2)

26.2 Two plants that are heterozygous for both characteristics were crossed.

(a) Genotypes of the P_1-parents (2)

(b) Phenotypes of the F_1-generation (1)

26.3 Give the possible genotypes of both parents that must be crossed ifa farmer wants summer squash that are white with oval fruit only. (2)

(9)

Question 27

Read the extract below.

> When a child is born, the umbilical cord is cut and stem cells can be obtained from it. Many people think that the stem cells for treating human conditions should be obtained from umbilical cords, rather than from human embryos.
>
> Recently, stem cells have also been obtained from bone marrow. These stem cells are used to treat conditions such as heart disease and spinal injuries.

27.1 Name THREE sources of stem cells mentioned in the extract. (3)

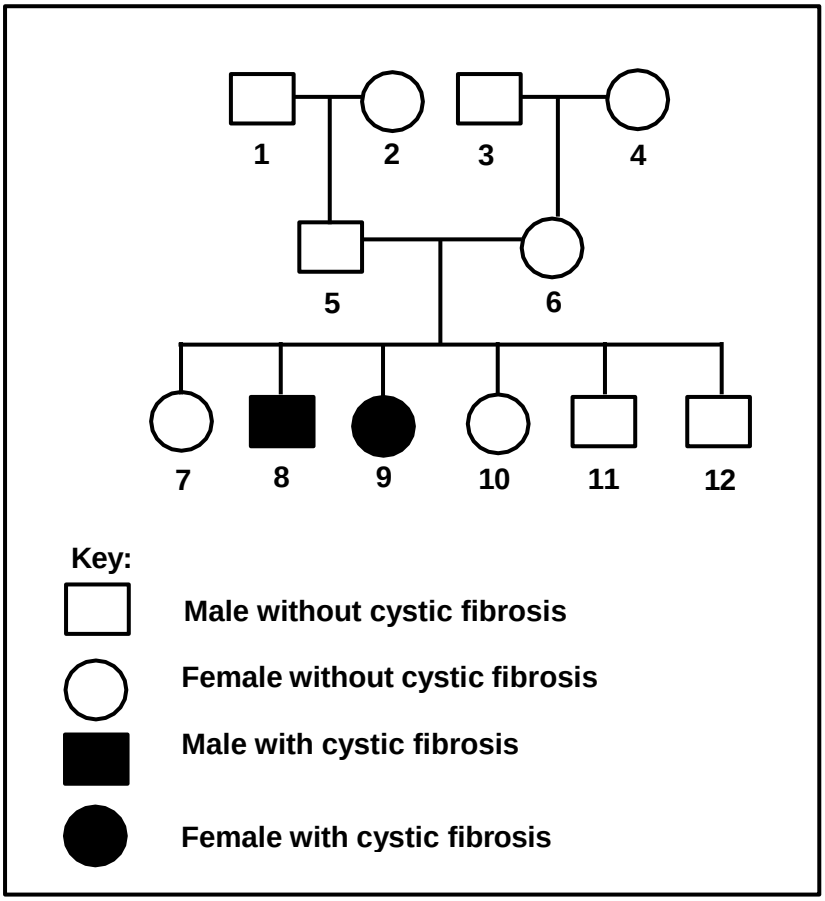
27.2 Explain why the characteristics of stem cells make them useful for treating some disorders. (2)

27.3 Name ONE condition in the extract that can be treated with stemcells. (1)

(6)

Question 28

28 Cystic fibrosis is a genetic disorder caused by a recessive allele (**b**).The pedigree diagram below shows the inheritance of cystic fibrosis in a certain family.



28.1 How many generations are represented in the diagram above? (1)

28.2 Give the genotype of individual **9**. (1)

28.3 Explain why both individuals **5** and **6** must be heterozygous for cystic fibrosis. (4)

28.4 Using the letters **B** and **b**, do a genetic cross to show the inheritance of cystic fibrosis when heterozygous parents are crossed. (6)

(12)

Question 29

29 In a certain species of butterfly, one gene controls wing-spot colour and another controls eye colour. The wing-spot colour can be red spots (R) or grey spots (r), while eye colour can be black (E) or brown (e).

Butterflies that are heterozygous for both genes were crossed.

29.1 Name the type of cross represented above. (1)

29.2 Give the dominant characteristic of EACH gene. (2)

29.3 The table below shows the phenotypes and all the possible genotypes of the offspring.

PHENOTYPES	ALL POSSIBLE GENOTYPES
Red spots, brown eyes	**(X)**
(Y)	RrEe
Grey spots, brown eyes	rree

Give:

(a) ALL the possible genotypes at **X** (4)

(b) The phenotype at **Y** (1)

(c) The genotype of the gametes produced by a butterfly with grey spots and brown eyes (1)

(9)

Question 30

The table below shows the percentage of blood donors for each of the blood groups in South Africa for 2018.

BLOOD GROUP	% DONORS
O	48
A	38
B	10
AB	4

30.1 According to the data, which is the most common blood group among the donors? (1)

30.2 Name the type of dominance shown by the inheritance of blood group **A**. (1)

30.3 Explain how it is possible for a man with blood group **A** and a woman with blood group **AB** to have a child with blood group **B**. (5)

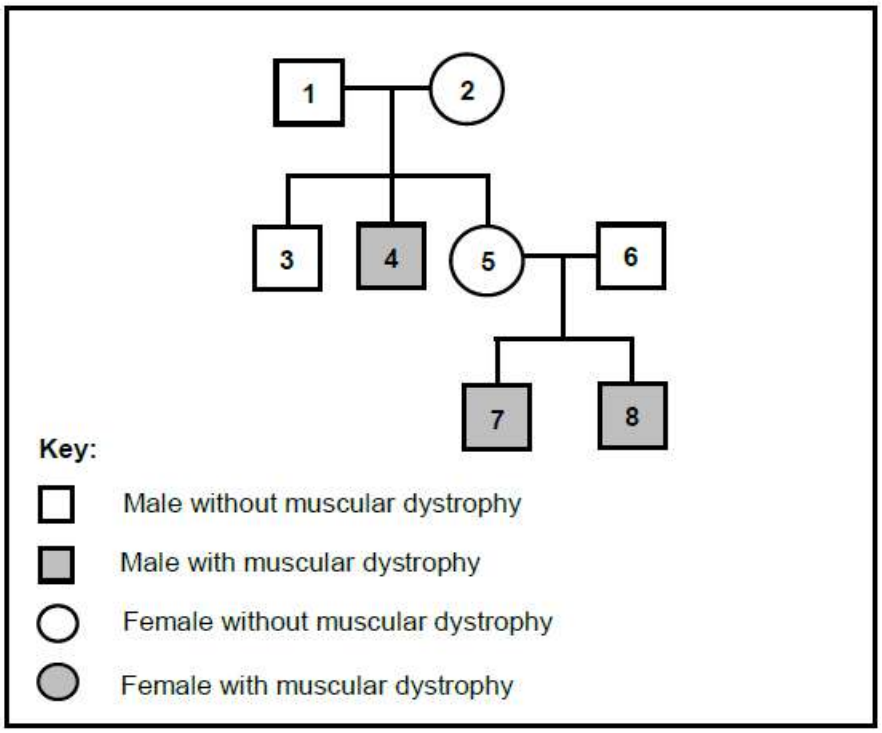
30.4 Plot a bar graph to represent the data in the table. (6)

(13)

Question 31

31 Muscular dystrophy is a genetic condition that causes muscles to weaken over time. It is caused by a recessive allele on the X chromosome ($\mathbf{X}^{d}$). The dominant allele ($\mathbf{X}^{D}$) results in normal muscle formation.

The pedigree diagram below shows the inheritance of muscular dystrophy in a family.



31.1 How many offspring do individuals **1** and **2** have? (1)

31.2 Give the:

(a) Phenotype of individual **1** (1)

(b) Genotype of individual **2** (1)

31.3 Explain why more males than females are likely to have muscular dystrophy. (5)

31.4 Parents **5** and **6** plan to have another child.

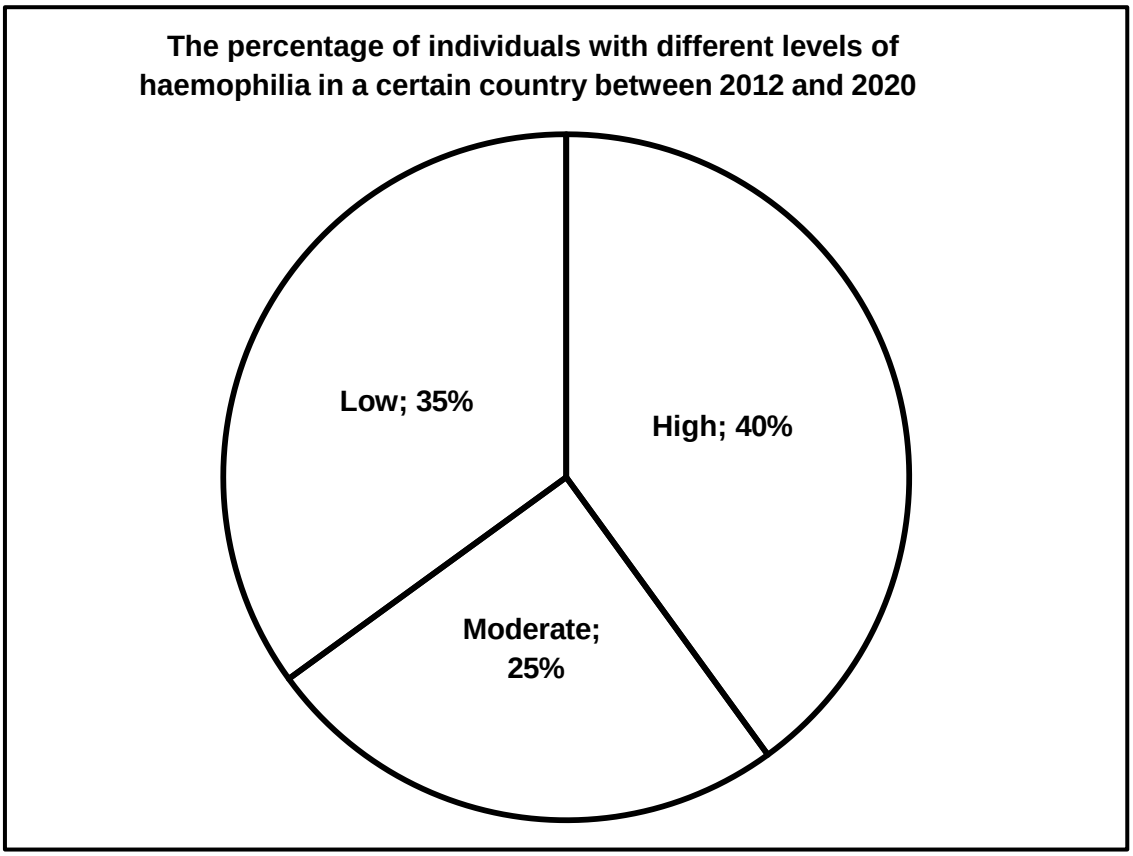
Use a genetic cross to show the percentage chance of having a child with muscular dystrophy. (6)

(13)

Question 32

32 In a certain country, 25 000 individuals were suffering from haemophilia between 2012 and 2020. Haemophilia is a genetic disorder that is caused by a mutation.

The pie chart below shows the percentage of individuals with different levels of haemophilia in this country.



32.1 Explain the effect of this mutation on an individual. (2)

32.2 Calculate the number of individuals who were moderately affected by haemophilia in this country. Show ALL working. (2)

32.3 Explain why it would be expected that most of the individuals affected by haemophilia will be males. (3)

(7)

Question 33

33 Read the passage below.

GENETICALLY MODIFIED MAIZE

The bacterium *Bacillus thuringiensis* produces a toxin, called Bt, that kills insects. This bacterium is used to genetically modify maize to contain the Bt toxin. This Bt maize is toxic to insects.

33.1 Describe how the Bt maize is genetically modified to be insect resistant. (3)

33.2 Explain TWO reasons why farmers might want to grow Bt maize. (4)

(7)

TOPIC: HUMAN RESPONSE TO ENVIRONMENT

THE NERVOUS SYSTEM

Diagnostic Analysis

Common Errors and Misconceptions	Possible Solutions
• Terminology is written incorrectly or incompletely eg. PNS for *peripheral nervous system,* semi-circular' instead of *semi-circular canals,* myelin instead of *Myelin sheath*	✓ Biological terms must be written in their complete form to earn credit. Acronyms and abbreviations will not be accepted in the section on biological terms and should therefore answers are required
• The location of parts/structures are not accurately described	✓ When learning the structure of systems and organs, the location of parts and structures must be noted eg. The *corpus callosum* is found 'between the two hemispheres of the cerebrum', NOT 'underneath the cerebrum' or 'between the two hemispheres of the brain'
• Questions that require application of knowledge of the parts and functions of the brain are poorly answered	✓ Functions of parts of the brain must be accurately described/explained eg. Marks will be lost when referring to the function of the cerebellum as "*controlling balance*" instead of *"co-ordinating voluntary muscle movement, therefore controlling balance"*
• A generic account of a reflex arc is given when application to a specific example is required	✓ Knowledge of a reflex arc must be applied when a specific example is given eg. A reflex arc in a knee jerk reaction does not have an interneuron. The *patellar tendon* and *quadriceps muscles* MUST be mentioned in the description
• *Alzheimer's disease* is confused with *Multiple sclerosis*	✓ A clear distinction must be made between *Alzheimer's disease and Multiple sclerosis* with respect to causes and symptoms
• Candidates performed well except for Q1.1.10 where they had to apply their knowledge. They were not familiar with the pathway of the nerve impulses for balance. Some candidates did not know which part of the brain was involved in balance and gave the answer as C (cerebrum), instead of B (cerebellum). • It was also evident that the individual bones of the ossicles in Q1.2.4 had not been well taught. • Q2.4 was poorly answered. In Q2.4.1 most candidates referred to the lens instead of how the eyeball affected vision. In Q2.4.2 they had difficulty explaining why the convex lenses helped to improve vision. Convex lenses cause light to be refracted more, thereby causing the image to fall on the retina • Many candidates performed well in Q2.5. In Q2.5.1 some still referred to the type of neuron as multipolar, instead of a motor neuron. In Q2.5.2 and Q2.5.3 they referred to	✓ As elaborated in previous diagnostic reports, Paper 1 is about the physiology of humans; therefore, diagrams of different structures/organs are an integral part of this paper. The structures/organs are best taught using annotated diagrams. Diagrams without labels should be given to learners to identify the parts and their functions.

