



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

CURRICULUM GRADE 10-12 DIRECTORATE

NCS (CAPS)

LEARNER SUPPORT WINTER DOCUMENT

GRADE 12

LIFE SCIENCES

JUST IN TIME

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TOPIC: DNA CODE OF LIFE

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	The bond formed between two amino acids during protein synthesis	
1.18	An organelle that contains DNA which is used in tracing female ancestry	
1.19	The DNA-containing cell organelle found only in plants	
1.20	A change in the sequence of nitrogenous bases resulting in the formation of a different protein	
	(20 x 1)	(20)

Question 2

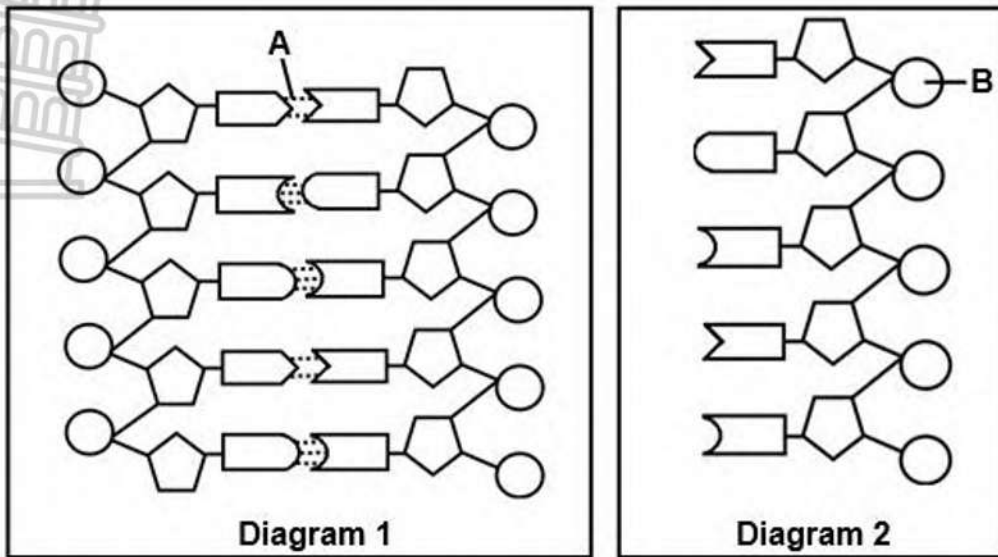
Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number.

	Column I	Column II
2.1	Discovered of the structure of the DNA molecule	A: Franklin and Wilkins B: Lamarck and Darwin
2.2	Location of DNA in plants	A: Nucleus B: Chloroplast
2.3	The organelle where DNA is found in animals	A: Mitochondria B: Chloroplast
2.4	Proposed a model of DNA structure	A: Mendel and Watson B: Watson and Crick
2.5.	Contains thymine	A: tRNA B: mRNA
	(5 x 2)	(10)



Question 3

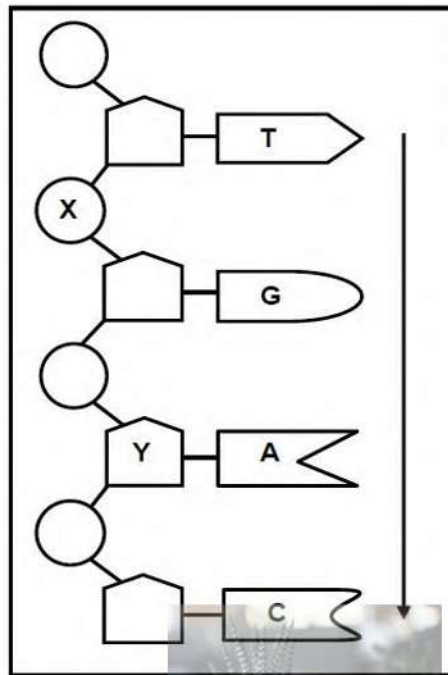
The diagrams below represent two types of nucleic acids.



- 3.1 Identify the nucleic acid shown in diagram 1. (1)
- 3.2 Identify: (1)
 - (a) A (1)
 - (b) B (1)
- 3.3 Name the type of sugar found in the nucleic acid represented in diagram 2. (1)
- 3.4 Which diagram (1 or 2) represents a nucleic acid that is used for: (1)
 - (a) Tracing of human ancestry (1)
 - (b) Paternity testing (1)

Question 4

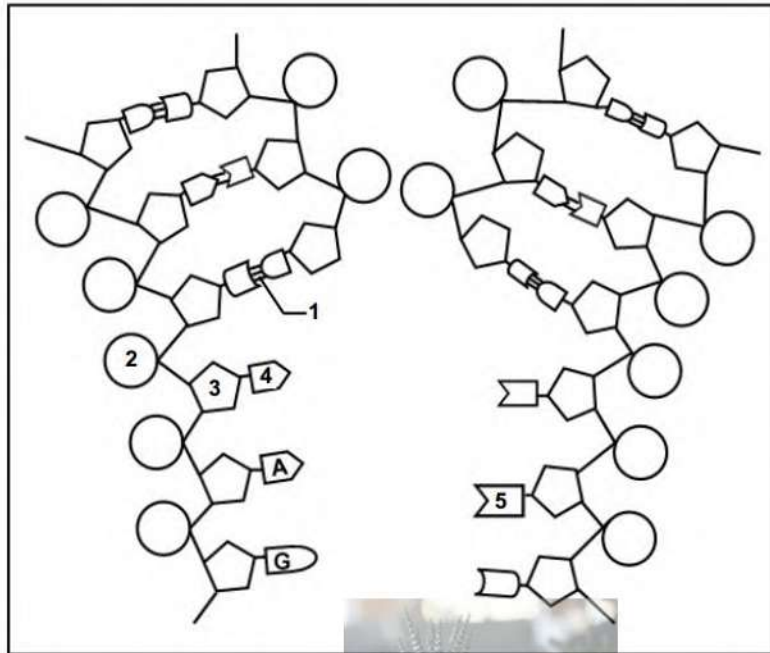
The diagram below represents some nucleotides in a single strand of DNA.



- 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

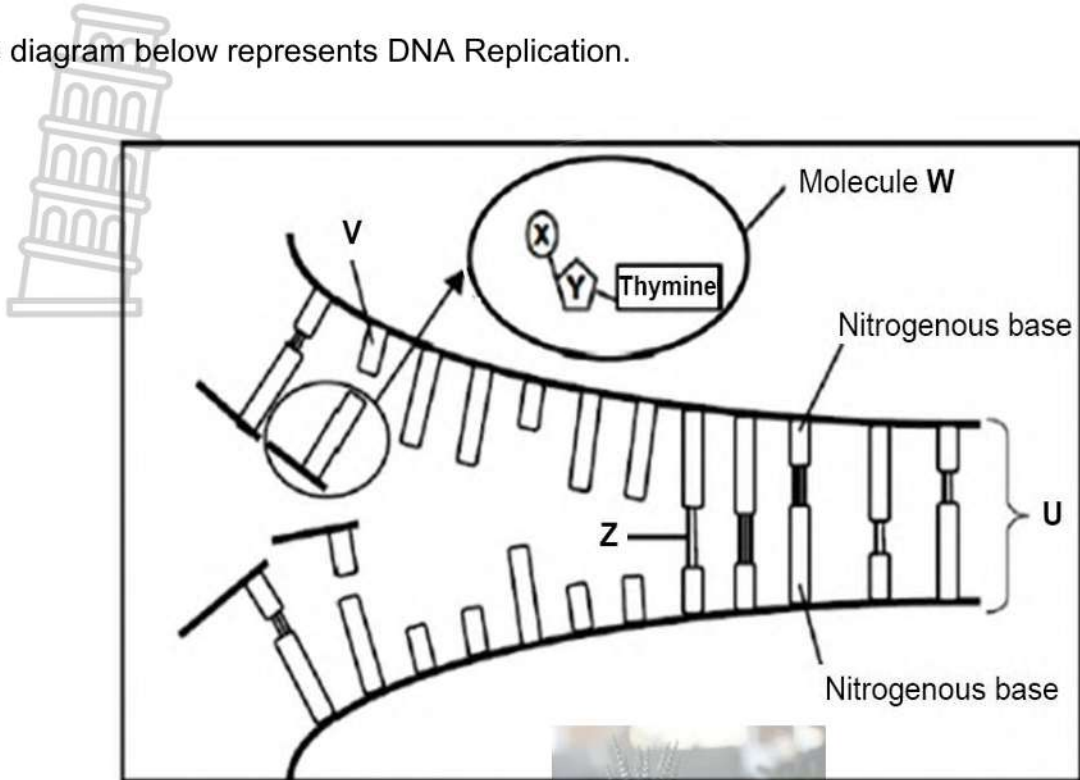
The diagram below represents a DNA molecule undergoing an important biological process.



- 5.1 Identify the :
(a) Process shown in the diagram (1)
(b) Chemical bond labelled 1 (1)
- 5.2 Give the :
(a) Collective name for the parts labelled 2, 3 and 4 (1)
(b) Full name of nitrogenous base labelled 5 (1)
- 5.3 During which phase of the cell cycle does this process take place? (1)
- 5.4 Where in the cell does the process occur? (1)
- (6)**

Question 6

The diagram below represents DNA Replication.



6.1 Identify the following:

- (a) Molecules **W** and **U**.
- (b) Parts of molecule **W** labelled **X** and **Y**.
- (c) Bond **Z**.
- (d) Nitrogenous base **V**.

(2)

(2)

(1)

(1)

6.2 Where in the cell does this process take place?

(1)

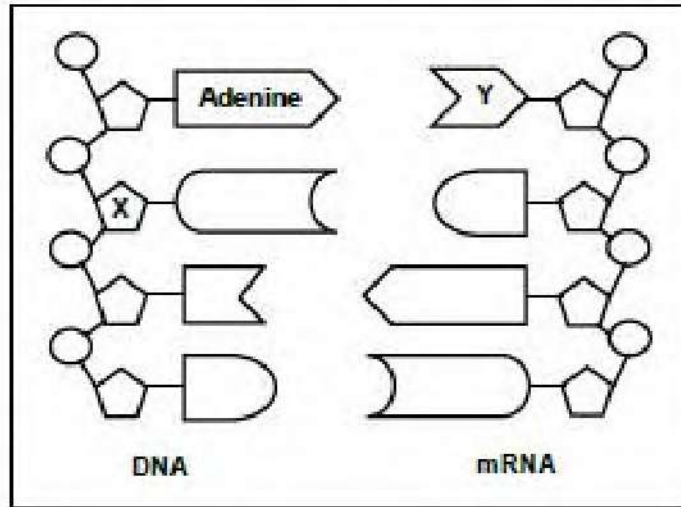
6.3 Name the phase of the cell cycle where replication takes place.

(1)

(8)

Question 7

The diagram below represents transcription during protein synthesis.