• outgrowths instead of dendrites. In Q2.5.5 some candidates referred to the disorder as Alzheimer's disease instead of Multiple sclerosis. • Many candidates performed well in Q2.5. In Q2.5.1 some still referred to the type of neuron as multipolar, instead of a motor neuron. In Q2.5.2 and Q2.5.3 they referred to outgrowths instead of dendrites. In Q2.5.5 some candidates referred to the disorder as Alzheimer's disease instead of Multiple sclerosis.	✓ Teachers need to emphasise that a reflex action is a rapid, involuntary action in response to a stimulus.

Question 1

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION	TERM
1.1	The part of the brain that receives impulses from the maculae	
1.2	The structure that connects the left and right hemispheres of the brain	
1.3	The part of the brain that controls body temperature	
1.4	The branch of the autonomic nervous system that restores an increased heart rate back to normal	
1.5	The part of the nervous system that is made up of spinal and cranial nerves	
1.6	A part of the nervous system that consist of sympathetic and parasympathetic section	
1.7	A functional gap between two consecutive neurons	
1.8	Collective name for the membranes that surround the brain and spinal cord	
1.9	Neurons that carry impulses from receptors	
1.10	The part of the skull that protects the brain	
1.11	The part of the brain that regulates breathing	
1.12	The disease characterised by the degeneration of brain tissue, leading to memory loss	
		(12x1) **(12)**

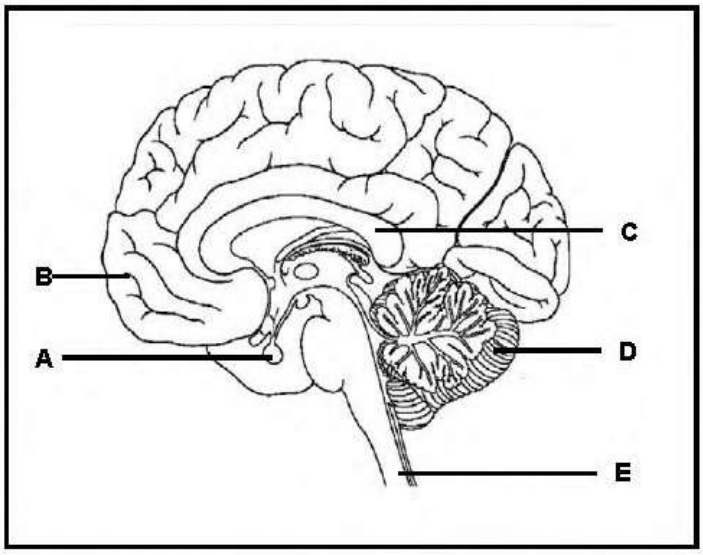
Question 2

Indicate whether each of the descriptions 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.

	Column I		**Column II**
2.1	The functional connection between two consecutive neurons	A B	Receptor Synapse
2.2.	The part of a neuron that speeds up the transmission of an impulse	A B	Myelin sheath Axon
2.3.	A component of the peripheral nervous system	A B	Cranial nerves Spinal nerves
2.4.	A disorder of the nervous system characterised by the degeneration of the cells	A B	Goitre Alzheimer's disease
2.5	The part of the brain that controls heart Rate	A B	Corpus callosum Medulla oblongata
			(8X2) **(16)**

Question 3

The diagram below represents a human brain.



3.1. Give the **LETTER** and **NAME** of the part of the brain responsible for:

(a) Memorising a cellular phone number (2)

(b) Coordinating all voluntary movements (2)

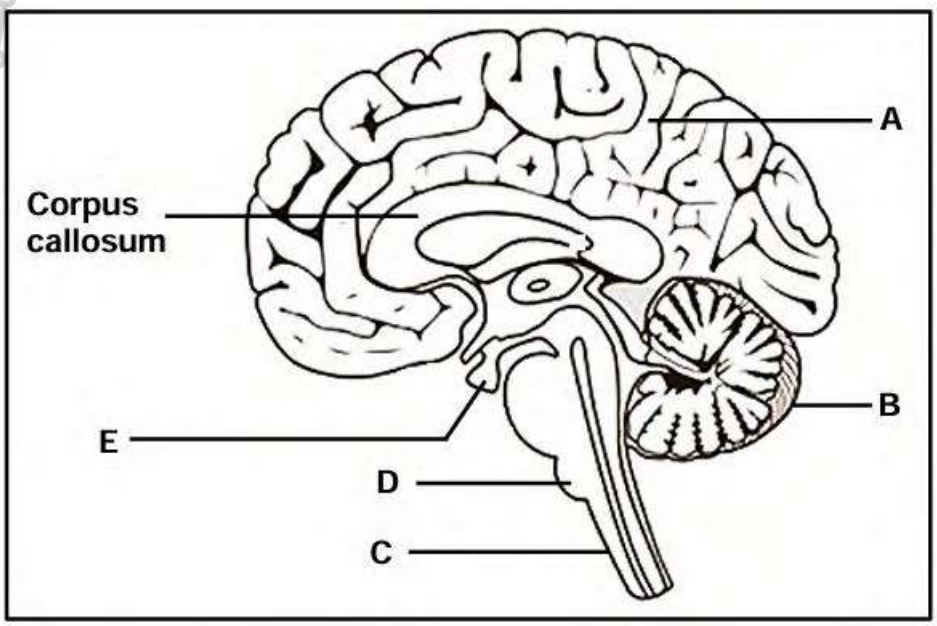
(c) Secreting hormones (2)

(d) Connecting the hemispheres of part B (2)

(e) The reflex action that occurs when stepping barefooted on a sharp object (2)

(10)

Question 4



4.1. Identify:

(a) Part C (1)

(b) Gland E (1)

4.2 Give the LETTER of the part that controls voluntary. (1)

4.3 Describe the location of the corpus callosum. (2)

4.4 A learner suffered a brain injury during a rugby match. He could still breathe properly but he experienced occasional loss of memory and balance.
Explain why:

(a) The learner could still breathe properly (2)

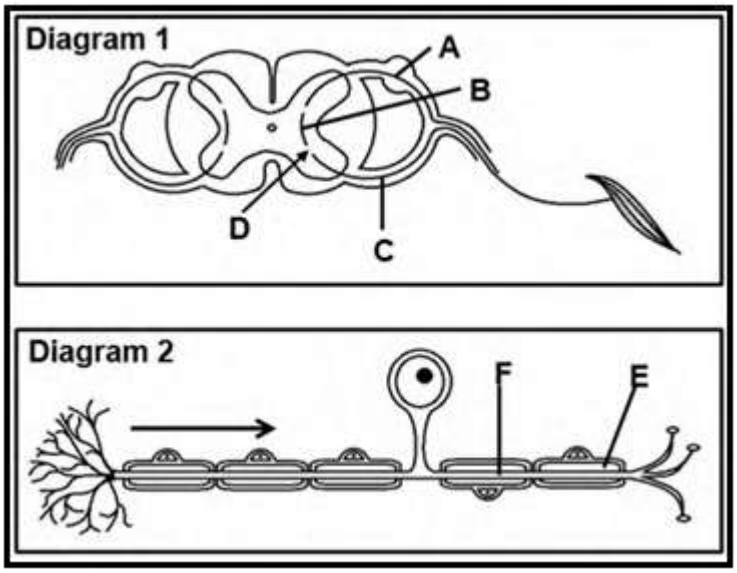
(b) It is possible that the injury affected part B (2)

(c) The hearing of the learner could also be affected because of the injury (2)

(11)

Question 5

Diagram 1 below represents part of the reflex arc and diagram 2 represents a neuron



5.1 Identify:

(a) Layer **E** (1)

(b) Structure **F** (1)

5.2. Which neuron (**A, B or C**)

(a) Represents the type of neuron shown in diagram **2** (1)

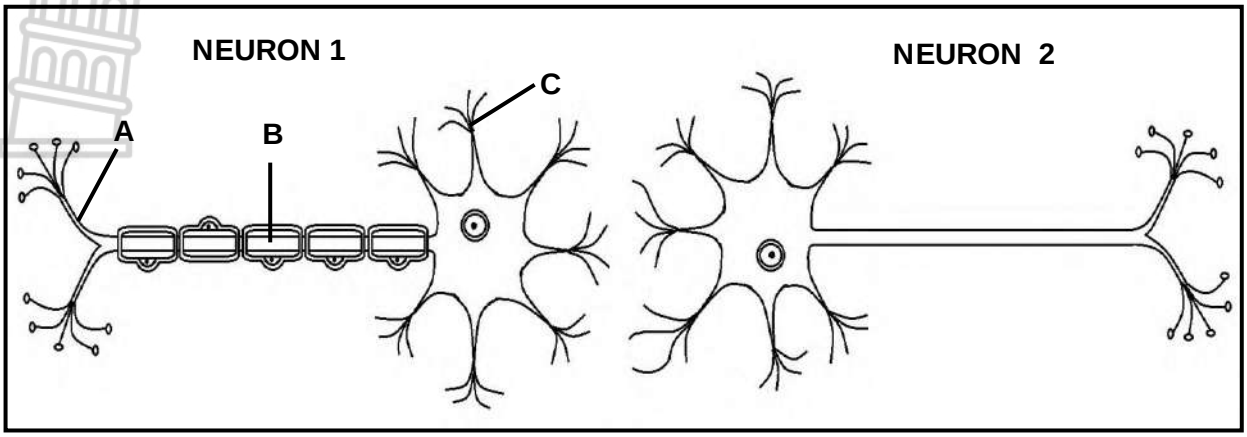
(b) Is damaged when a person can feel the stimulus but cannot respond to it. (1)

5.3. Give the LETTER and NAME of the part that ensures one-directional flow of impulse. (2)

(6)

Question 6

The diagram below represents a type of neuron found in human body



6.1. Identify the type of neuron shown. (1)

6.2. Using the LETTERS **A, B** AND **C** only, give the correct sequence for the transmission of an impulse along neuron **1.** (2)

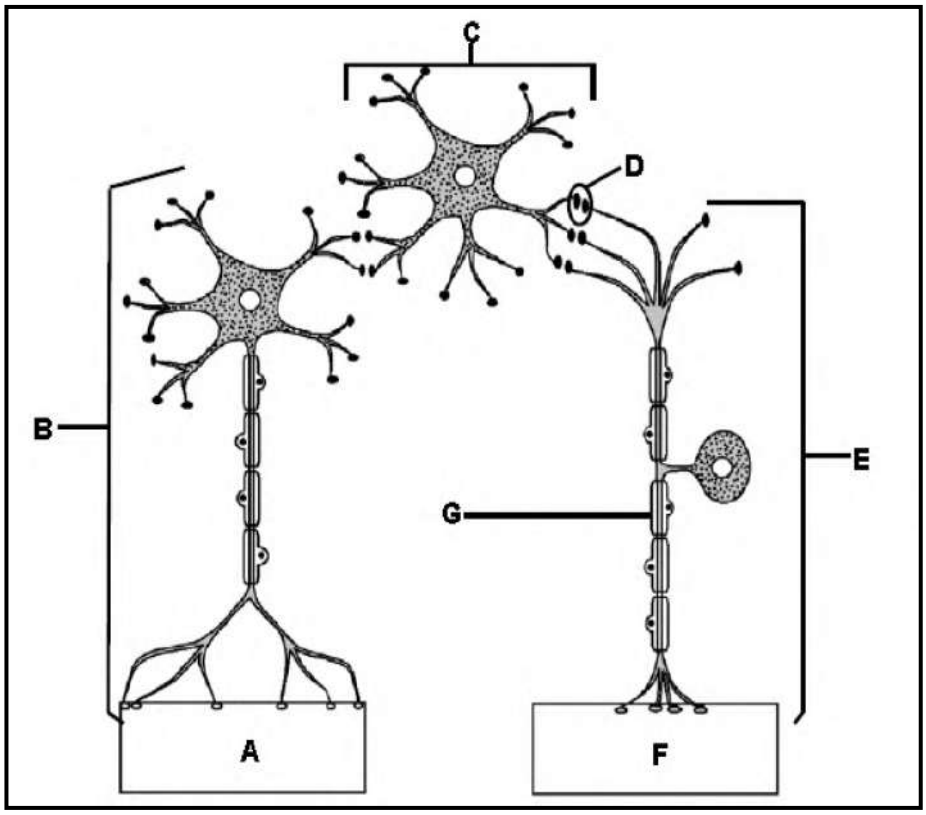
6.3. Explain how the speed of transmission of impulses will differ for neuron **1** and neuron **2.** (3)

6.4. Explain why a person will feel the stimulus but will not be able to respond if only type of neuron is damaged. (3)

(9)

Question 7

The diagram below represents a possible path followed by an impulse when a person touches a hot plate



7.1 Name the path represented in the diagram (1)

7.2 Identify the type of neuron represented by:

(a) B (1)

(b) C (1)

(c) E (1)

7.3 Give the LETTER only of the part represents the:

(a) Receptor (1)

(b) Effector (1)

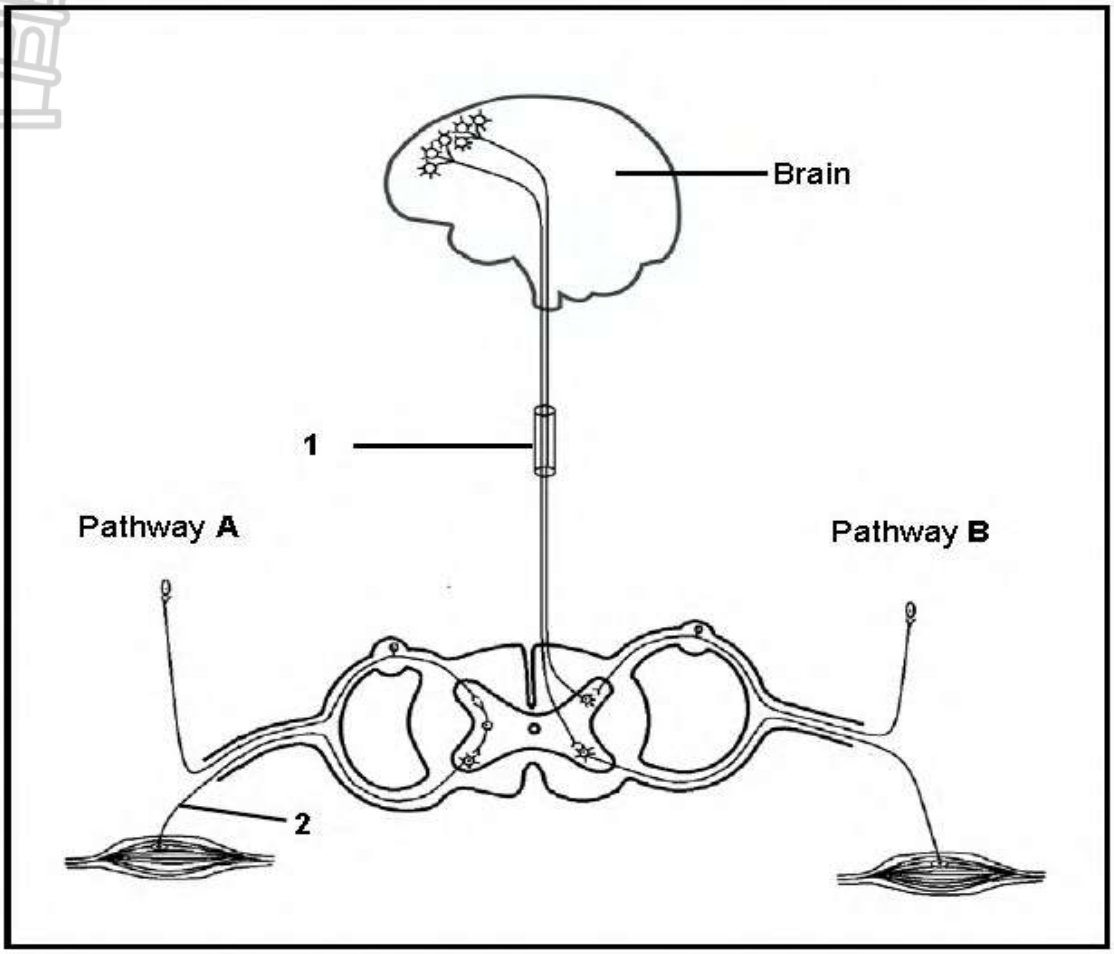
7.4 Give the LETTER and the NAME of the:

(a) Region where the impulse is transmitted chemically (2)

(b) Part that has an insulating function (2)

Question 8

The diagram below represents two possible pathways, **A** and **B**, which a nerve impulse may follow in the human body.



8.1. Which pathway A or B represents a reflex arc? (1)

8.2. Give the visible reason in the diagram for your answer to QUESTION 8.1. (1)

8.3. Describe the importance of a reflex action in the human body (3)

8.4. Identify the part of the nervous system represented by 1 (1)

8.5. Explain ONE way in which the myelin sheath is important in the functioning of neurons (2)

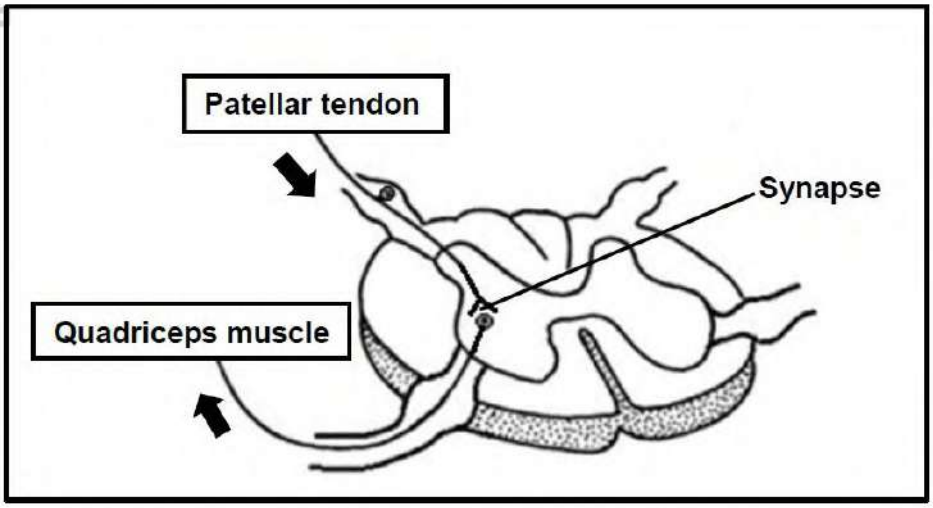
8.6. Describe how the person would be affected if the axon of neuron 2 was cut. (2)

8.7. Describe pathway **B** (6)

(16)

Question 9

The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the knee cap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg. The diagram below represents the reflex arc for the knee-jerk reaction containing only ONE synapse. The arrows indicate the transmission of nerve impulses.



9.1 What is a *reflex action*? (2)

9.2 State:

(a) ONE reason why a synapse is significant (1)

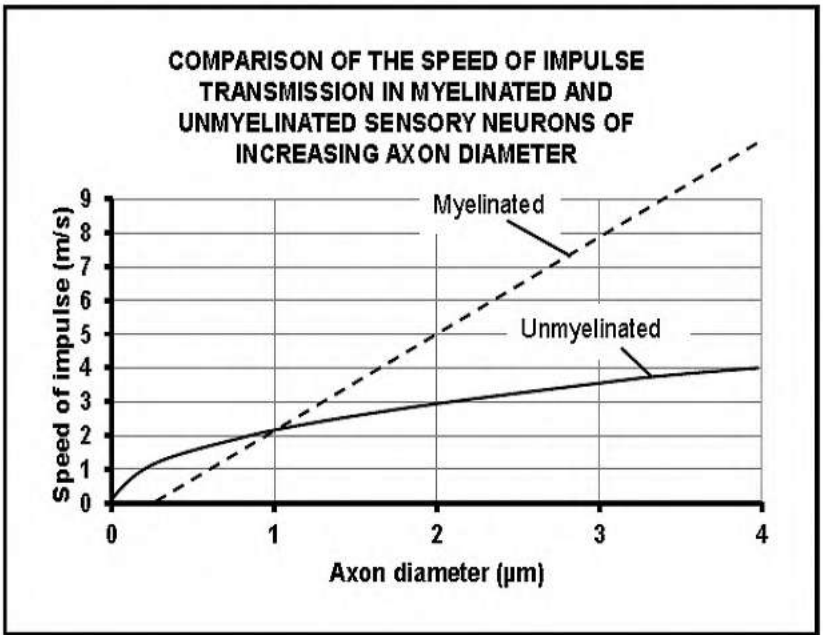
(b) The importance of the knee-jerk reaction (1)

9.3 Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction. (5)

(9)

Question 10

The graph below shows the speed at which impulses are transmitted along sensory neuron axons are myelinated (covered with myelin sheath) and unmyelinated (no myelin sheath present)



10.1 Describe the direction of the impulses within a neuron (2)

10.2 Give the diameter range of (in µm) when the speed of the impulse is faster in unmyelinated axons than myelinated axons (2)

10.3 Describe the relationship between axon diameter and speed of impulses in myelinated axons (2)

10.4 Use the evidence from the graph to explain the effect of multiple sclerosis on a sufferer whose motor neuron axons are greater than 1µm in diameter (3)

(9)

Question 11

Read the extract below.

ALZHEIMER'S DISEASE AND EXERCISE

Age and family history are the known risk factors for Alzheimer's disease. The most common symptom of Alzheimer's disease is a worsening ability to remember new information. Regular exercise may help to reduce the risk of developing Alzheimer's disease because it can improve blood flow to the brain and help to maintain the volume of the hippocampus. The hippocampus is located deep inside the cerebrum and plays a major role in learning ability and orientation.

Scientists conducted an investigation to determine if regular exercise reduces the risk of Alzheimer's disease in humans.

They:

- Used 37 female participants between the ages of 65 and 75 in an exercise programme
- Used participants that did not show symptoms of Alzheimer's disease at the start of the investigation
- Conducted the investigation three times a week for three months

The results showed an improvement in higher-order thinking abilities and an increased blood flow to the cerebrum.

11.1 State ONE change in the nerve tissue of the brain that can cause Alzheimer's disease. (1)

11.2 From the extract, state:

(a) ONE symptom of Alzheimer's disease (1)

(b) A genetic risk factor (1)

(c) TWO functions of the hippocampus (2)

11.3 Name TWO factors that were considered when selecting the participants for this investigation. (2)

11.4 State TWO ways in which the scientists improved the reliability of their results. (2)

11.5 Explain why this investigation cannot be used to conclude that exercise reduces the risk of getting Alzheimer's disease. (2)

11.6 From the extract, explain why it is expected that regular exercise can reduce the risk of Alzheimer's disease. (3)

(14)

Question 12

The table below shows the recorded number of severe brain injuries per 100 000 people per year in different regions of the world.

REGIONS OF THE WORLD	NUMBER OF SEVERE BRAIN INJURIES (PER 100 000 PEOPLE PER YEAR)
Latin America	900
USA and Canada	1 300
East Mediterranean	890
Europe	1 010
Africa	800

12.1 Which region has the smallest number of severe brain injuries? (1)

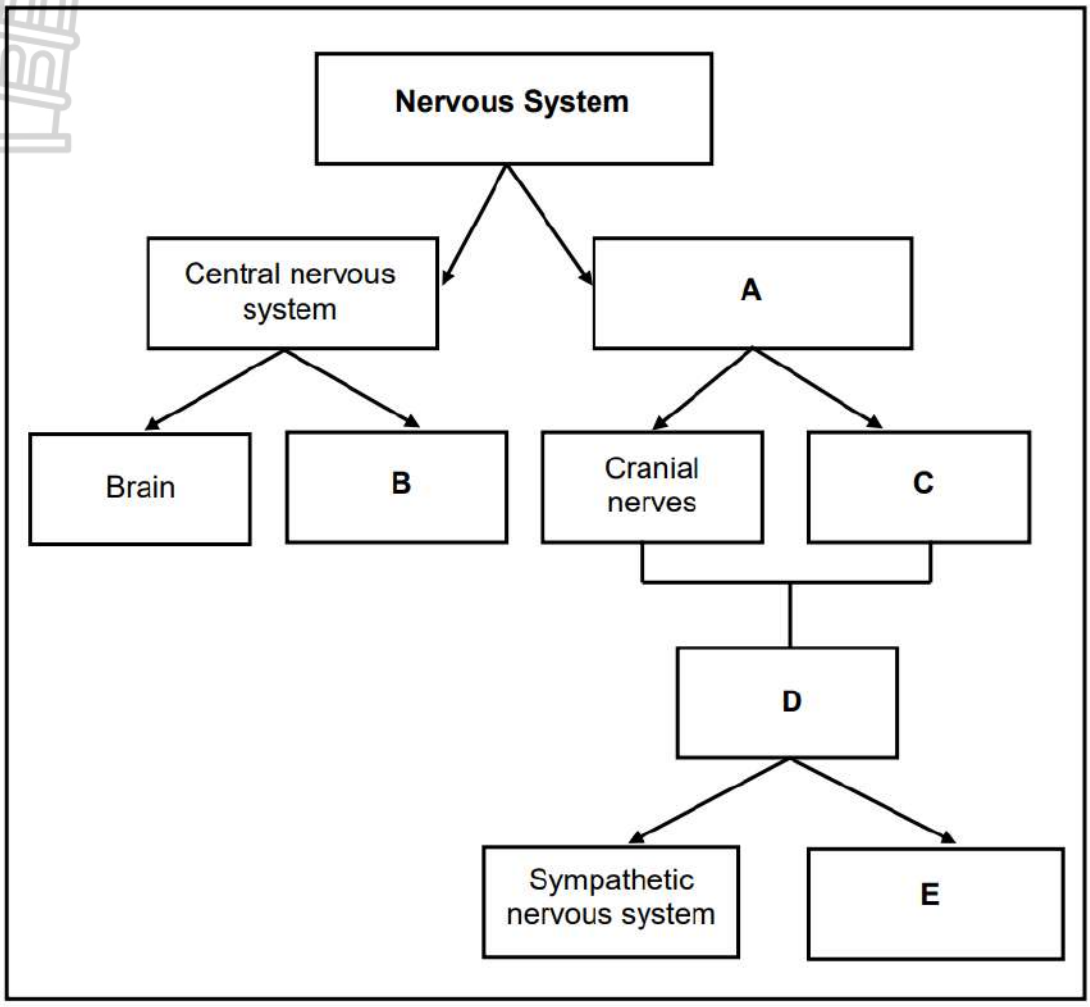
12.2 Explain why this data may not be accurate for the region named in QUESTION 12.2 (2)

12.3 Draw a bar graph to represent the data in the table. (6)

(9)

Question 13

The flow diagram below represents the components of the nervous system.



13.1 Identify the component of the nervous system represented by:
(a) **A** (1)
(b) **D** (1)

13.2 Name the type of nerves found at **C**. (1)

13.3 Give the LETTER and NAME of the component that slows down the heart rate when an emergency situation has passed. (2)

13.4 Name the nerve cells that make up nervous tissue. (1)

13.5 State TWO ways in which the brain is protected. (2)

(8)

Question 14

THE DIFFERENCE BETWEEN HYPOREFLEXIA AND HYPERREFLEXIA

Hyporeflexia is a condition where the skeletal muscles have a decreased reflex response. It is caused by damage to parts of a reflex arc. The damage is usually to the motor neurons, which send messages from the spinal cord to the skeletal muscles. This can be due to a medical condition called Guillain- Barré syndrome.

Hyperreflexia is the result of damage to the motor neurons that send messages from the brain to the spinal cord. People suffering from multiple sclerosis (MS) usually demonstrate hyperreflexia and have loss of muscle control.