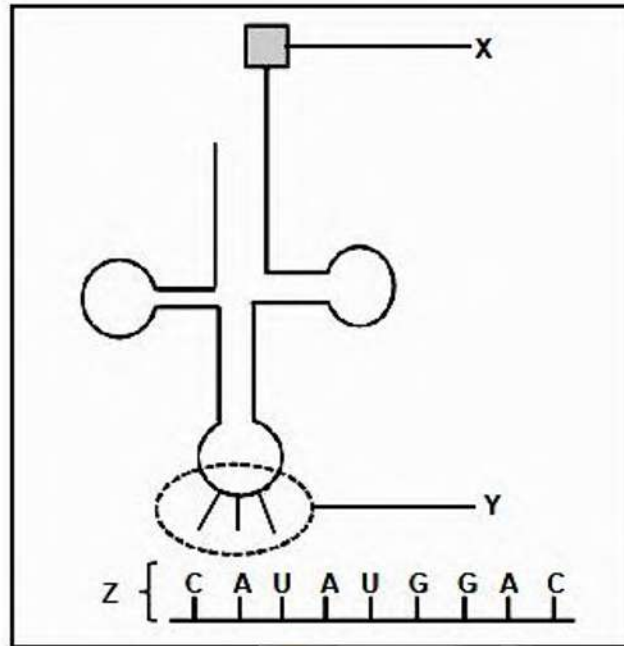


- 7.1 Name the part of the cell where this process occurs (1)
- 7.2 Identify: (1)
 - (a) Sugar X (1)
 - (b) Nitrogenous base Y (1)
- 7.3 Tabulate TWO differences between transcription and DNA replication (5)



Question 8

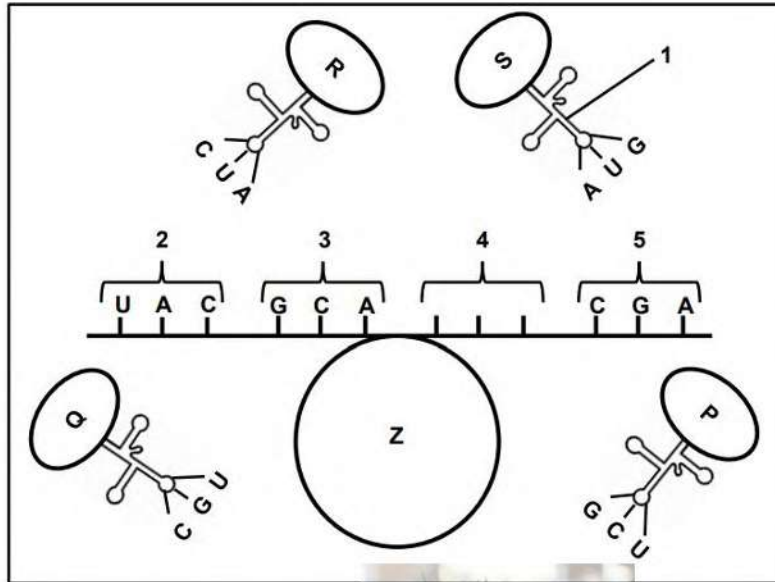
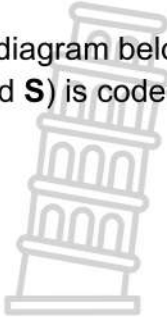
The diagram below represents a process that occurs during protein synthesis.



- 8.1 Identify molecule:
- (a) X (1)
 - (b) Z (1)
- 8.2 Give the nitrogenous base sequence of:
- (a) The DNA base triplet complementary to the middle codon on molecule Z. (2)
 - (b) Y (1)
- 8.3 Name and describe the process shown in the diagram during the formation of a protein. (7)
- (12)**

Question 9

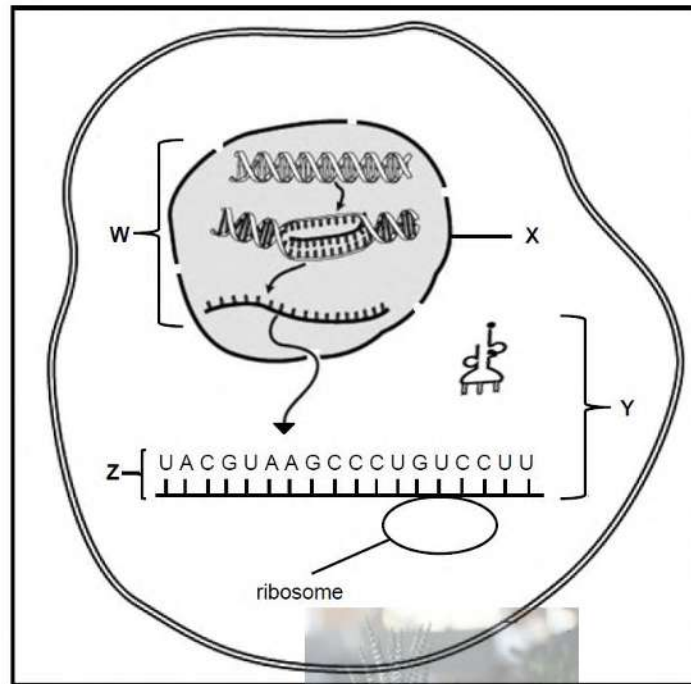
The diagram below represents a stage of protein synthesis. Each amino acid (**P**, **Q**, **R** and **S**) is coded for by a different codon on this mRNA molecule.



- 9.1 Identify:
- (a) The stage of protein synthesis represented (1)
 - (b) Molecule 1 (1)
 - (c) Organelle Z (1)
- 9.2 State the sequence of nitrogenous bases on the DNA molecule for codon:
- (a) 3 (1)
 - (b) 4 (2)
- 9.3 Which amino acid (P, Q, R or S) is coded for by codon 5? (1)
- (7)**

Question 10

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



- 10.1 Name the process which occurs at:
- (a) **W** (1)
 - (b) **Y** (1)
- 10.2 Identify:
- (a) Organelle **X** (1)
 - (b) Molecule **Z** (1)
- 10.3 State TWO locations of DNA in a cell, other than in the nucleus. (2)
- 10.4 Describe the process at
- (a) **W** (7)
 - (b) **Y** (6)

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

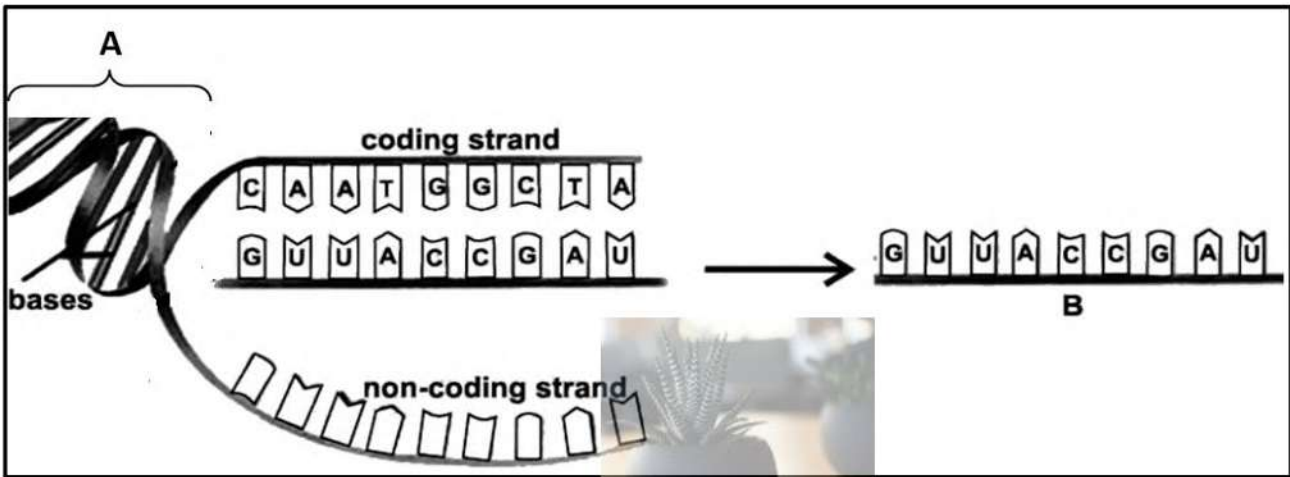
tRNA ANTICODON	AMINO ACID
CAG	Valine
GAA	Leucine
AUG	Tyrosine
GGA	Proline
UCG	Serine
CAU	Valine

- 10.5 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)

- 10.6 What is the change in the sequence of nitrogenous bases in a DNA molecule called? (1)
- 10.7 The codon CUU (last codon) on molecule **Z** changed to CCU. Explain the effect it would have on this particular protein molecule. (3)
- (26)**

Question 11

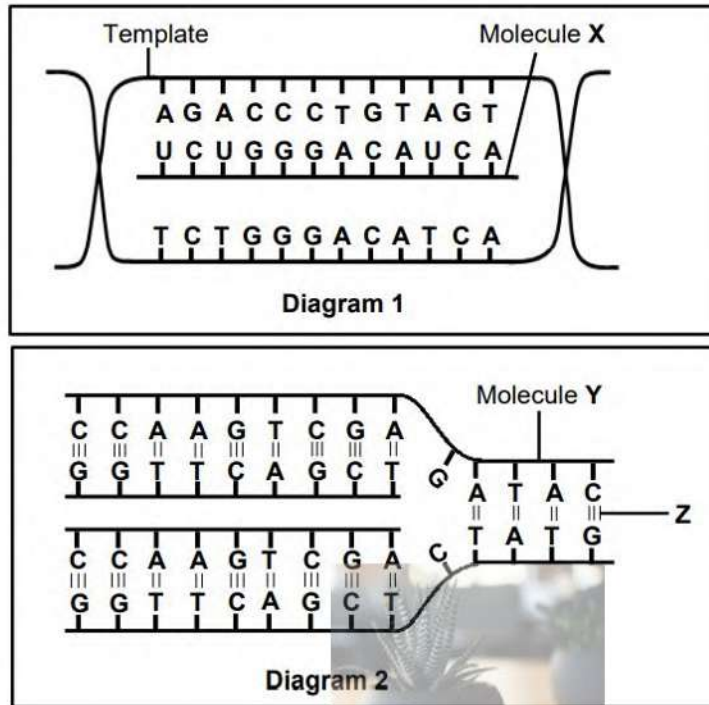
The diagram below shows parts of Protein synthesis.



- 11.1 Name the process shown in the diagram above. (1)
- 11.2 Identify molecule **B**. (1)
- 11.3 State TWO functions of molecule **A**. (2)
- 11.4 Tabulate TWO observable differences between molecules **A** and **B**. (5)
- 11.5 Describe the process that is responsible for the formation of molecule **B**. (6)
- 11.6 Explain how the protein molecule would be affected if codon GUU is changed to GUC on molecule **B**. (3)
- (18)**

Question 12

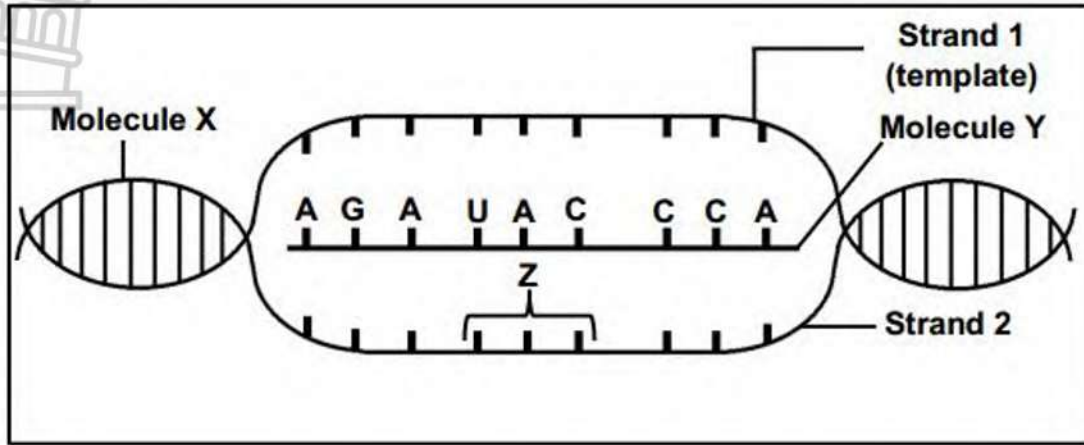
The diagrams below represent two biological processes occurring in the nucleus.