14.1 What is meant by a reflex arc? (2)

14.2 From the extract, state ONE:

(a) Medical condition that causes hyporeflexia (1)

(b) Similarity in the causes of hyporeflexia and hyperreflexia (1)

(c) Symptom of hyporeflexia (1)

14.3 Describe ONE difference between the causes of hyporeflexia and hyperreflexia. (2)

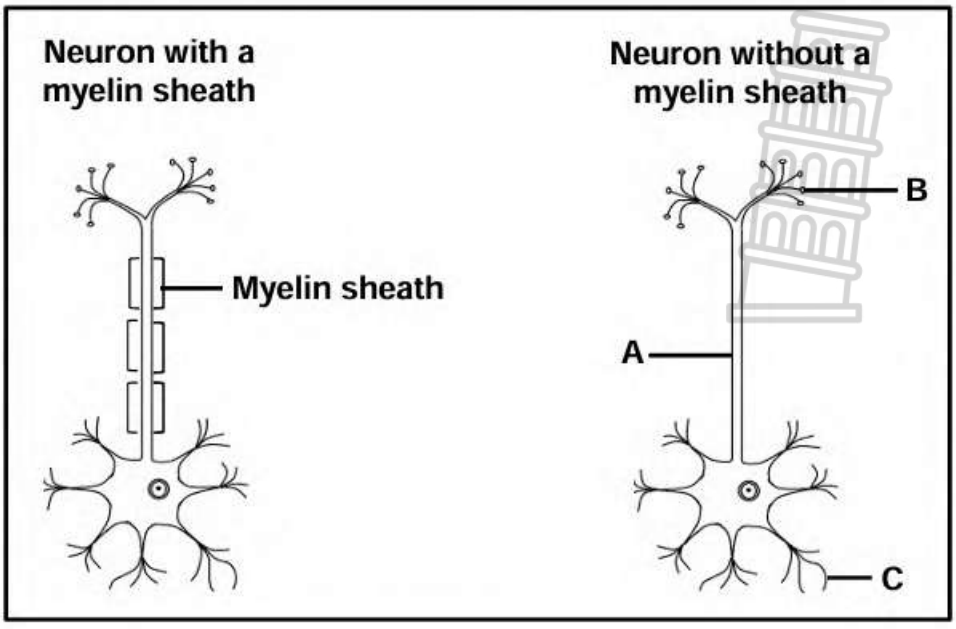
14.4 Name the part of a neuron that degenerates, leading to multiple sclerosis. (1)

14.5 Explain how damage to the part named in QUESTION 14.4 can lead to the symptoms of multiple sclerosis, as stated in the extract. (3)

(11)

Question 15

The diagrams below represent a neuron with a myelin sheath (myelinated) and a neuron without a myelin sheath (unmyelinated).
(The diagrams are NOT drawn to scale.)

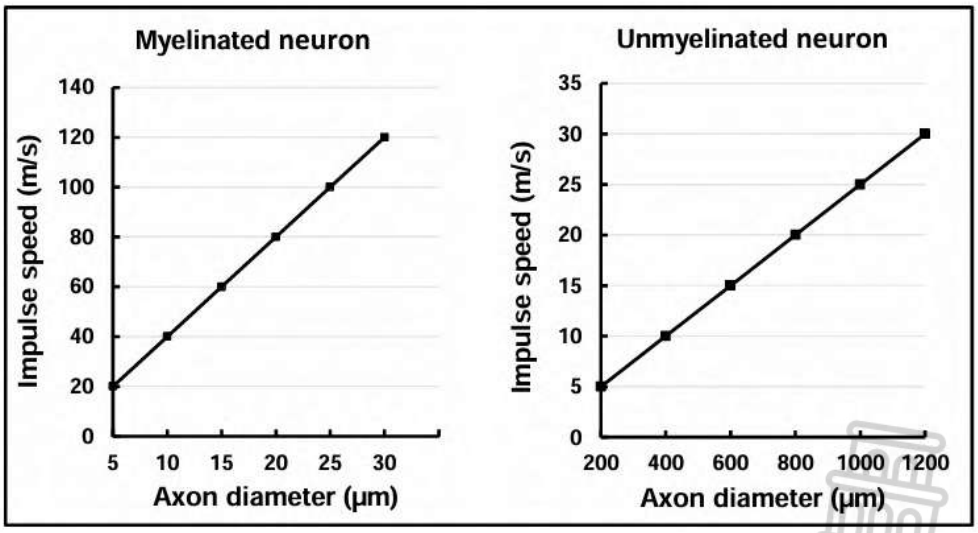


15.1 Identify the type of neuron shown in the diagrams. (1)
15.2 Give ONE visible reason for your answer to QUESTION 2.5.1. (1)
15.3 Describe the function of the type of neuron identified in QUESTION 2.5.1. (3)
15.4 Use the letters A, B and C to indicate the direction in which an impulse moves through the neuron. (2)
15.5 Name the disorder associated with degeneration of the myelin sheaths of neurons. (1)
(8)

Question 16

In the human body, the axons of myelinated neurons have much smaller diameters than the axons of unmyelinated neurons.

The graphs below show the speed of nerve impulses in myelinated neurons and in unmyelinated neurons with different axon diameter



16.1 Give the axon diameter (in µm) at which an impulse move at 20 m/s in:
(a) A myelinated neuron (1)
(b) An unmyelinated neuron (1)
16.2 Use the graphs to describe the following:
(a) Difference in impulse speed for myelinated and unmyelinated neurons (2)
(b) Relationship between axon diameter and impulse speed (2)
(6)

THE EYE

Question 1

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION	TERM
1.1	A type of vision in which both eyes are used together to focus on an object	
1.2	The watery fluid that supports the cornea and the front chamber of the eye	
1.3	The pigmented layer of the eye that absorbs excess light	
1.4	The series of changes that take place in the shape of the lens and the eyeball in response to the distance of an object from the eye	
1.5	A defect condition of the eye where a person can see nearby objects clearly while distant objects are blurred.	
1.6	The visual defect characterised by a cloudy lens	
1.7	The area of the retina that contains the highest concentration of cones	
1.8	The layer in the eye that is richly supplied with blood vessels	
1.9	Photoreceptors that react to low light intensity and are responsible for black and white vision	
		(9x1) **(9)**

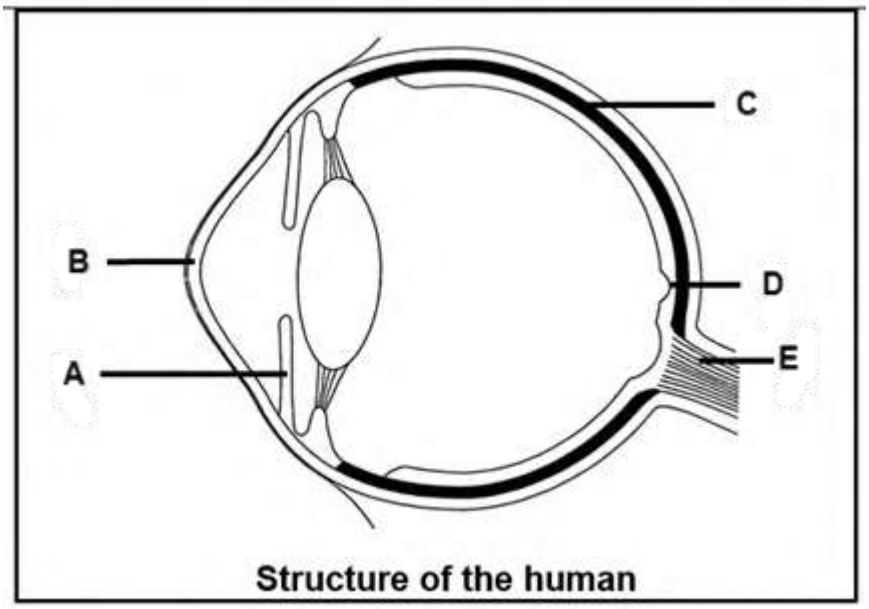
Question 2

Indicate whether each of the descriptions 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.

	Column I	Column II
2.1	Condition affecting the cornea of the eye	A: Astigmatism B: Cataract
2.2	Occurs during accommodation for a distant vision	A: Suspensory ligaments slacken B: Lens become less convex
2.3	Occurs in the iris under dim light conditions	A: Circular muscles relax B: Radial muscles contract
2.4	A type of lens used to correct short sightedness (myopia)	A: Biconvex lens B: Biconcave lens
2.5	The liquid found in front of the lens in the eye	A: Vitreous humour B: Aqueous humour
		(5x2) **(10)**

Question 3

The diagram below shows parts of the eye.



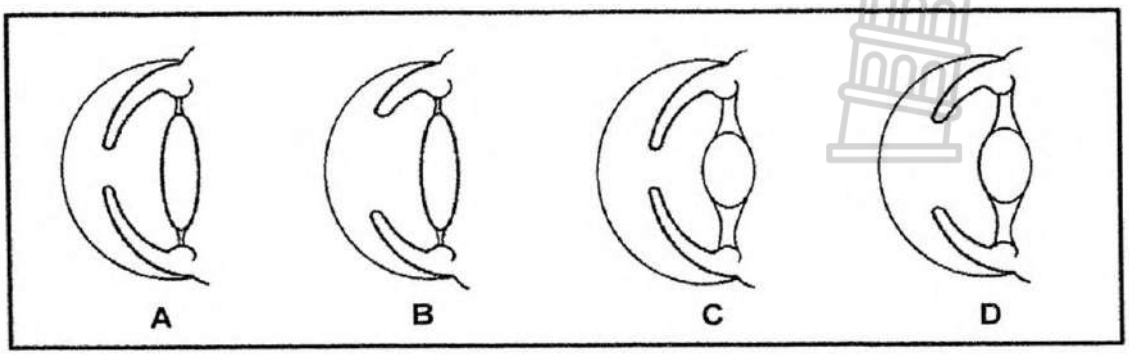
Structure of the human

Give the LETTER and the NAME of the part which:

(a) Regulates the amount of light entering the eye (2)
(b) Transmits impulses to the brain (2)
(c) Supplies food and oxygen to the eye (2)
(d) Contains cones and is the area of clearest vision (2)
(e) Assists in the refraction of light rays (2)
(10)

Question 4

The diagrams below show part of the eye under different conditions



4.1 Name the process that occurs when the:

(a) Curvature of the lens changes to focus on the near or distant objects (1)
(b) Pupil size changes to regulate the amount of light entering the eye (1)

4.2 Give the LETTERS of TWO diagrams **(A, B, C** or **D)** that represent the condition of the eye of a person.
(a) In a dim light (2)
(b) Focusing on the distant object (2)

4.3 Give the LETTERS of TWO diagrams **(A, B, C** or **D)** that represent the eye of a person whose:
(a) Ciliary muscles are contracted (2)
(b) Radial muscles are relaxed (2)
(10)

Question 5

The table below indicate the percentage of visually impaired people in the world suffering from different visual defects.

VISUAL DEFECT	PEOPLE (%)
Blindness	**2**
Long-sightedness	**64**
Short-sightedness	**30**
Other	**4**

5.1 Which visual defect in the table is the most common among the world population? (1)

5.2 In some cases where people are blind, the condition is caused by cataracts
(a) Explain why people with cataracts may become blind (2)
(b) State ONE way in which cataract can be treated. (1)

5.3 Explain why long-sighted people need to wear glasses with biconvex lenses as a corrective measure (3)

5.4 Name a visual defect that is characterised by an uneven cornea or lens (1)

5.5 Draw a pie chart to represent the data in the table (6)
(14)

Question 6

Topsie did an investigation to determine the effect of distance on the curvature (thickness) of the lens of the human eye.

- She sat in a well–lit room
- She covered her one eye with an eye patch
- A pencil was held in front of her uncovered eye for 10 seconds
- She focussed on the pencil until a clear image could be seen and at the same time the curvature of the lens of her eye was measured with an optical instrument
- The pencil was then moved to different distances from the eye and the curvature of the lens of the eye was measured each time

DISTANCE OF THE PENCIL FROM THE EYE (cm)	CURVATURE OF THE LENS OF THE (mm)
10	4.0
20	3.6
30	3.2
50	2.9
100	2.7
150	2.6
200	2.6

6.1 In this investigation identify

(a) the dependent variable. (1)

(b) the independent variable. (1)

6.2 State TWO factors that must be kept constant during the investigation (2)

6.3 Explain why the factors named in QUESTION 6.2 must be kept constant (2)

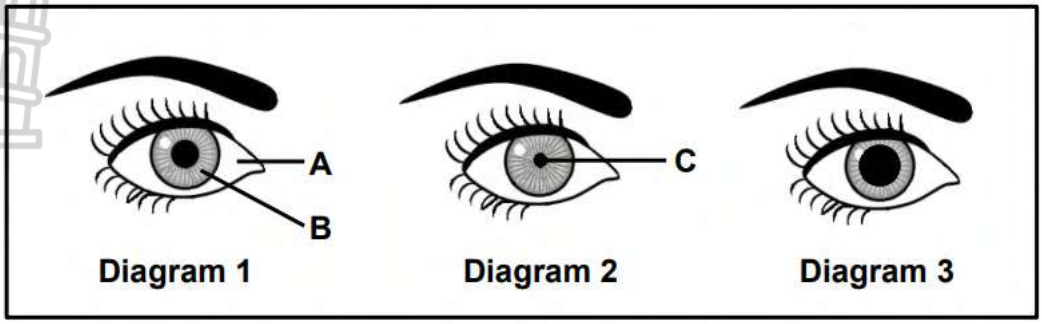
6.4 Describe the relation between the distance of the pencil from the eye and the curvature of the lens of the eye. (2)

6.5 Name TWO structures in the eye that are responsible for the changes in the curvature of the lens. (2)

(10)

Question 7

The diagrams below show the condition of the eyes for different light intensities when viewing the same object.



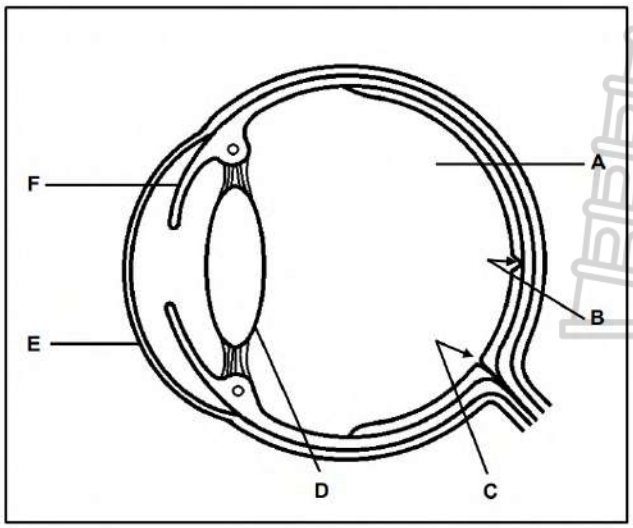
7.1 Give the LETTER and NAME of the part that:
(a) Contains muscles (2)
(b) Is made up of tough white fibrous tissue (2)

7.2 Which diagram (1, 2 or 3) represents the eye of a person:
(a) In a very bright area Where the rods are stimulated the most (1)
(b) In a very bright area Where the rods are stimulated the most (1)

7.3 Which muscles are:
(a) Contracted in diagram 2 Relaxed in diagram 3 (1)
(b) Contracted in diagram 2 Relaxed in diagram 3 (1)
(8)

Question 8

The diagram below represents the human eye.



8.1 Identify structure **F**. (1)
8.2 State TWO functions of fluid **A**. (2)

8.3 Describe the structural difference between area **B** and area **C**. (2)

8.4 Name the visual defect that occurs when the curvature of part **E** is uneven. (1)

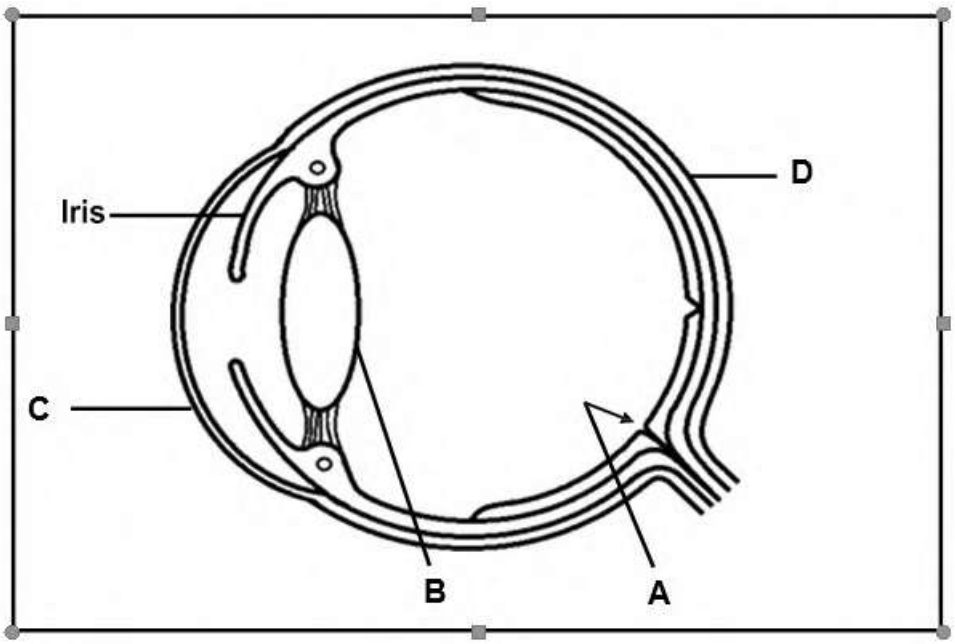
8.5 Explain how the sight of a person will be affected if cataracts developed in part **D**. (3)

8.6 Describe the process of accommodation that takes place when an object is less than 6 metres away from the eye. (6)

(15)

Question 9

The diagram below represents the structure of a human eye.



9.1 Identify part:

(a) **A** (1)

(b) **C** (1)

(c) **D** (1)

9.2 Describe how the muscles in the iris enable a person to see in dim light. (4)

9.3 Name the process that occurs in the eye when a person focuses on objects at different distances. (1)

9.4 Explain how the shape of part B enables a person to read a book (3)

(11)

Question 10

CATARACTS – THE MOST COMMON CAUSE OF BLINDNESS

Cataracts are primarily formed when protein structures in the lens of the eye start to disintegrate and clump together. Cataracts is the most common cause of blindness and the main cause of vision loss in people over 40 years of age.

Two types of cataracts that occur are nuclear cataracts and subcapsular cataracts. In nuclear cataracts, the cataracts form in the central region of the lens and gradually spread outwards. In subcapsular cataracts, the cataracts develop at the back of the lens and it is most common in people with diabetes.

10.1 According to the passage, which type of cataract is associated with a disorder of the pancreas? (1)

10.2 Use information in the passage to explain why cataracts cause vision loss. (5)

A man is long-sighted.
Explain how:

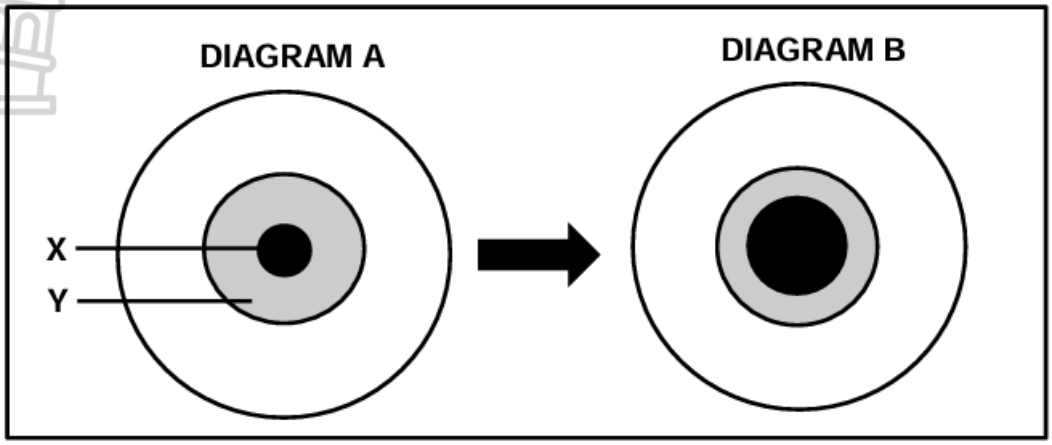
10.3 The structure of his eyeball affects his vision when he reads a book without glasses (3)

10.4 Wearing glasses with convex lenses will improve his vision when he reads a book (2)

(11)

Question 11

The diagrams below represent the pupillary mechanism in the human eye.



11.1 Identify part:
(a) **X** (1)
(b) **Y** (1)

11.2 Explain why the pupillary mechanism is considered to be a reflex action. (3)

11.3 Name the TWO effector muscles that are involved in the pupillary mechanism. (2)

11.4 Explain the significance of the change in the diameter of part X from diagram A to diagram B (4)

(11)

THE EAR

Question 1

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	Description	Term
1.1	Receptors that provide information about the gravitational position of the head	
1.2	A small device that is inserted in the ear to drain fluids caused by a middle-ear infection	
1.3	A structure in the ear that contains receptors that converts pressure waves into nerve impulse in the ear	
1.4	A structure in the ear that absorbs excess pressure waves from the inner ear	
1.5	A structure in the ear that transmits the nerve impulse to the cerebellum for the balance of the body	
1.6	The part of the ear that receives sound waves from the auditory canal	
1.7	Receptors in the ear that detect changes in speed and direction of movement of the head	
1.8	The ossicle that transfers vibrations to the oval window	
1.9	The part in the inner ear where the organ of Corti is located	
		(9x1) **(9)**

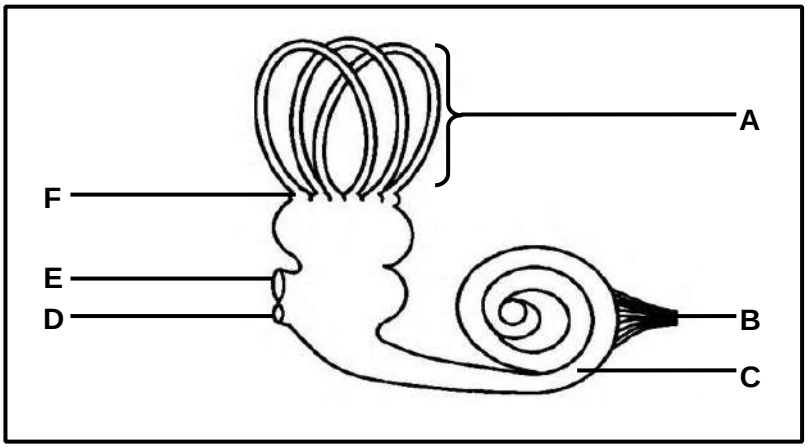
Question 2

Indicate whether each of the descriptions 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.

	Column I	Column II
2.1	The part of the ear that directs the sound waves to the tympanic membrane	A: Pinna B: Auditory canal
2.2	Equalises pressure on either side of the tympanic membrane	A: Eustachian tube B: Round window
2.3	It has membrane that sets up the pressure waves in the inner ear	A: Round window B: Oval window
2.4	A structure in the ear that absorbs excess pressure waves from the cochlea	A: Pinna B: Auditory canal
		(4x2) **(8)**

Question 3

The diagram below represents a part of the human ear.



3.1 Identify part:

(a) A (1)

(b) B (1)

3.2 Give the LETTER and NAME of the part that:

(a) Creates pressure waves in the fluid of the inner ear (2)

(b) Absorbs excess pressure waves in the inner ear to prevent the formation of an echo (2)

3.3 Name the:

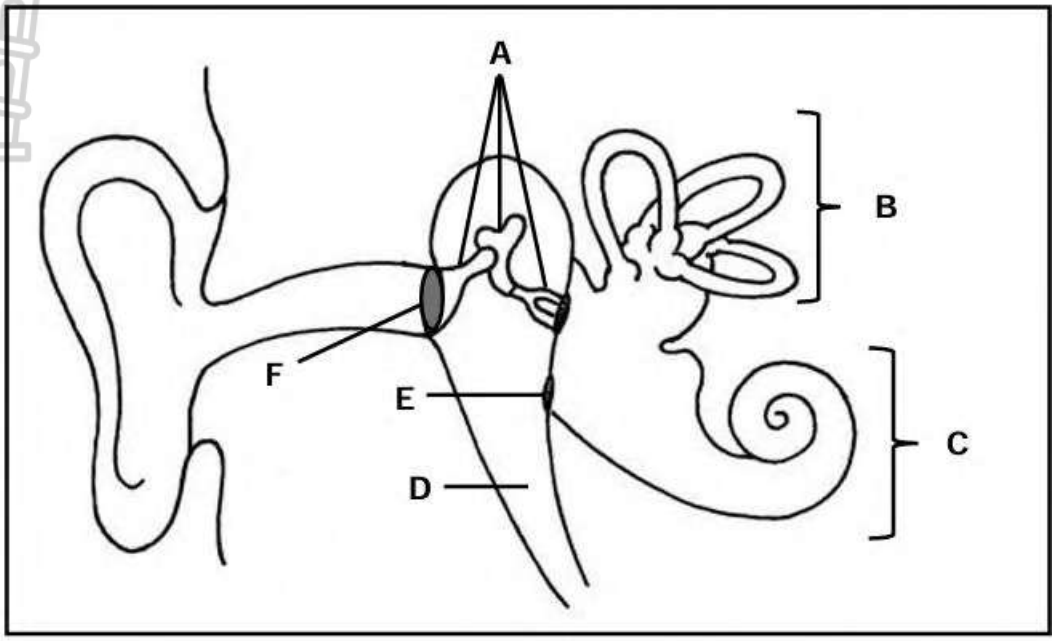
(a) Part of the brain that interprets impulses from part F (1)

(b) Receptors found at C (1)

(8)

Question 4

The diagram below represents the human ear.



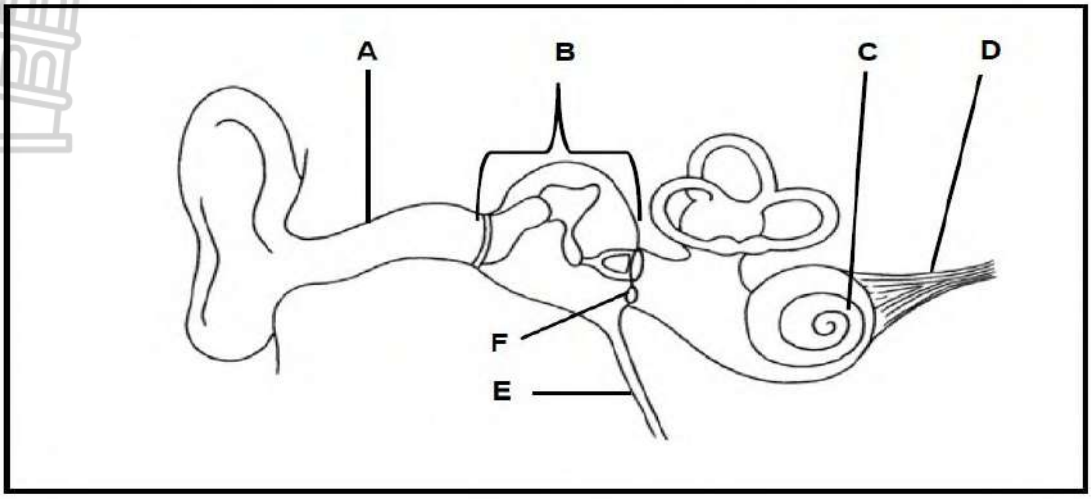
4.1 Identify part:
(a) **B** (1)
(b) **E** (1)

4.2 Give the LETTER and NAME of the part that:
(a) Is filled with air (2)
(b) Contains the organ of Corti (2)

4.3 Give the LETTER of the part:
(a) Where grommets are inserted (1)
(b) That amplifies vibrations (1)
(8)

Question 5

The diagram below shows parts of human ear



5.1 Give one function of part:

(a) **A** (1)

(b) **E** (1)

(c) **F** (1)

5.2 Write down only the LETTER of the part where sound is transmitted in the form of:

(a) A pressure wave in a liquid (1)

(b) An electrical impulse (1)

5.3 Explain the effect if the receptors in region C are damaged (3)

5.4 Describe how the parts of the middle ear, including the membranes, assist with amplifying sounds. (3)

5.5 Describe the role of the semi-circular canals in maintaining balance (4)

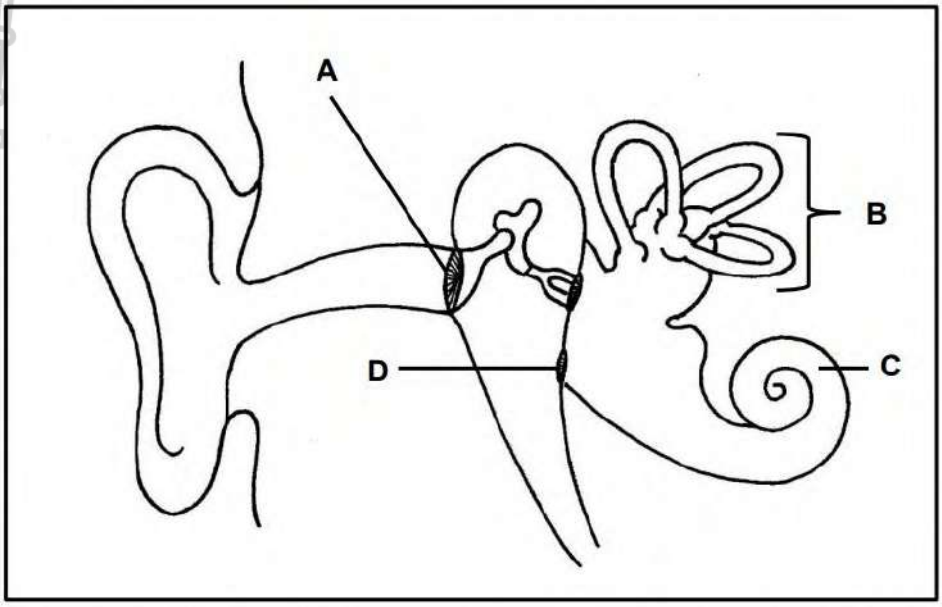
(15)

Question 6

6.1 Describe the process of hearing **(7)**

Question 7

The diagram below represents a part of the human ear.