- 12.1 Name the process represented by: (1)
- (a) Diagram 1 (1)
- (b) Diagram 2 (1)
- 12.2 Identify molecule X. (1)
- 12.3 Give the: (1)
- (a) Natural shape of molecule Y (1)
- (b) Phase of the cell cycle during which the process in Diagram 2 occurs (1)
- (c) Full name of the nitrogenous base that is found in molecule X, but not in molecule Y (1)
- 12.4 Name the: (1)
- (a) Sugar found in molecule X (1)
- (b) Bond Z (1)
- 12.5 State the number of codons on molecule X. (1)
- (9)**

Question 13

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



- 13.1 Identify molecule Y (1)
- 13.2 Describe the process that resulted in the formation of molecule Y. (6)
- 13.3 Give ONE structural difference between molecule X and molecule Y. (2)
- 13.4 Give the sequence of bases at triplet Z on strand 2. (1)
- 13.5 The table below shows some amino acids coded for by codons on molecule Y. (1)

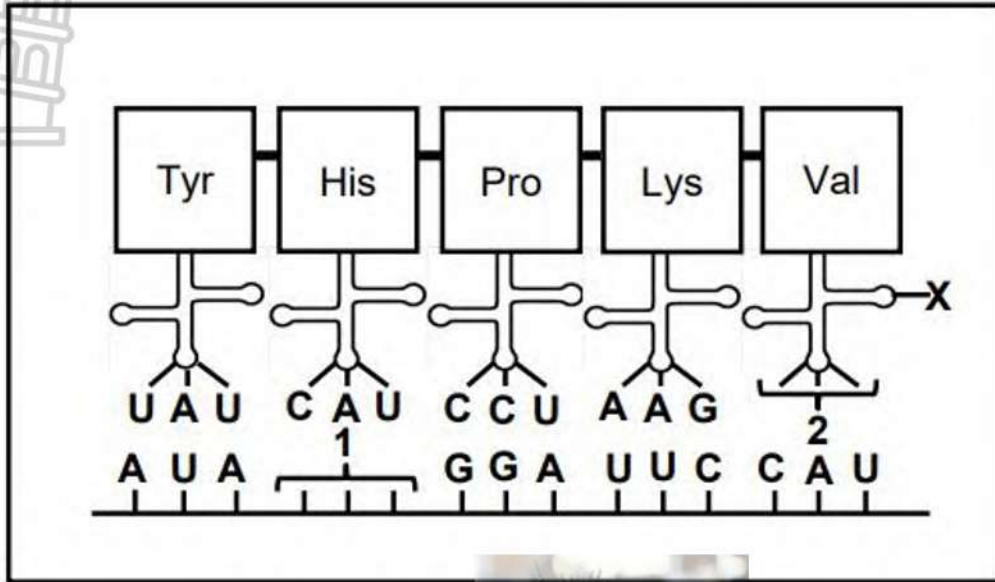
CODON	AMINO ACID
AGA	Arginine
UCU	Serine
CCA	Proline
UAC	Tyrosine
GGU	Glycine

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

(12)

Question 14

The diagram below represents a stage of protein synthesis.



- 14.1 Name the:
 (a) Stage of protein synthesis represented in the diagram (1)
 (b) Site where the process named in QUESTION 14.1 (a) occurs (1)
- 14.2 Describe the role of molecule X in protein synthesis. (2)
- 14.3 Identify the complementary bases (from left to right) representing the following:
 (a) Anticodon 2 (1)
 (b) The DNA triplet for codon 1 (1)
- 14.4 The table below represents the anticodons coding for different amino acids.

ANTICODON	AMINO ACID
UAU	Tyrosine (Tyr)
CCU	Proline (Pro)
AAG	Lysine (Lys)
GUA	Valine (Val)
CGU	Arginine (Arg)

A mutation occurs during replication. The mutation results in the amino acid proline (Pro) being replaced by arginine (Arg).

Use the table and explain how this mutation will affect the protein that is synthesised.

(7)
(13)

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

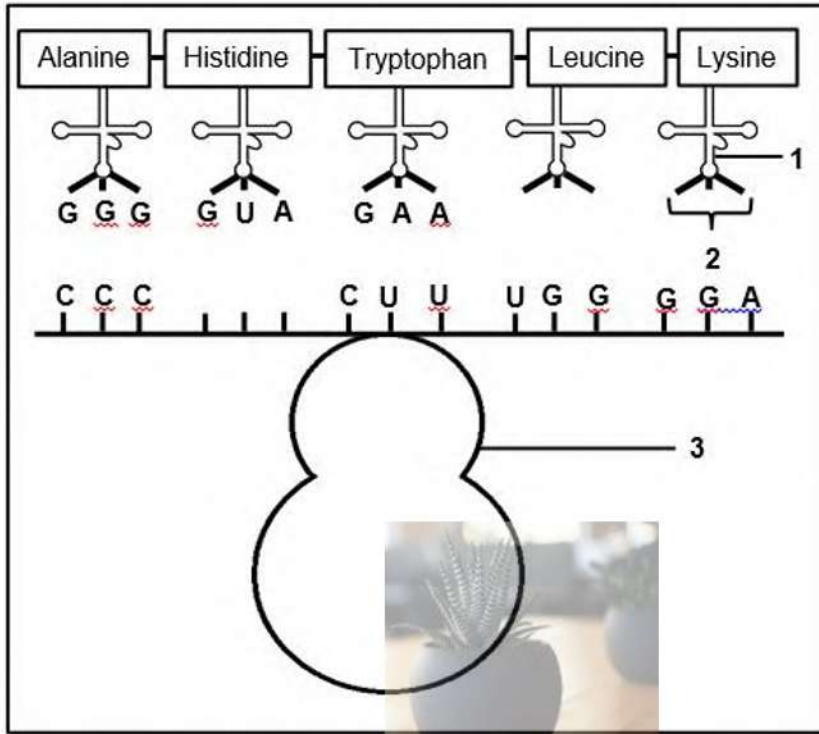
The table below shows the DNA base triplets coding for some amino acids.

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

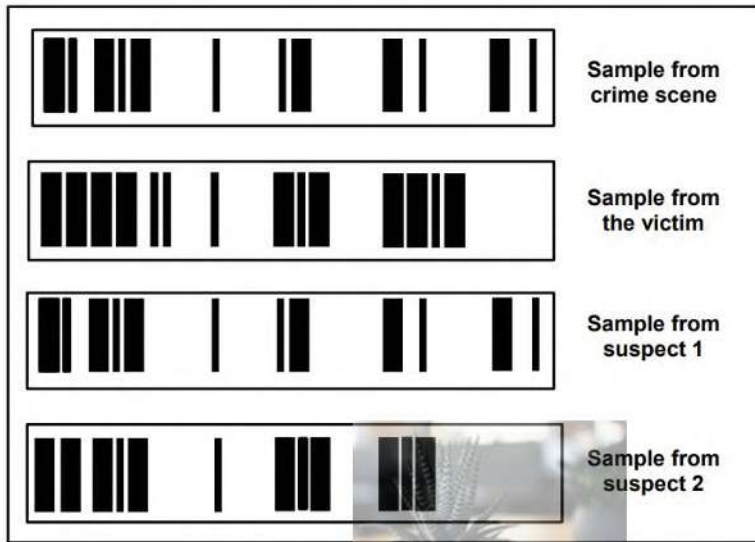
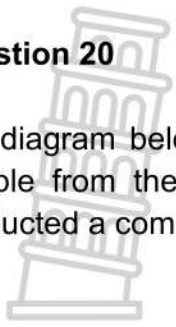
The diagram below represents a stage during the synthesis of a certain protein.



- 19.1 Identify organelle **3**. (1)
 - 19.2 Describe the role of molecule **1** during this stage of protein synthesis. (2)
 - 19.3 Give the sequence of nitrogenous bases:
 - (a) At **2** (1)
 - (b) On the DNA molecule that coded for histidine (2)
 - 19.4 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 20

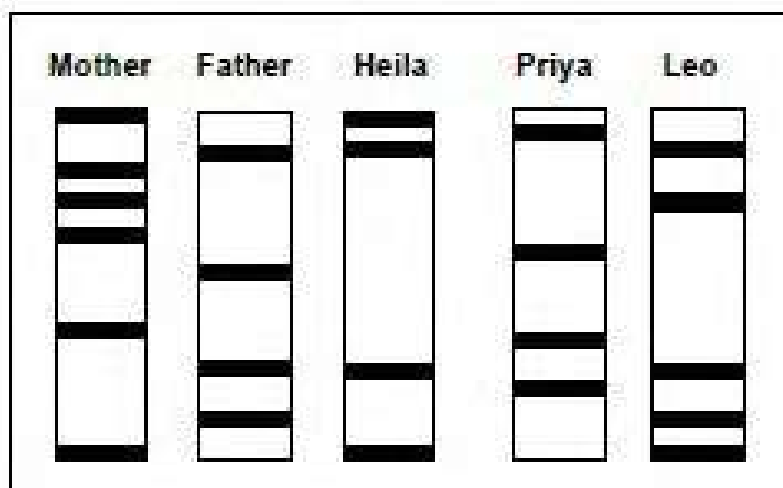
The diagram below shows the DNA analysis of a sample obtained at a crime scene, a sample from the victim and samples from two suspects. In their investigation, police conducted a comparison of the DNA to identify the criminal.



- 20.1 Name the technique used in this criminal investigation. (1)
 - 20.2 Which ONE of the suspects (1 or 2) was at the crime scene? (1)
 - 20.3 Give ONE observable reason for your answer to QUESTION 20.2. (1)
 - 20.4 Give TWO possible reasons why the suspect identified in QUESTION 20.2 might NOT be convicted if only this evidence is used. (2)
 - 20.5 Explain how the technique named in QUESTION 20.1 is used in paternity testing. (4)
- (9)**

Question 21

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

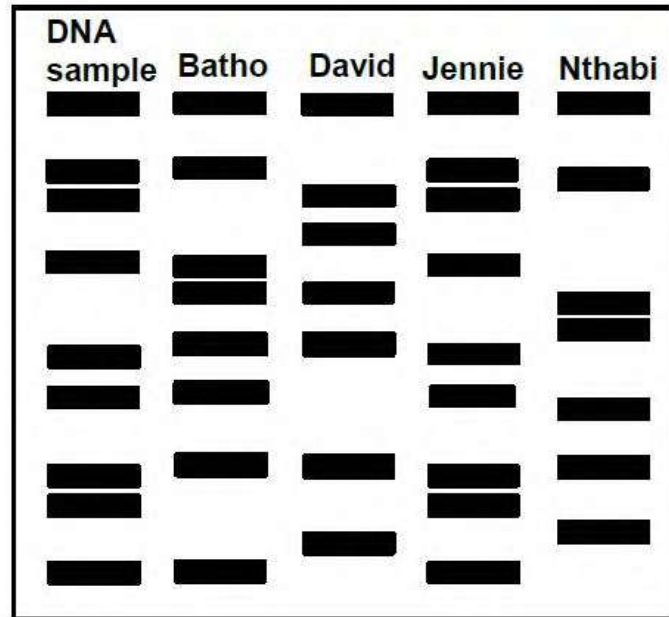


- 21.1 Identify the TWO biological children. (2)
 - 21.2 Explain your answer to QUESTION 21.1 (2)
 - 21.3 State THREE other uses of DNA profiling (3)
- (7)**



Question 22

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:



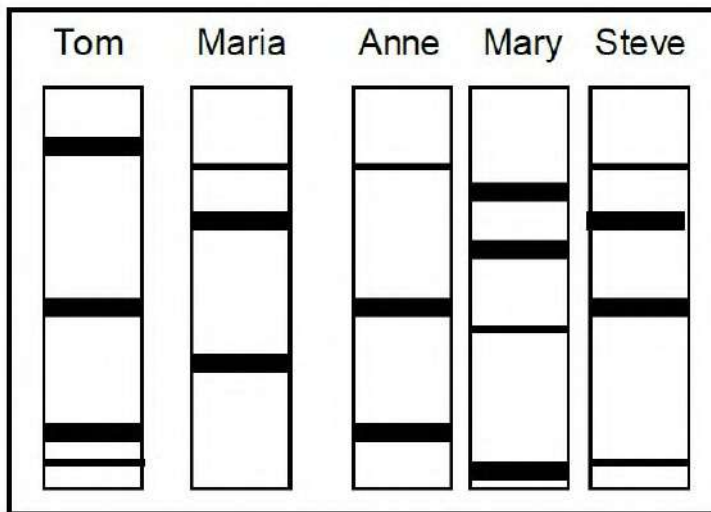
- 22.1 Name the technique that was used to identify the criminal. (1)
- 22.2 Who is the possible criminal? (1)
- 22.3 Explain your answer to QUESTION 22.2. (2)
- 22.4 State ONE other use of the technique identified in QUESTION 22.1. (1)
- 22.5 Give TWO views against the use of the technique identified in QUESTION 22.1. (2)

(7)



Question 23

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.