7.1 Identify part C. (1)

7.2 State ONE function of:

(a) Part D The receptors found in part C (1)

(b) Part D The receptors found in part C (1)

7.3 Explain why a build-up of ear wax at part A may result in temporary hearing loss. (2)

7.4 A grommet is a small device that allows the air to move into and out of the middle ear. This prevents pressure build-up in the middle ear.

Explain how the use of grommets in the treatment of middle-ear infections prevents hearing loss. (4)

7.5 Describe how the receptors in part B are involved in maintaining balance when there are changes in the speed and direction of movement of the head. (4)

(13)

Question 8

Workers in some factories are constantly exposed to loud noise for long periods. This can destroy the hair cells in the organ of Corti and damage the auditory nerve, resulting in hearing loss. A survey was conducted in a developing country from 2014 to 2018, to establish the number of factory workers who suffered from hearing loss. The results are shown in the table below.

Year	Number of factory workers with hearing loss
2014	85 000
2015	100 000
2016	115 000
2017	120 000
2018	130 000

8.1 Name the structure in the ear where the organ of Corti is located. (1)

8.2 Calculate the percentage increase in the number of factory workers with hearing loss between 2014 and 2018. Show ALL workings. (3)

8.3 Suggest ONE reason for the increase in the number of factory workers with hearing loss caused by exposure to loud noise in this country. (1)

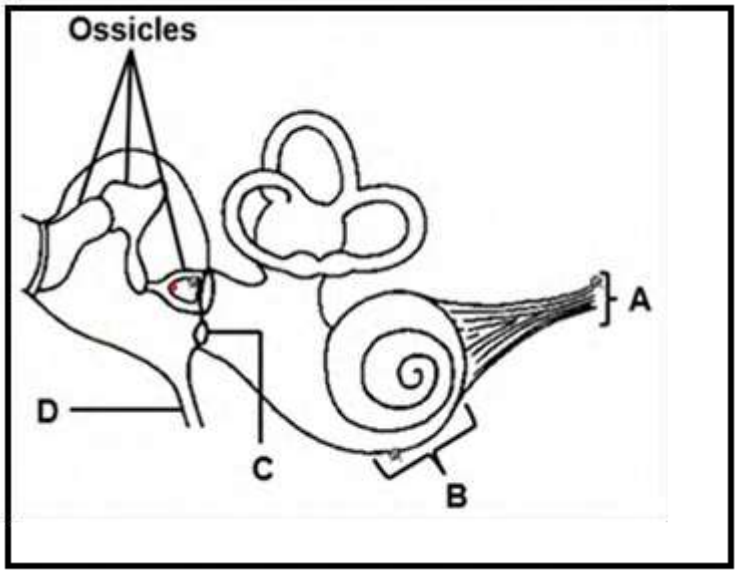
8.4 Explain why damage to the auditory nerve may result in hearing loss. (2)

8.5 Draw a bar graph to represent the data in the table. (6)

(13)

Question 9

The diagram below represents a part of the ear.



Identify part:

9.1 (a) **A** (1)

(b) **B** (1)

9.2 State the function of part:

(a) **C** (1)

(b) **D** (1)

Otosclerosis is a medical condition that prevents the ossicles from vibrating.

9.3 Explain how this condition will affect hearing**.** (4)

9.4 Describe the role of the ear in maintaining balance. (6)

(14)

TOPIC : HUMAN ENDOCRINE SYSTEM AND HOMEOSTASIS

Diagnostic Analysis

Common Errors and Misconceptions	Possible solutions
• Terminology related to hormones is often confused eg. *glycogen* and *glucagon*	✓ The correct *meaning* and well as *spelling* of biological terms must be emphasized
• Confusion between an organ and organelles e.g., kidney is required but renal tubules, nephron is written which are not organs.	✓ Basic understanding of organs as collection of tissues must be emphasized as well as organelle which is a small structure in a cell that is surrounded by a membrane.
• The hormones are not correctly associated with their correct homeostatic processes eg. *aldosterone*, with the homeostasis of the *salt levels* and *ADH* with *osmoregulation*.	✓ The names of hormones, and the details of the homeostatic processes that they control, must be tabulated so that they are easily linked
• When explaining *homeostasis,* credit is lost when key words are left out, such as 'more', 'increases', 'reabsorbed' and 'in the blood'. Credit is lost if it is stated that salt concentration increases in *the body*. The term r*eabsorption* is confused with *absorption.*	✓ Descriptions and explanations on homeostatic processes must be clear and accurate eg. when the adrenal glands are stimulated, they produce *more aldosterone*, which *increases the permeability* of the renal tubules, and *more salt* is *reabsorbed into the blood*.
• When explaining the effect of exercise on *skin temperature* it is confused with the effect of exercise on body temperature. *Vasodilation* is confused with *vasoconstriction.*	✓ Questions that are presented in a new context require *application* of knowledge. It is therefore not sufficient to write generic accounts of thermoregulation. The answers required must be in the context of the question/data given.

Question 1

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION	TERM
1.1	A gland whose secretions are transported through blood streams.	
1.2	A system that is responsible for chemical coordination in the body.	
1.3	A hormone that stimulates ovulation in humans	
1.4	The process of maintaining a constant internal environment in the human body	
1.5	A gland whose secretions are transported through ducts.	
1.6	A hormone that stimulates mammary gland to produce milk.	
1.7	A hormone that is responsible for osmoregulation in the body.	
1.8	Specialized cells in the pancreas that secretes insulin and glucagon.	
1.9	A hormone responsible for secondary sexual characteristics in males	
1.10	A hormone that is responsible for maintaining salt balance in the blood.	
1.11	A gland that secretes FSH and LH in females.	
1.12	Chemical messengers produced by endocrine glands.	
1.13	A gland located in the neck that secretes thyroxin hormone.	
1.14	A hormone that controls the metabolic rate in the body.	
1.15	A hormone that increases the blood glucose level in the body.	
1.16	A hormone that lowers the blood glucose level in the body.	
1.17	Promotes the secretions of hormones produced by thyroid glands.	
1.18	A mechanism that detects imbalances and restores balance in the internal environment	
1.19	A hormone responsible for growth and development in the body.	
1.20	The blood vessel in the neck that contains receptors which are sensitive to carbon dioxide levels in the blood	
1.21	A hormone that stimulates the production of milk in humans	
		(21 x 1) **(21)**

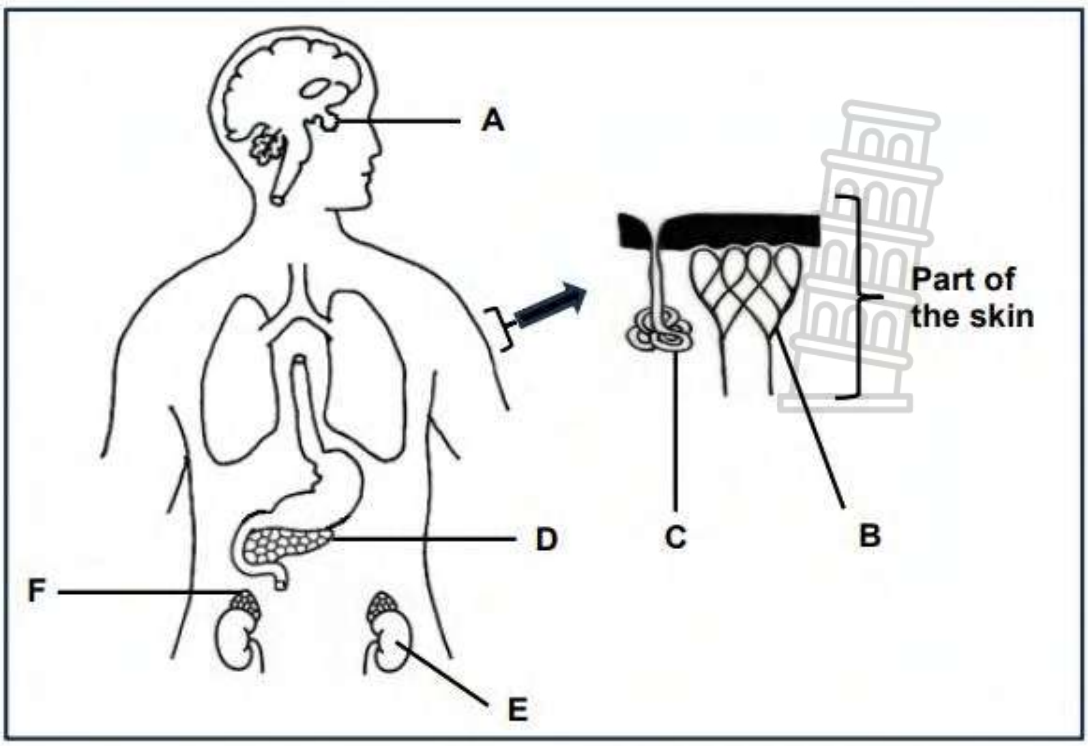
Question 2

Indicate whether each of the descriptions 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.

	COLUMN I	COLUMN II
2.1	The hormone that is in excess in a person that grows abnormally tall	A: ADH B: Thyroxin
2.2	A hormone that controls the salt content in a human body	A: Aldosterone B: Adrenalin
2.3	The state of the blood vessels in the skin of a human when the environmental temperature is high	A: Dilated B: Constricted
2.4	May cause a decrease in the pH of the blood	A: excess carbon dioxide B: excess glucose
2.5	Acts both as an endocrine and exocrine gland	A: Adrenal B: Pancreas
2.6	Part of the brain responsible for thermoregulation	A: Hypothalamus B: Hypophysis
		(6x2) **(12)**

Question 3

3.1 The diagram below represents some structures involved in homeostasis in the human body.



3.1.1 Write the LETTERS of the parts that serve as endocrine glands only. (2)

3.1.2 Give the LETTERS and NAMES of the parts responsible for the regulation of body temperature. (4)

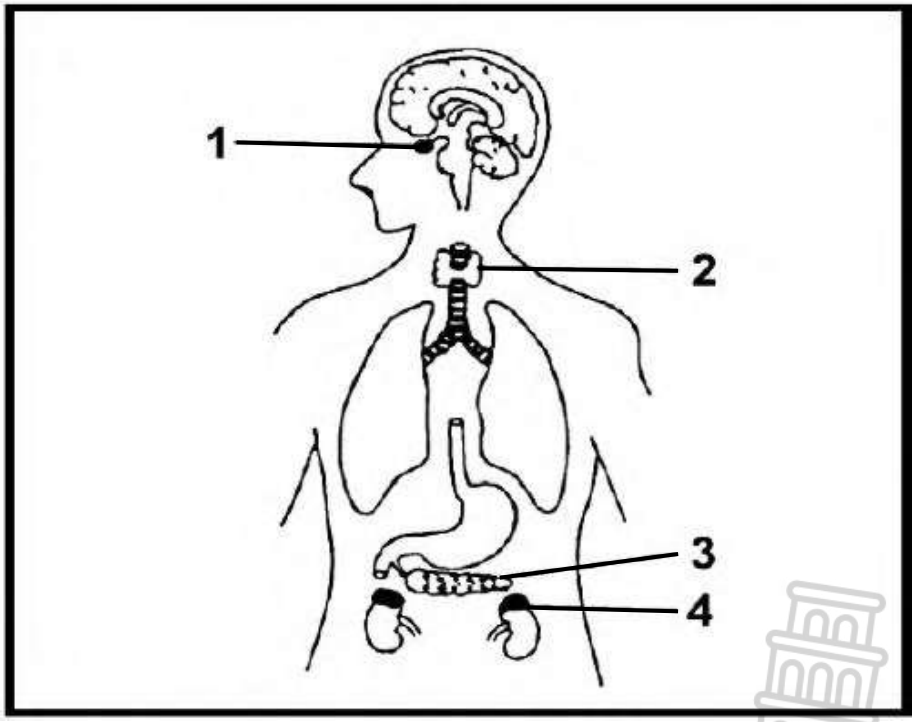
3.1.3 Name the following with regard to the regulation of water content in the blood:

(a) Hormone secreted by part **A** (1)

(b) Target organ **E** (1)

(8)

3.2 The diagram below represent human endocrine system



3.2.1 Identify part **1** and **4** (2)

3.2.2 Write down the LETTER and the NAME of the part that

(a) Produces the hormone glucagon (2)

(b) Produces a hormone that controls the growth of long bones (2)

(c) Produces an iodine-containing hormone (2)

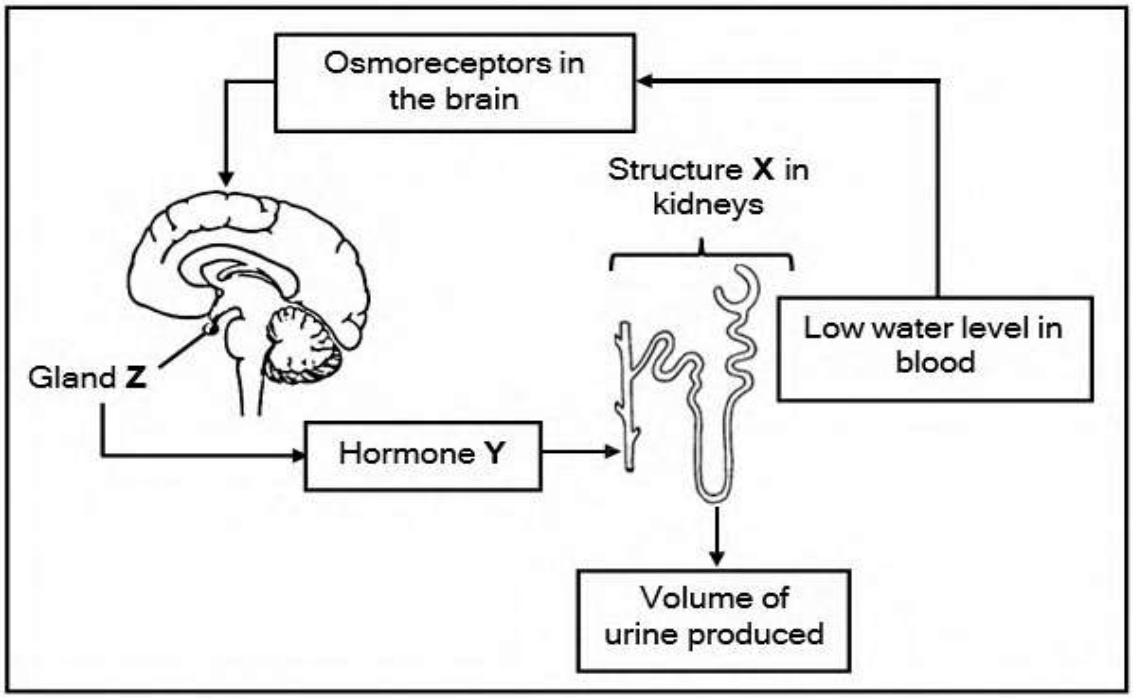
(d) Produces a hormone that is involved in the re-absorption of some salts by the kidneys (2)

3.2.3 State TWO similarities between hormones and nerves with regard to their functions. (2)

(12)

Question 4

The diagram below represents a homeostatic mechanism in the human body when water levels are low.