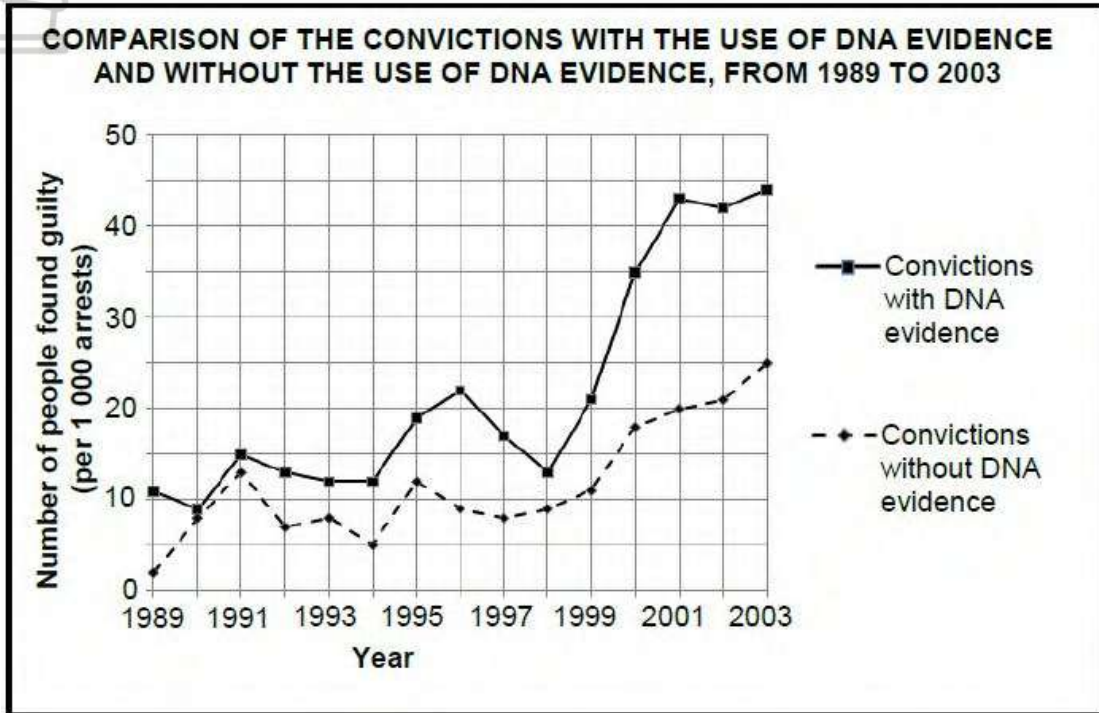


- 23.1 Which ONE of the children has been adopted? (2)
 23.2 Explain your answer to QUESTION 23.1. (2)
(4)



Question 24

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.



- 24.1 State the dependent variable in this investigation. (1)
- 24.2 How many more successful convictions per 1 000 arrests were made in 2003 with the use of DNA evidence? Show ALL calculations. (2)
- 24.3 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)

TOPIC : MEIOSIS

Question 1

Give the correct biological term for EACH of the following descriptions.
 Write only the term next to the question numbers (1.1 to 1.11) in the ANSWER BOOK.

1.1	Non 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	
1.11	The representation showing the arrangement of a diploid set of chromosomes	
	10x1	(10)

Question 2

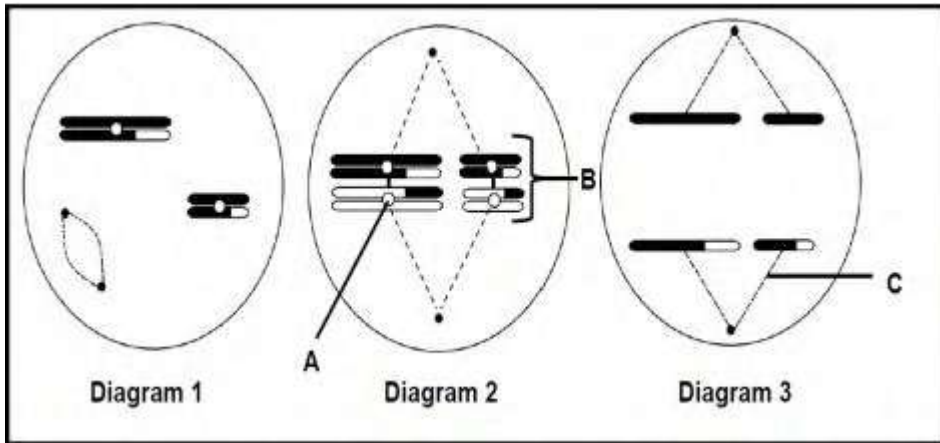
Indicate whether each of the statements in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number.

COLUMN I		COLUMN II
2.1	The phase of meiosis during which non-disjunction can occur	A: Anaphase I B: Anaphase II
2.2	The alleles of a gene separate into different gametes during meiosis.	A: Law of independent assortment B: Law of segregation

2.3	The phase between two consecutive cell divisions	A: Prophase B: Telophase
2.4	The point where two chromatids overlap during crossing over	A: Chiasma B: Locus
2.5	Occurs during meiosis	A: Karyokinesis B: Cytokinesis
2.6	Process of meiosis produces	A: 4 diploid daughter cells B: 4 haploid daughter cells
(5 x 2)		(10)

Question 3

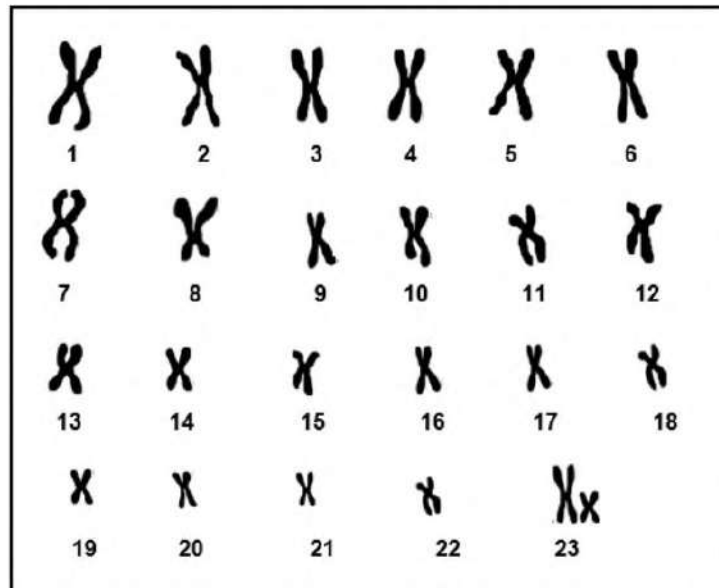
The diagram below represents different phases of meiosis in the diagram.



- 3.1 Identify:
 - (a) A (1)
 - (b) B (1)
 - (c) C (1)
 - 3.2 Identify phase represented in Diagram 3 (1)
 - 3.3 Write down the numbers of the diagrams to show the sequence in which the phases occur. (2)
 - 3.4 State ONE difference between metaphase I and metaphase II (2)
- (8)**

Question 4

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



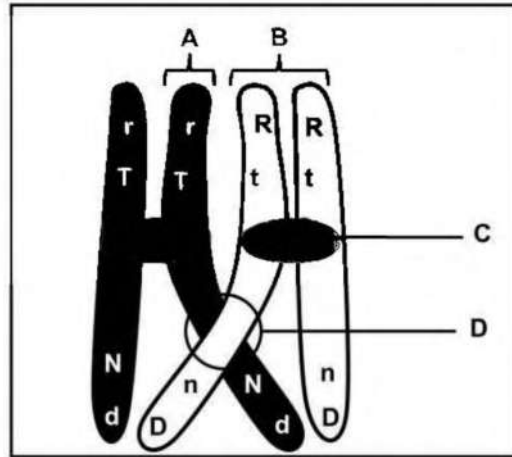
- 4.1 Name the type of mutation that occurred during the production of this gamete. (1)
- 4.2 What type of gamete is represented in the karyotype? (1)
- 4.3 In this gamete, give the number of:
 - (a) Autosomes (1)
 - (b) Gonosome (1)
- 4.4 This gamete fuses with a normal gamete.
 - Using X and Y representation, write the sex chromosomes of the offspring. (2)

(6)



Question 5

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

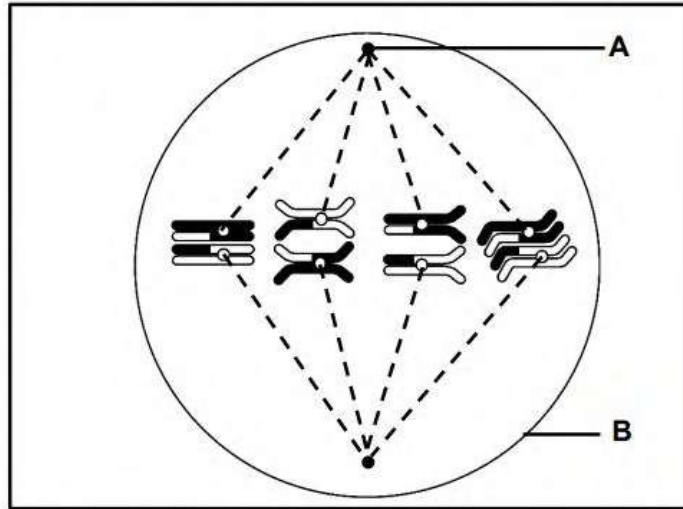


- 5.1 Name the:
 - (a) Process shown in the diagram (1)
 - (b) Phase of meiosis represented above (1)
 - 5.2 Identify:
 - (a) Point D (1)
 - (b) Part B (1)
 - 5.3. Write down the **LETTER** and **NAME** of the part that join together two chromatids (2)
 - 5.4 Write down the genotype of the resulting chromatid **A** after the process named in QUESTION 5.1 (a) (1)
 - 5.5 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 6

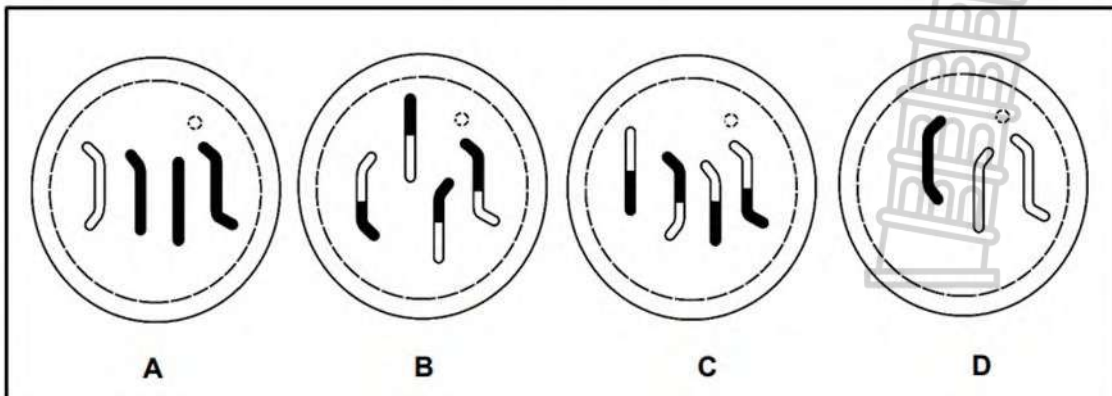
The diagram below represents metaphase I of meiosis.



- 6.1 Identify part B. (1)
- 6.2 State ONE function of A (1)
- 6.3 Explain the appearance of chromosomes in the diagram (3)
- 6.4 What are homologous chromosomes (2)

- 6.5 The total amount of DNA is 12 arbitrary units in each daughter cell at the end of this cell division
 How much DNA (in arbitrary units) was in the parent cell at the beginning of the cell division? (2)

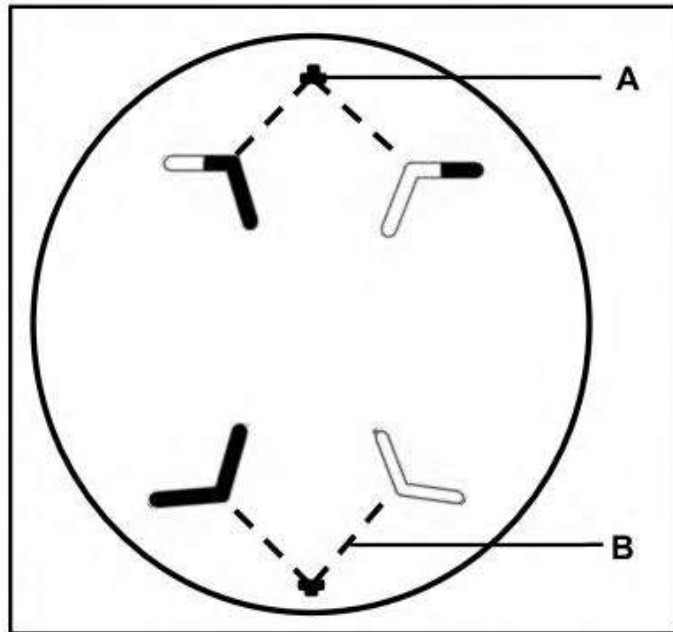
The diagram below shows four possible daughter cells formed at the end of this meiosis.



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

Question 7

The diagram below represents a phase of meiosis II



- 7.1 Identify the phase of meiosis shown (1)
- 7.2 State ONE difference between the phase shown in the diagram above and the same phase in meiosis I (2)
- 7.3 Identify structure A (1)
- 7.4 Describe the role of structure B during cell division (2)
- 7.5 Draw a labelled diagram representing the cell above as it would have appeared in metaphase II (5)

NOTE: The diagram should show the correct shading and include labels (exclude labels for A and B).

(11)



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.

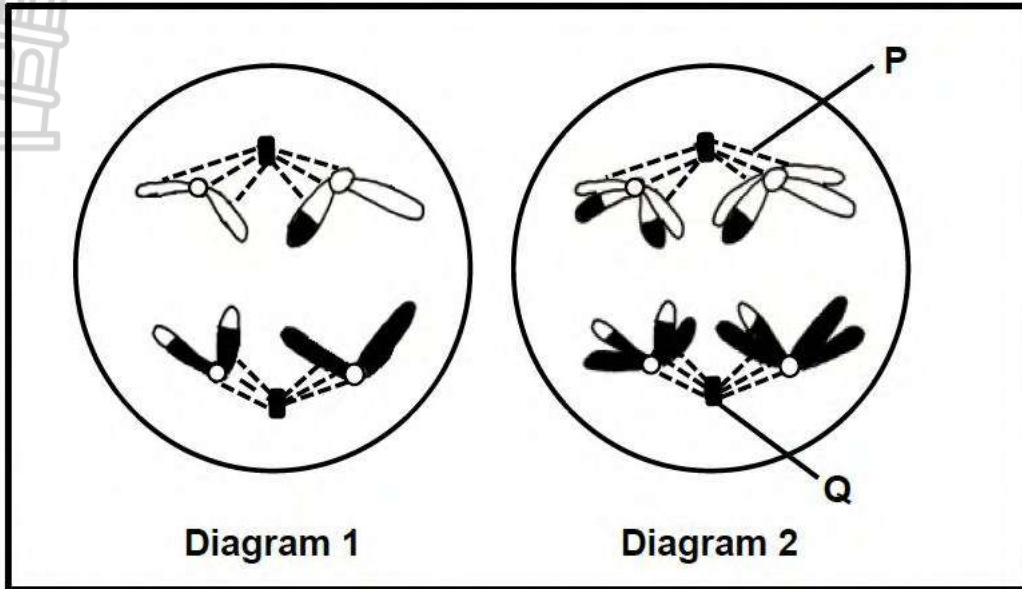
Age of mothers in years	Number of babies born with the genetic disorder
25	1 in 1250
32	1 in 378
40	1 in 100
45	1 in 30

- 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 disorder 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)**



Question 9

Diagrams 1 and 2 below show two cells of the same organism in different phases of meiosis. The phases are **NOT** necessarily shown in the correct order.



- 9.1 State ONE place in the human body where meiosis occurs. (1)
- 9.2 Identify:
 - (a) Structure P (1)
 - (b) Organelle Q (1)
- 9.3 Identify the phase of cell division represented in Diagram 2. (1)
- 9.4 How many chromosomes will be found in a somatic cell of this organism? (1)
- 9.5 State ONE difference between the processes occurring in Diagram 1 and Diagram 2. (2)
- 9.6 The chromosomes in the diagram are genetically different due to crossing over. (1)

Describe the process of crossing over

(3)
(10)

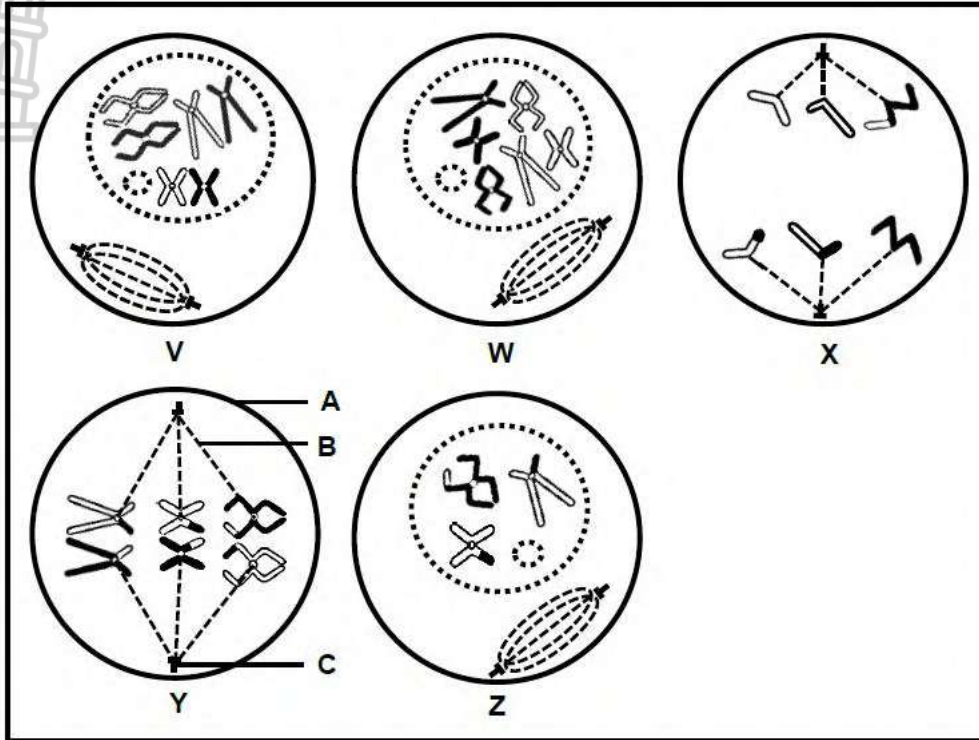
Question 10

- 10.1 Describe how non-disjunction leads to Down syndrome

(5)

Question 11

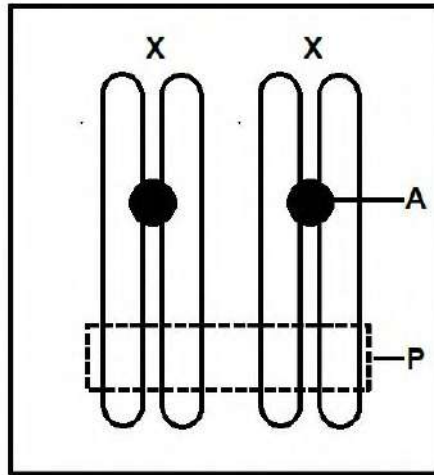
The diagrams below represent cells from the same organism during different phases of mitosis and meiosis.



- 11.1 Identify part:
- (a) **A** (1)
 - (b) **B** (1)
- 11.2 Which diagram (**V**, **W**, **X**, **Y** or **Z**) represents a cell during:
- (a) Prophase of mitosis (1)
 - (b) Metaphase I (1)
 - (c) Prophase I (1)
- 11.3 How many chromosomes will there be in each cell at the end of:
- (a) Mitosis (1)
 - (b) Meiosis I (1)
- (7)**

Question 12

The diagram below represents the sex chromosomes in a female.



- 12.1 Give the biological term for the sex chromosomes. (1)
- 12.2 Describe how these chromosomes would differ in the somatic cells of a male. (1)
- 12.3 An exchange of genetic material takes place at region **P**.
 - (a) Name the process above. (1)
 - (b) Identify the phase during which the process named in QUESTION 12.3(a) takes place. (1)
 - (c) Give ONE reason why the process named in QUESTION 12.3(a) is important. (1)
- 12.4 Explain how the structure of the chromosomes would differ at the end of meiosis II. (2)
- 12.5 Non-disjunction of these chromosomes occurred during meiosis and a gamete with an extra chromosome is formed. If this gamete is fertilised by normal gametes, the resulting zygotes will not be normal.

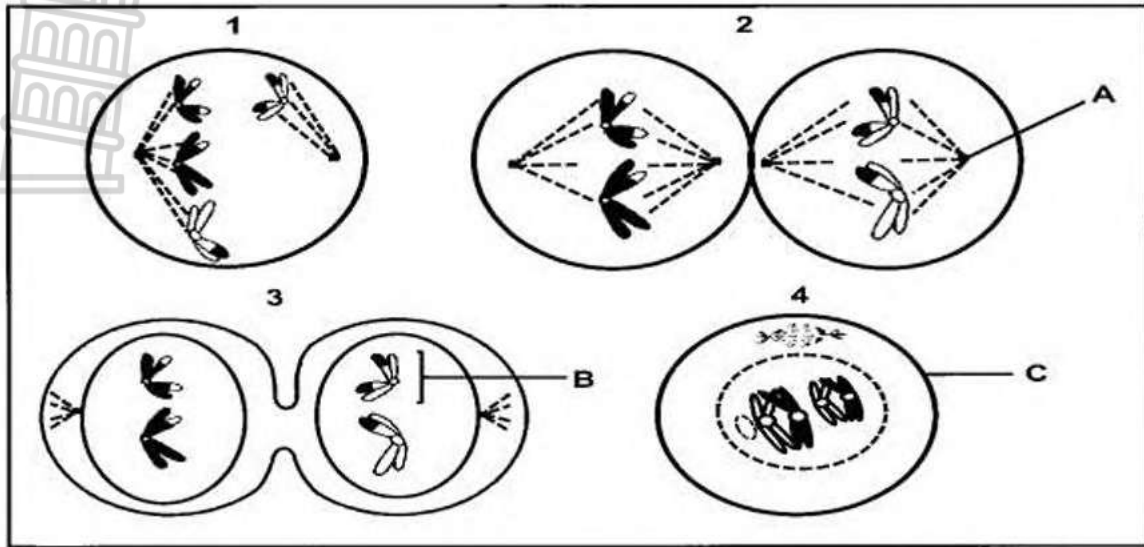
Explain the genetic composition of these zygotes.