4.1 Identify parts:

(a) The part of the brain where the osmoreceptors are located (1)

(b) Gland Z (1)

(c) Hormone Y (1)

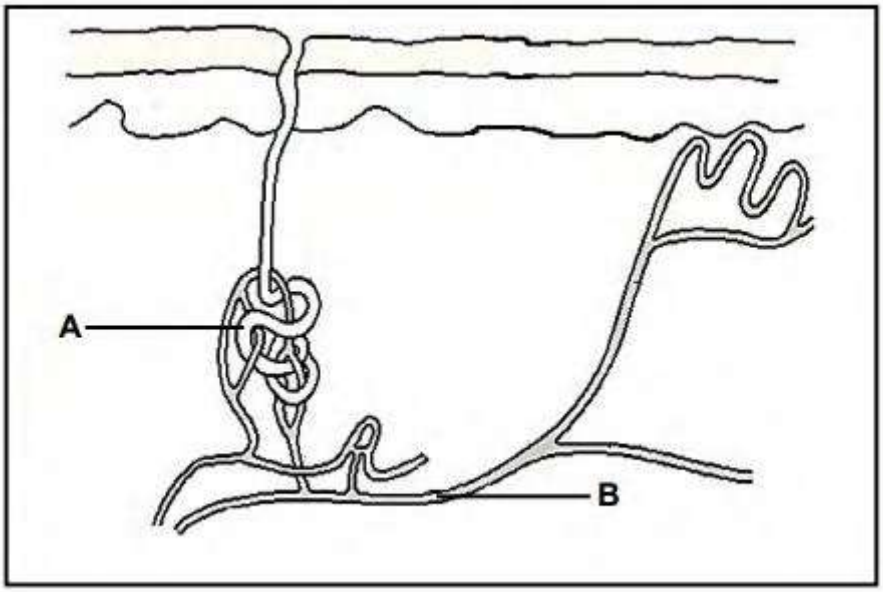
(d) Structure X (1)

4.2 State whether the volume of urine produced will increase or decrease for this individual. (1)

(5)

Question 5

The diagram below represents a part of the human skin



5.1 Identify part A. (1)

5.2 Describe how structure B functions during thermoregulation on a cold day. (3)

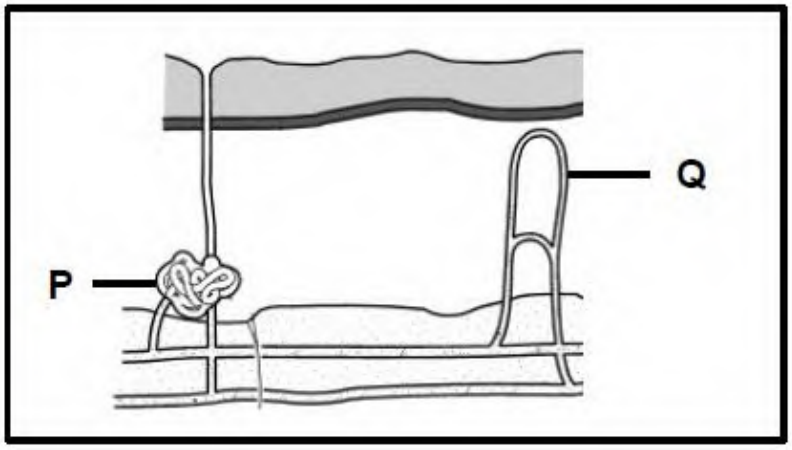
5.3 Explain why temperature needs to be kept constant in the human body. (2)

(6)

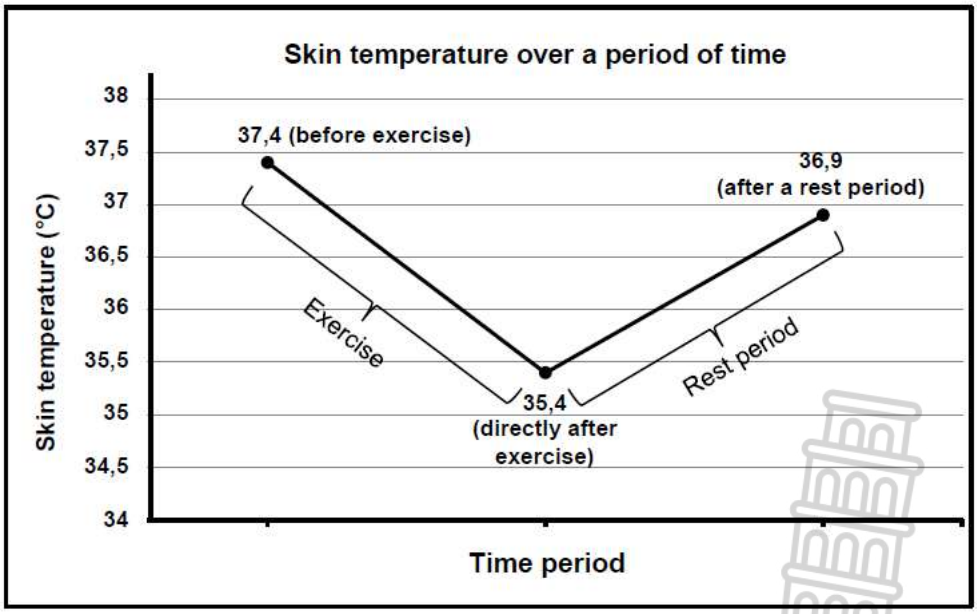
Question 6

A twelve-year-old boy participated in physical exercise for 45 minutes, followed by a 15-minute rest period. The skin temperature of the boy was measured and the results were recorded.

The diagram below represents the skin of the boy before exercise.



The graph below shows the changes in skin temperature over a period of time.



6.1 Name the:

(a) Homeostatic mechanism that brings about the change in skin temperature (1)

(b) Part of the brain that is responsible for the mechanism named in QUESTION 6.1 (a) (1)

6.2 From the diagram, identify the following parts:

(a) **P** (1)

(b) **Q** (1)

6.3 Calculate the percentage decrease in the average skin temperature of the boy before and directly after exercise.
Show ALL working. (3)

6.4 Explain the roles of part **P** and **Q** in the change in skin temperature from before exercise to directly after exercise. (6)

(13)

Question 7

The blood glucose levels in a healthy person, when not eating, is between 3,9 and 7,1 mmol/L of blood.

The table below shows the blood glucose levels in a healthy person who ate only one meal.

TIME (hours)	BLOOD GLUCOSE LEVEL (mmol/L)
07:00	4,2
08:00	4,2
09:00	8,4
10:00	7,6
11:00	7,1
12:00	5,1
13:00	4,8
14:00	3,1
15:00	4,1
16:00	4,3
17:00	4,6

7.1 Name the:

(a) TWO hormones involved in the normal homeostatic control of blood glucose levels (2)

(b) Organ in human body that secrete the hormones named in QUESTION 7.1 (a) (1)

7.2 Between which hours of the day did the person eat? (1)

7.3 Using evidence from the table, give ONE reason for your answer to QUESTION 7.2. (2)

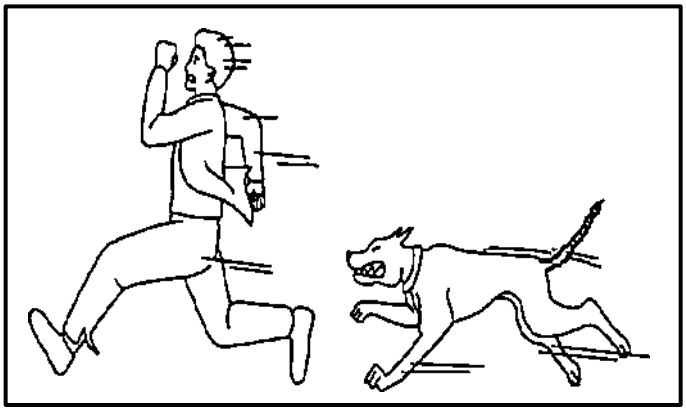
7.4 Explain the change in blood glucose levels between 14:00 and 15:00. (4)

7.5 Describe how blood glucose levels would have been different after 10:00 if the person suffered from diabetes mellitus. (2)

(12)

Question 8

8. The diagram below represents a 'fight or flight' reaction in humans.



8.1 Name the gland that is responsible for this reaction. (1)

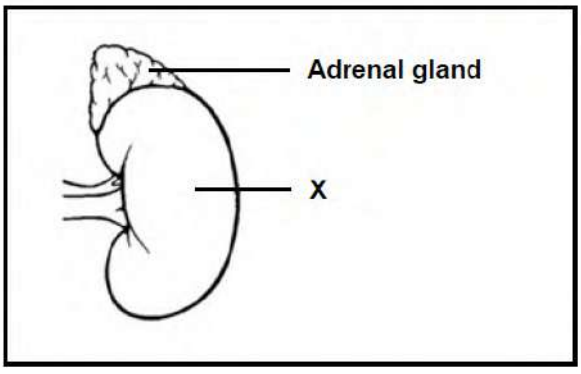
8.2 State the location of the gland named in QUESTION 8.1.1 in the human body. (1)

8.3 Explain the effect of adrenalin on the heart and the respiratory system during the situation shown in the diagram above. (5)

(7)

Question 9

The diagram below shows the location of the adrenal gland in the human body.



9.1 Identify:

(a) Organ X (1)

(b) The system to which the adrenal gland belongs (1)

9.2 State TWO characteristics of the type of glands that belongs to the system identified in QUESTION 9.1(b). (2)

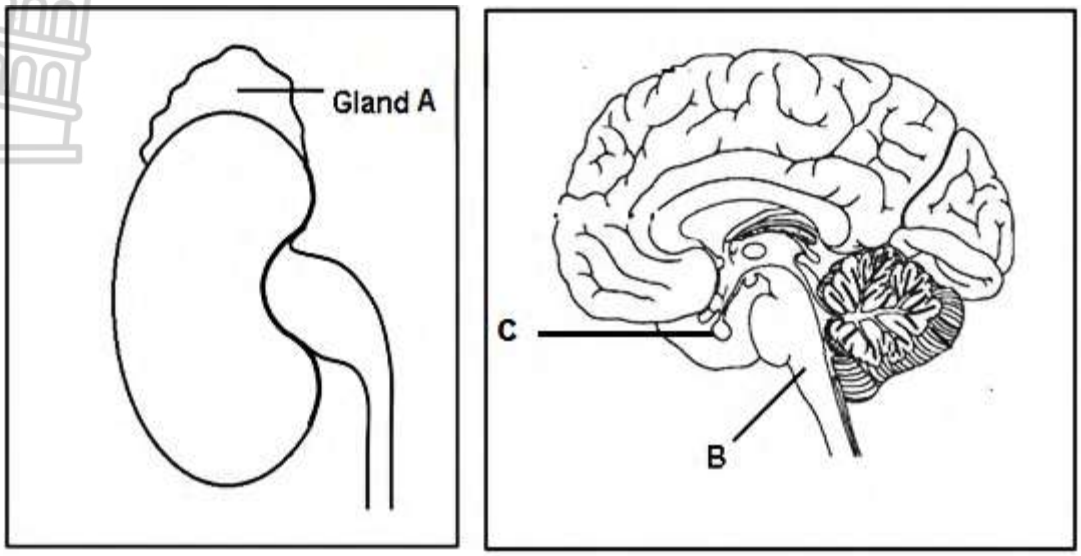
9.3 Describe the interaction between the adrenal gland and organ **X** in maintaining homeostasis when salt levels in the blood are low. (5)

9.4 Explain the effect that a secretion of the pituitary gland will have on organ **X** when a person experiences dehydration. (5)

(14)

Question 10

The diagrams below show the human kidney and human brain.



10.1 Name the hormone secreted by gland **C** that has an effect on:

(a) Long bones (1)

(b) Mammary glands in the breasts (1)

10.2 During an emergency, gland **A** releases a hormone that prepares the body for a 'fight or flight' response by stimulating an increase in breathing rate and heart rate. This increase leads to increased energy production in the skeletal muscles and an increase in blood carbon dioxide levels.