(3)
(10)

Question 13

Diagram below represents different phases of meiosis.



- 13.1 Identify part:
- (a) B (1)
 - (b) C (1)
- 13.2 Give the **NUMBER** and **NAME** of the phase which shows the following:
- (a) Random arrangement of chromosome at the equator (2)
 - (b) Crossing over (2)
 - (c) Non-disjunction (2)
- 13.3 How many chromosome will be found in?...
- (a) The cell at the end of meiosis shown in the diagrams. (1)
 - (b) A normal, human sperm. (1)
 - (c) The somatic cell of the normal mother who has a son with Down syndrome. (1)
- (11)**



TOPIC: REPRODUCTIVE STRATEGIES AND HUMAN REPRODUCTION

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	
1.54	The structure that connects the foetus to the placenta	
1.55	The ovarian hormone that is secreted by the corpus luteum	
1.56	The extra-embryonic membrane that plays a role in the formation of the placenta	
		(56 x 1) (56)

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.

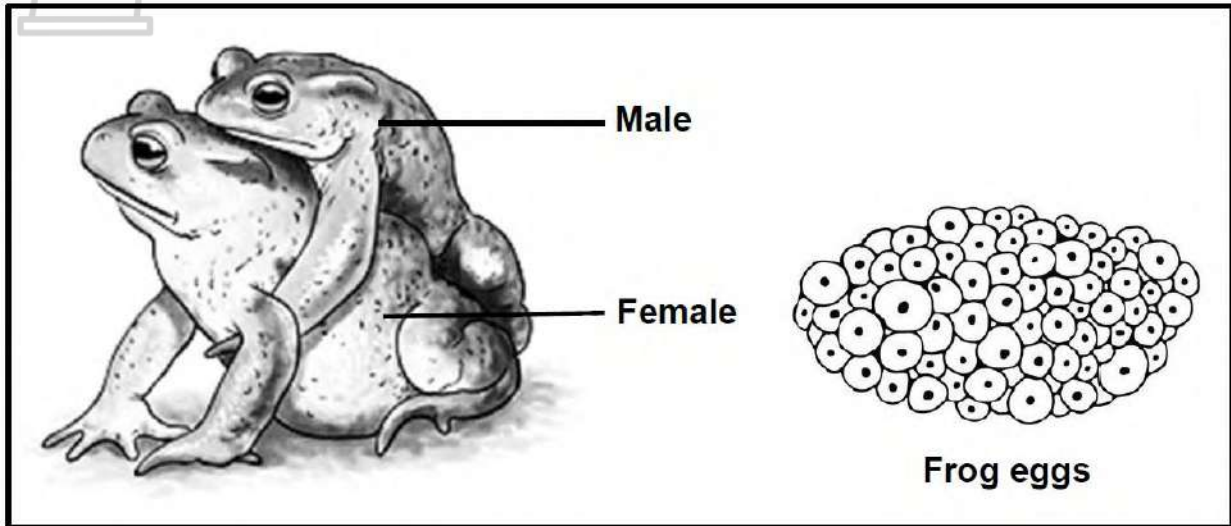
COLUMN I		COLUMN II	
2.1	Nutrition provided by the egg	A B	Ovipary Ovovivipary
2.2	A process that produces four mature gametes in humans from a single diploid cell	A B	Oogenesis Spermatogenesis
2.3	Unfertilised eggs are released from the female's body	A B	Asexual reproduction External fertilisation
2.4	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
2.22	Acts as a micro-filter for the developing foetus	A B	Placenta Cervix
2.23	The hormone responsible for the development of secondary sexual characteristics during puberty	A B	Oestrogen Testosterone
(23 x 2)			(46)



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.

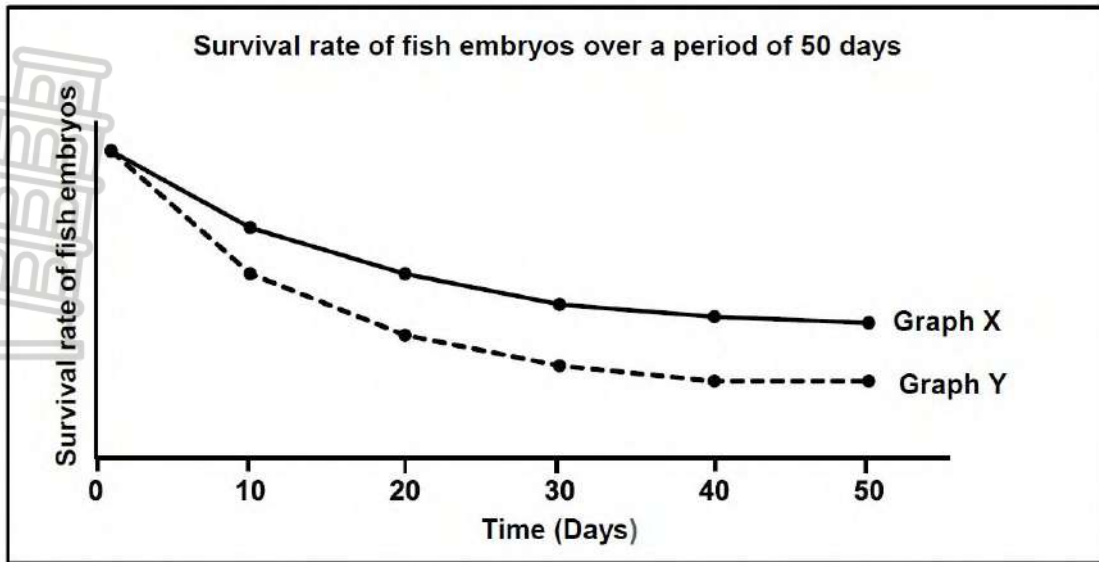
- 6.1 Name the type of fertilisation that takes place in the bottlenose dolphin. (1)
- 6.2 Explain how TWO of the reproductive strategies of the great white shark increase its reproductive success. (4)
- 6.3 Explain ONE reason why the Bluefin tuna releases a large number of eggs. (2)
- (7)

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 all around the female. The fertilised eggs attach to vegetation near the riverbed, where embryonic development occurs until hatching.



- 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 northern pike 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

In bird eggs, the yolk is the main source of energy for the developing embryo. The table below provides information about the eggs of some bird types.

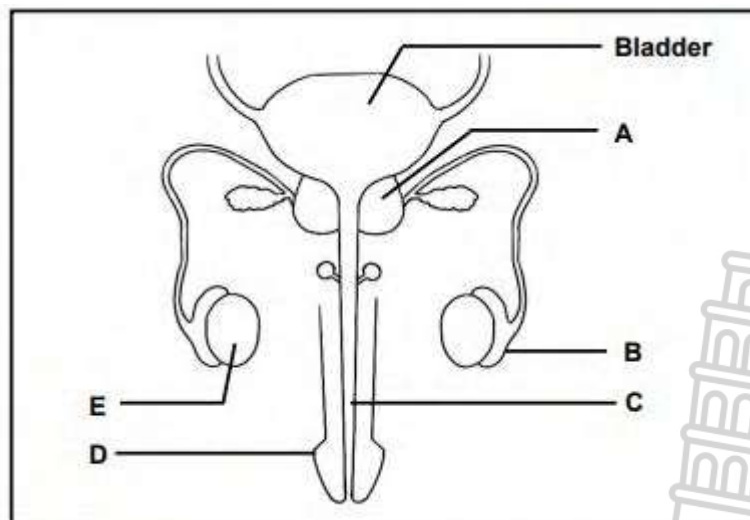


TYPE OF BIRD	AVERAGE % OF YOLK IN THE EGG
Goose	35,1
Eagle	12,0
Duck	35,4
Vulture	14,0
Chicken	31,9
Pigeon	17,9

- 9.1 Explain why we may conclude that ducks display precocial development. (3)
 - 9.2 Name the THREE bird types that would have a higher degree of parental care. (3)
 - 9.3 Give a reason for your answer to QUESTION 9.2. (2)
- (8)**

Question 10

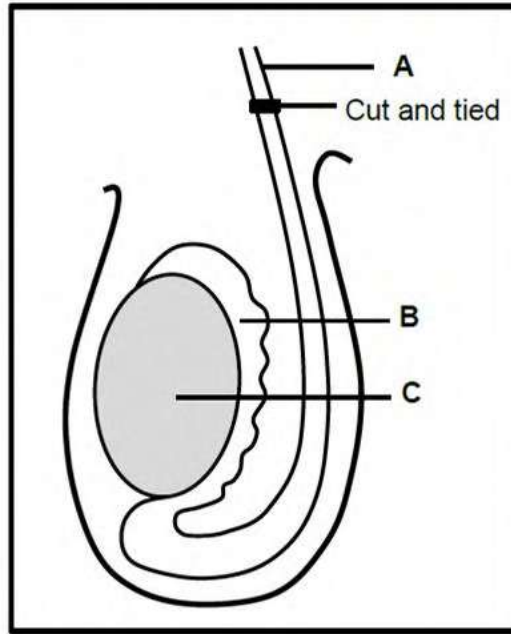
The diagram below represents the front view of the human male reproductive system.



- 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.

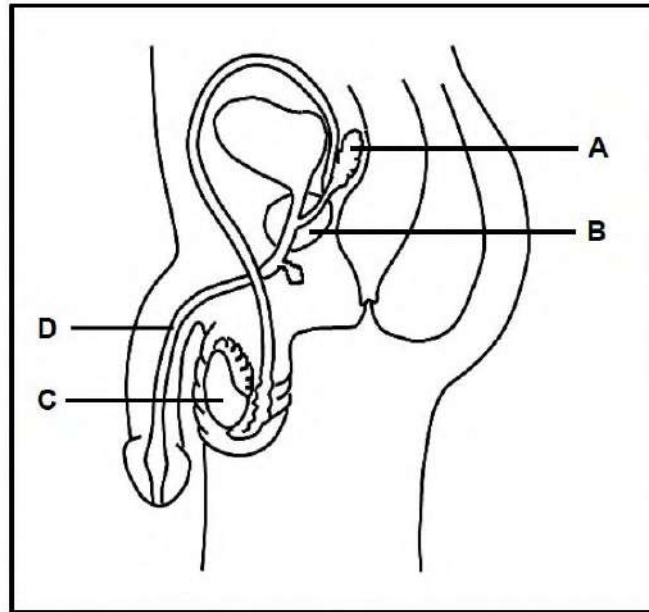
Explain the composition of the semen after a vasectomy. (3)
 - 11.4 In some rare cases, males are born with part **C** located inside the body because it failed to descend into the scrotum.

Explain how this condition may affect male fertility. (3)
 - 11.5 Describe the process of spermatogenesis. (4)
- (12)**



Question 12

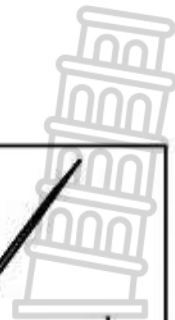
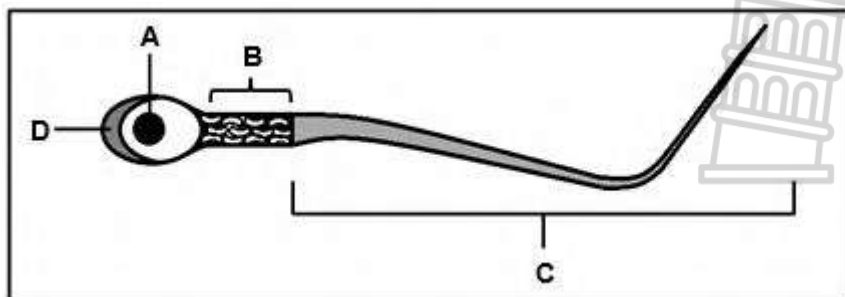
The diagram below represents the human male reproductive system.



- 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.

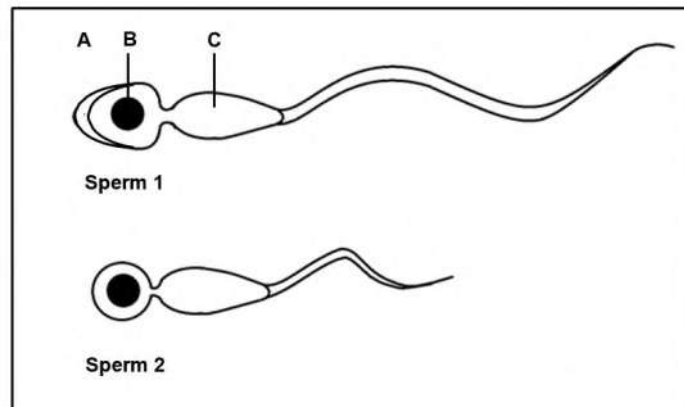


- 13.1 Name:
 - (a) The organelles found in large numbers in part **B** (1)
 - (b) Part **D** (1)
- 13.2 Name the part of the testes where spermatogenesis takes place. (1)

- 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

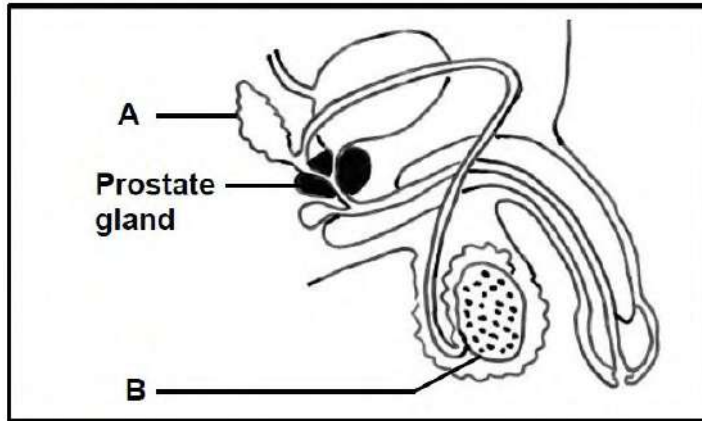
The diagrams below show the structure of a normal and an abnormal sperm. (The diagrams are drawn to scale.)



- 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.

- (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

The thickness of the endometrium varies throughout the menstrual cycle of a female.

The table below shows the results recorded for a woman who had her endometrial thickness monitored for a particular menstrual cycle.

DAY OF THE MENSTRUAL CYCLE	THICKNESS OF THE ENDOMETRIUM (mm)
0	14
7	3
14	5
21	13
28	16

- 16.1 Referring to ovarian hormones, explain the: (3)
- (a) Decrease in thickness of the endometrium from day 0 to day 7 (3)
- (b) Increase in thickness of the endometrium from day 7 to day 14 (2)
- 16.2 Describe changes in the endometrium that cause it to become thicker. (2)
- 16.3 State the significance of the change in endometrium thickness described in QUESTION 16.2 (1)
- 16.4 Draw a bar graph to show the results in the table. (6)
- (14)**

Question 17

- 17.1 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.

- 17.1 Identify the dependent variable in the investigation. (1)
- 17.2 State how the dependent variable in QUESTION 17.1 was measured. (1)
- 17.3 Name TWO other factors that should be considered when selecting volunteers. (2)
- 17.4 Explain how TU reduces fertility. (2)
- 17.5 Explain why wearing tight-fitting trousers will decrease male fertility. (2)
- 17.6 Suggest ONE reason for doing the sperm count for an additional 12 months after stopping the TU treatment. (1)
- 17.7 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 18

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.

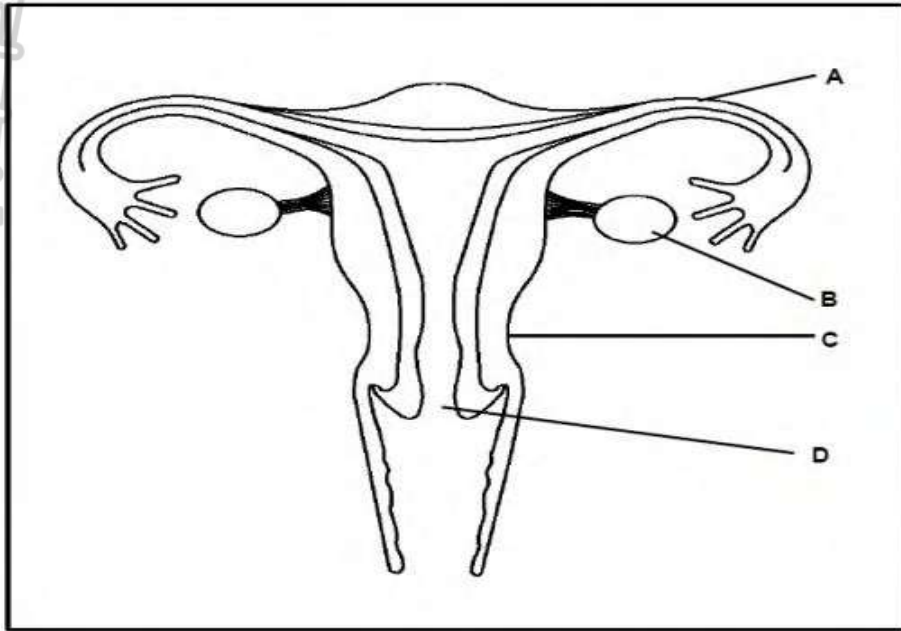
The procedure was as follows:

- 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).

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

Question 19

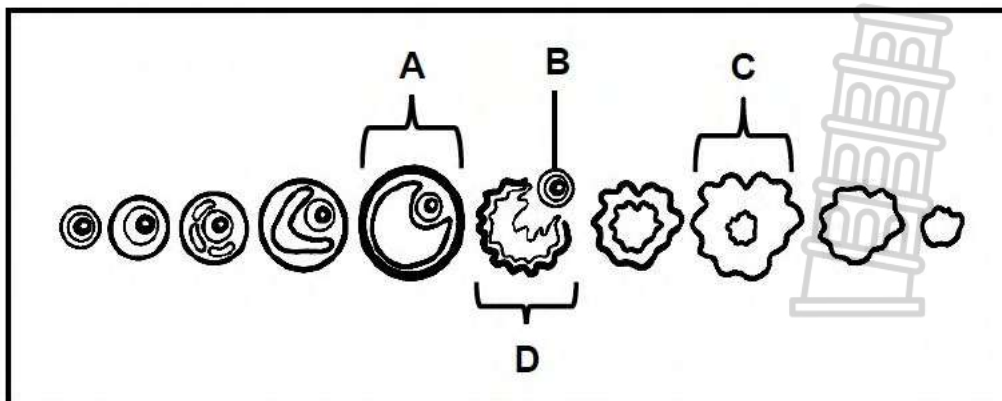
The structure below represents a part of the female reproductive system.



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

Question 20

The diagram below represents a part of the menstrual cycle that occurs in the human ovary.



- 20.1 Name the part of the menstrual cycle represented by the diagram. (1)
- 20.2 Identify structure:
 - (a) **A** (1)
 - (b) **B** (1)
 - (c) **C** (1)

- 20.3 Name the hormone that:
- (a) Controls the development of structure **A** (1)
 - (b) Is secreted by structure **A** (1)
 - (c) Stimulates the process occurring at structure **D** (1)
- (7)**

Question 21

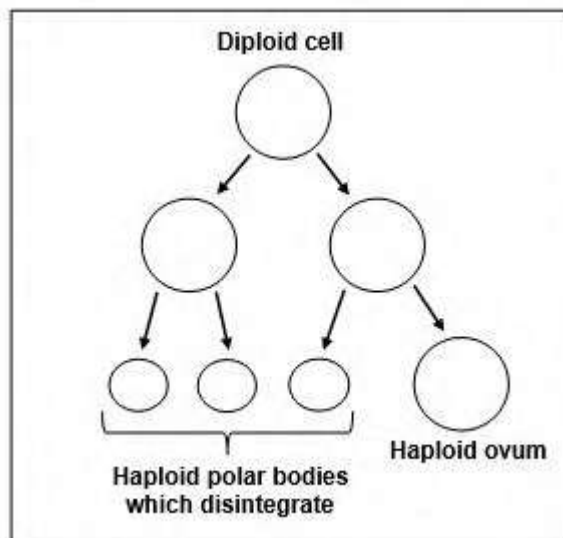
Describe the process of *spermatogenesis*. (4)

Question 22

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

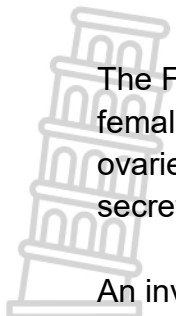


- 22.1 Name the type of meiotic division shown in the diagram above. (1)
- 22.2 Name the type of egg that was laid by the crocodile. (1)
- 22.3 Crocodiles lay their eggs on land.

Explain ONE way in which the type of egg named in QUESTION 22.2 is structurally suited to survive the conditions on land. (2)

- 22.4 Explain ONE advantage of parthenogenesis. (2)
- (6)**

Question 23



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.

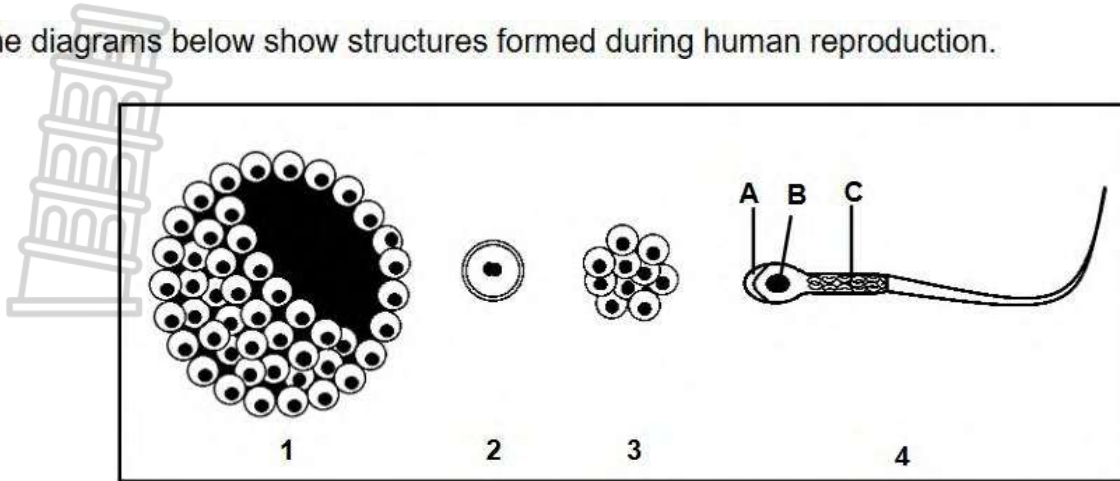
AGE GROUP	AVERAGE FSH LEVELS
20–32	7,0
33–35	7,8
36–40	8,0
41–50	8,5

- 23.1 State TWO factors, regarding the females that should have been kept constant during the investigation. (2)
- 23.2 State TWO ways in which the reliability of the results was ensured. (2)
- 23.3 State ONE conclusion that can be drawn from the results. (2)
- 23.4 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 24

The diagrams below show structures formed during human reproduction.