(a) Name the hormone secreted by **gland A** in an emergency situation. (1)

(b) Explain how an increase in breathing rate and heart rate results in increased energy production in skeletal muscles. (4)

10.3 Describe how **part B** is involved in carbon dioxide homeostasis (4)

(11)

Question 11

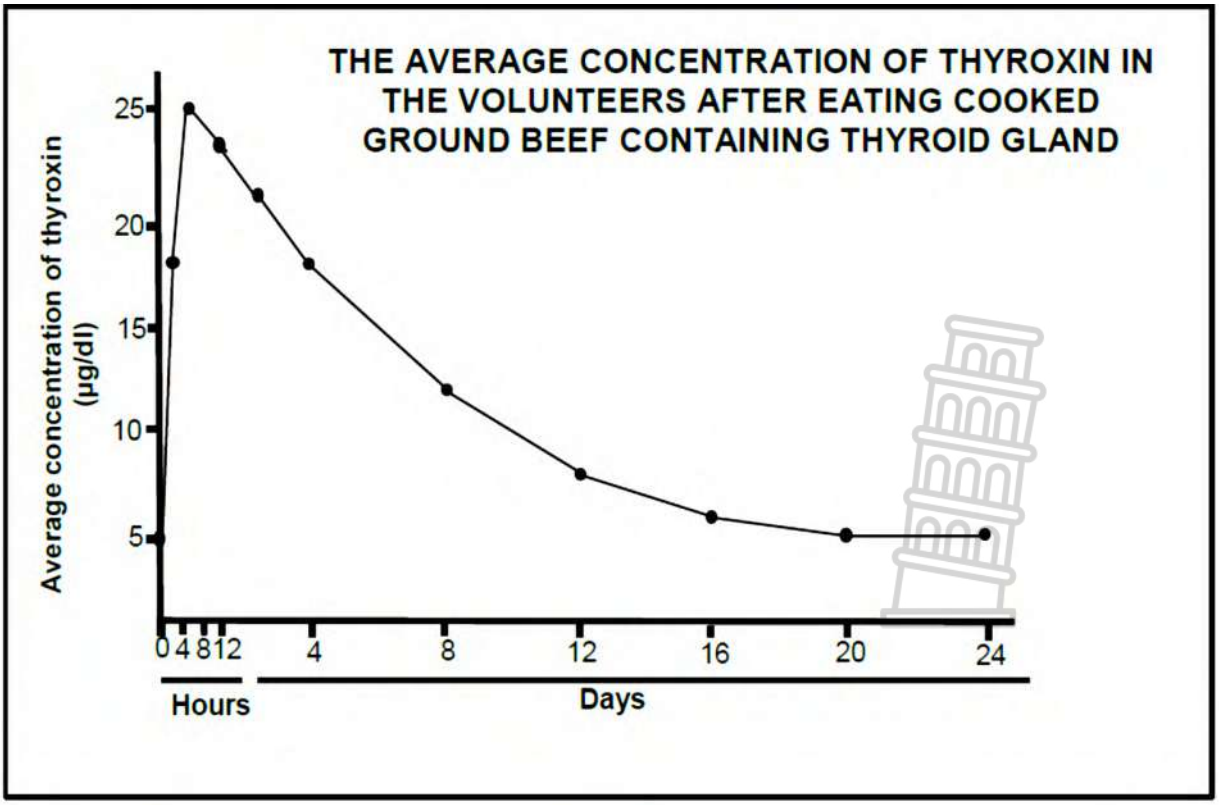
Read the extract below.

AN OUTBREAK OF THYROTOXICOSIS

Thyrotoxicosis is a medical condition caused by high levels of thyroxin in the blood. There was a sudden increase in the number of reported cases of this condition in one city. They suspected that this was due to people eating ground beef (minced meat) from a local butcher. The butcher added the thyroid glands of cattle when he produced the ground beef. Some people who ate this ground beef showed symptoms of increased heart rate, excessive sweating and weight loss.

Doctors conducted an investigation to determine if the ground beef caused the thyrotoxicosis. The normal thyroxin levels of 5 volunteers were measured. They were then given cooked ground beef from the butchery to eat. Their thyroxin concentration was measured every **4 hours on day 1** and then **once a day for the next 23 days**. The average thyroxin levels was calculated and recorded.

The results are shown in the graph below.



11.1 Give the average normal thyroxin concentration in the blood of the volunteers. (1)

11.2 Calculate the percentage increase of the average thyroxin concentration in the first 8 hours after eating the ground beef. Show ALL working. (3)

11.3 Explain why thyrotoxicosis causes weight loss. (3)

11.4 Explain the expected concentration of TSH in the blood 8 hours after eating the ground beef (4)

(11)

Question 12

The table below shows the average rate of blood flow to the skin at different environmental temperatures.

ENVIRONMENTAL TEMPERATURE (°C)	AVERAGE RATE OF BLOOD FLOW TO THE SKIN (mℓ /100 mℓ tissue/min)
0	2,5
5	4
20	4,5
35	11
45	18
50	19

12.1 Give the environmental at which there was the greatest average rate of blood flow to the skin. (1)

12.2 Describe the relationship between the environmental temperature and the average rate of blood flow to the skin. (2)

12.3 Calculate the percentage increase in blood flow to the skin between 5°C and 35°C. Show ALL your workings. (3)

12.4 Explain the average rate of blood flow to the skin between 20°C and 45°C (4)

12.5 Frostbite is a condition where long term exposure to extremely cold condition (0°C or less) leads to the death of tissue in areas like the hands and feet. (2)

Use the data from the table to explain why tissue may die **(12)**

Question 13

An investigation was carried out to determine the effect of caffeine on the body temperature and pulse rate. A group of 200 men participated in the investigation.

The procedure was as follows:

- At the start of the investigation each man's body temperature was measured, and the average of all the participants was calculated.
- Also, at the start of the investigation each man's pulse rate was measured, and the average of all the participants was calculated.
- The men each drank 100 ml of an energy drink containing the same amount of caffeine.
- Their body temperature was then measured every 15 minutes for a period of 1 hour, and an average of all the participants was calculated.
- Also, their pulse was then measured every 15 minutes for a period of 1 hour, and the average of all the participants was calculated.
- All the participants were seated during the period of investigation.

13.1 Describe the effect that caffeine had on body temperature and pulse rate after 15 minutes. (2)

13.2 How long after drinking the energy drink did the caffeine have its maximum effect? (1)

13.3 Caffeine causes vasoconstriction and an increase in metabolism

Explain how these effects contribute to the temperature change that occurred. (4)

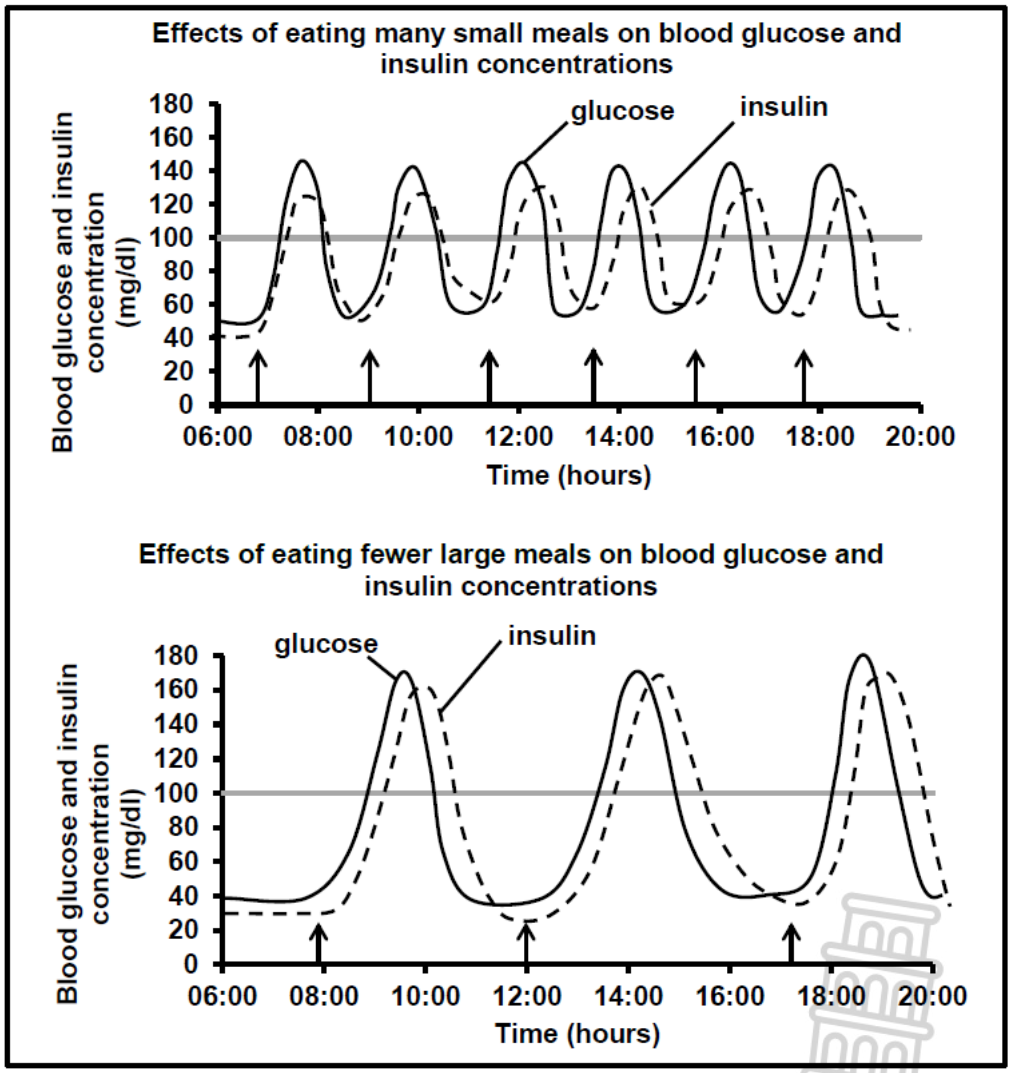
13.4 State TWO factors that were kept constant during this investigation (2)

(9)

Question 14

The graphs below show the effects of eating many small meals and eating fewer large meals on blood glucose and insulin concentrations in a normal person.

The arrows on the graphs below indicate when meals were eaten. The normal blood glucose concentration is 100 mg/dl.



14.1 State what happens to the blood glucose concentration immediately after a meal is eaten. (1)

Use the information in the graphs.

14.2 Explain why eating many small meals per day is better for a diabetic person than eating fewer larger meals a day. (5)

14.3 Tabulate TWO ways in which eating fewer large meals and eating many small meals affect the blood insulin levels differently. (4)

(10)

Question 15

15.1 Describe the negative feedback mechanism that occurs when thyroxin levels in the blood are high (5)

15.2 A person has a medical condition that results in the under-secretion of thyroxin.

Explain why this person will gain weight if the thyroxin levels remain continuously low in the blood (3)

(8)

Question 16

16.1 Name the hormone that is secreted the person's body in response to a dangerous situation. (1)

16.2 State THREE effects that the hormone in QUESTION 14.1 has on the body. (3)

16.3 Describe the homeostatic control of blood glucose levels in a person who consumed a drink with large amount of sugar (5)

(9)

Question 17

17. An investigation was conducted to determine the effect of insulin on blood glucose levels.

The procedure was as follows:

- Two groups of ten people each were selected.
- One of the groups consisted of healthy individuals and the second group, which served as a control, consisted of people with diabetes.
- Each group was given 75 g of glucose to ingest.
- Their blood was tested again after 60 and 90 minutes to determine the levels of glucose and insulin.

NOTE:

- The normal level of glucose in the blood is between 3,9 mmol/ℓ and 5,6 mmol/ℓ.
- The normal level of insulin in the blood, 60 minutes after glucose ingestion, is between 18 mU/ℓ and 276 mU/ℓ.

The results are recorded in the table below.

	GROUP X			GROUP Y		
Time after glucose ingestion (minutes)	0	60	90	0	60	90
Average level of glucose in blood (mmol/ℓ)	6,8	8,9	8,7	4,5	6,2	4,5
Average level of insulin in blood (mU/ℓ)	4	2	2	8	142	108

17.1 State the purpose of the control group in this investigation. (2)

17.2 Describe TWO ways in which insulin decreases blood glucose levels. (4)

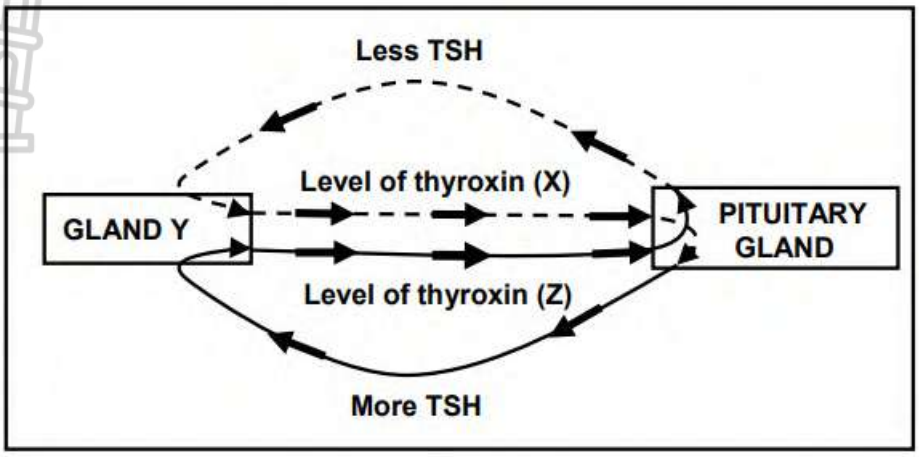
17.3 Which group (**X** or **Y**) consists of healthy individuals? (1)

17.4 Use data in the table to explain your answer to QUESTION 17.3. (3)

(10)

Question 18

The flow diagram below shows the homeostatic control of thyroxin in the human body.



18.1 Identify:
- (a) The type of interaction represented by the diagram (1)
- (b) Gland Y (1)
- (c) The disorder that is characterized by the enlargement of gland Y (1)

18.2 State ONE function of thyroxin (1)

18.3 Describe the role of the pituitary gland in correcting the level of thyroxin at X. (4)

18.4 Explain why a continuous under-secretion of thyroxin may lead to an increase in body mass. (2)

(10)

Question 19

Describe how the human body maintain the carbon dioxide concentration in the blood when it rises above normal limits. **(7)**

Question 20

Describe the role of different glands of the endocrine system in providing the body with extra energy during a dangerous situation. **(9)**