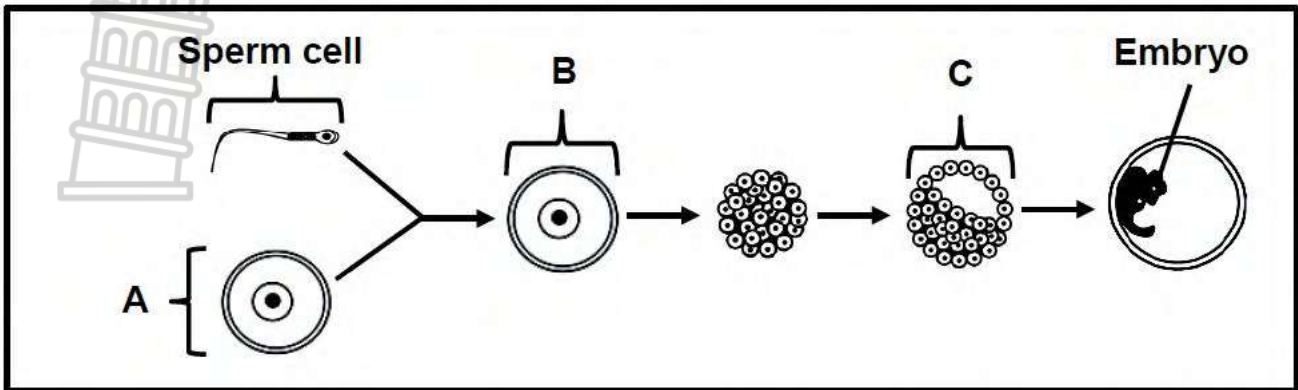


- 24.1 Identify part **A**. (1)
 - 24.2 Name the organelle found in large numbers in part **C**. (1)
 - 24.3 Give the NUMBER (**1, 2, 3 or 4**) only of the diagram that represents the following:
 - (a) Morula (1)
 - (b) Structure that will implant in the uterus (1)
 - (c) Blastula/Blastocyst (1)
 - 24.4 Give the LETTER and NAME of the part that will enter the ovum during fertilisation. (2)
 - 24.5 Name the type of cell division that occurred to produce the structure in diagram **3**. (1)
 - 24.6 Describe the development of the placenta and umbilical cord from the time of implantation. (6)
- (14)**



Question 25

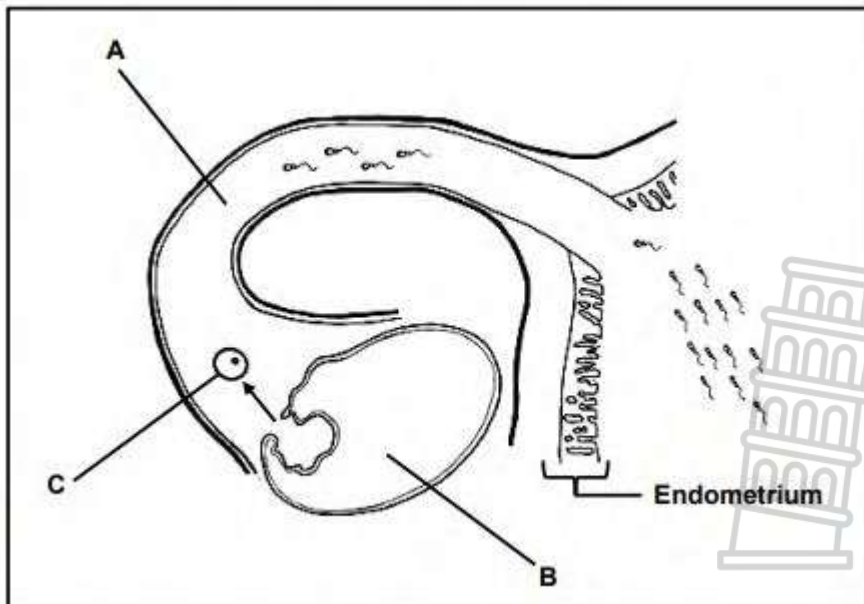
The diagram below represents human embryonic development.



- 25.1 Identify: (1)
 (a) Cell **B** (1)
 (b) Structure **C** (1)
- 25.2 Explain the difference between cell **A** and cell **B**. (3)
- 25.3 Name the fluid surrounding the embryo. (1)
- 25.4 State THREE functions of the fluid named in QUESTION 25.3. (3)
- (9)**

Question 26

The diagram below represents a part of the female reproductive system



- 26.1 Identify part: (1)
 (a) **A** (1)
 (b) **B** (1)
- 26.2 Give TWO: (2)
 (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)

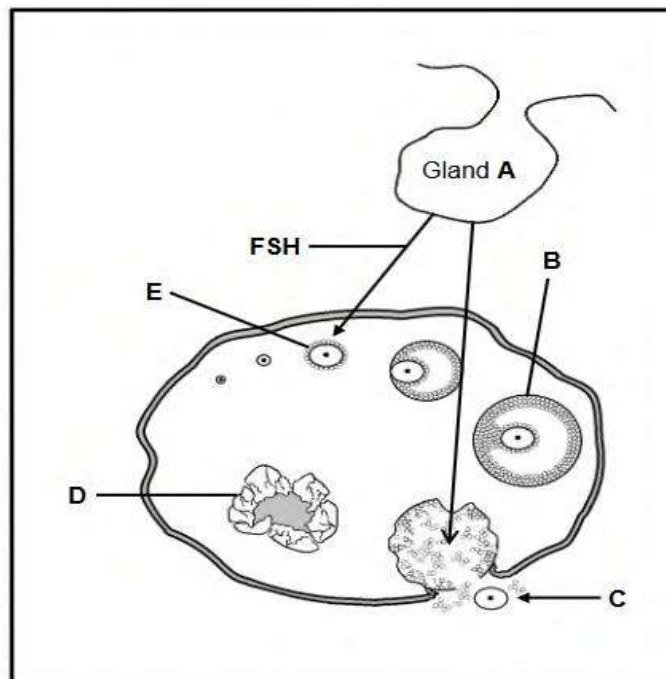
26.3 Identify and describe the type of gametogenesis that leads to the formation of structure **C**. (6)

26.4 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. (3)

Explain why an ectopic pregnancy may result in the death of an embryo. (15)

Question 27

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



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

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

27.3 State ONE function of LH. (1)

(6)

Question 28

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

- 28.1 On which day of this menstrual cycle is the level of progesterone the highest? (1)
 - 28.2 Name the reproductive hormone that will begin to increase from day 24 of this female's menstrual cycle. (1)
 - 28.3 Use data from the table to explain your answer to QUESTION 28.2. (2)
 - 28.4 Calculate the percentage increase in the oestrogen level from day 8 to day 10. Show ALL your working. (3)
 - 28.5 How would the progesterone level differ after day 20 if this female was pregnant? (1)
 - 28.6 Explain what causes the change in the progesterone level stated in QUESTION 28.5. (2)
- (10)**

Question 29

Read the extract and study the diagram below.

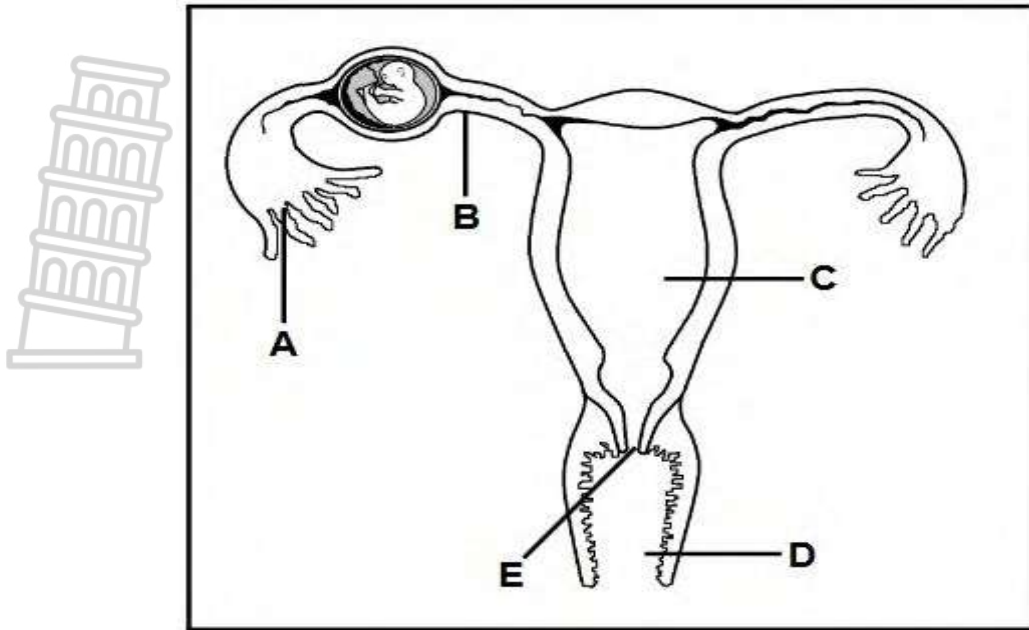
ECTOPIC PREGNANCIES

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.



- 29.1 Give only the LETTERS of the TWO parts in the diagram where implantation of the embryo may occur during an ectopic pregnancy (2)
 - 29.2 Explain why women who have had surgery on their Fallopian tubes have a greater risk of experiencing an ectopic pregnancy. (3)
 - 29.3 Explain why a woman who had her Fallopian tube removed after an ectopic pregnancy occurred, may still be able to fall pregnant. (2)
 - 29.4 Give TWO reasons why the embryo may not be able survive during an ectopic pregnancy inside the Fallopian tube. (2)
- (9)**

Question 30

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.

- 30.1 State ONE function of FSH. (1)
- 30.2 Name ONE other hormone in females that is secreted by the pituitary gland during the menstrual cycle. (1)
- 30.3 Explain how an under-secretion of the hormone in QUESTION 30.2 may lead to infertility (2)

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

Question 31

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.

- 31.1 Why is the injection of progesterone a good treatment to prevent premature delivery? (2)
 Identify the:
- 31.2 (a) Independent variable (1)
 (b) Dependent variable (1)
- 31.3 Describe how the investigators determined whether any of the participants in Group **A** had developed gestational diabetes mellitus. (2)
- 31.4 State TWO factors that were kept constant when the progesterone was administered in Group **A**. (2)
- 31.5 Group **B** was the control. Explain the importance of group **B** in this investigation. (2)
(10)

Question 32

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.

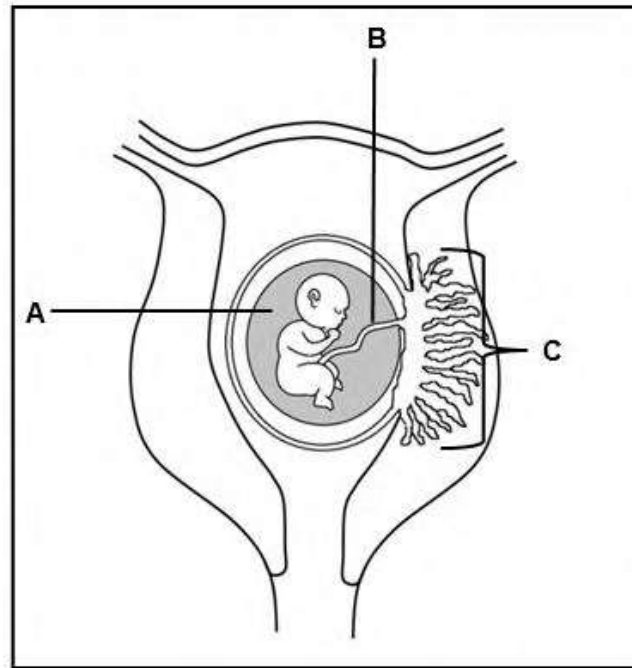
Women often show no symptoms, and the cysts disappear, but in rare cases ovarian cysts keep on increasing in size. A very large cyst can cause intense pain and may rupture, leading to internal bleeding. Such cysts will require surgical removal.

- 32.1 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)
- 32.2 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)
- 32.3 Give a reason for your answer to QUESTION 32.2(b). (1)
- 32.4 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 33

The diagram below represents a stage in human foetal development.



33.1 Identify:

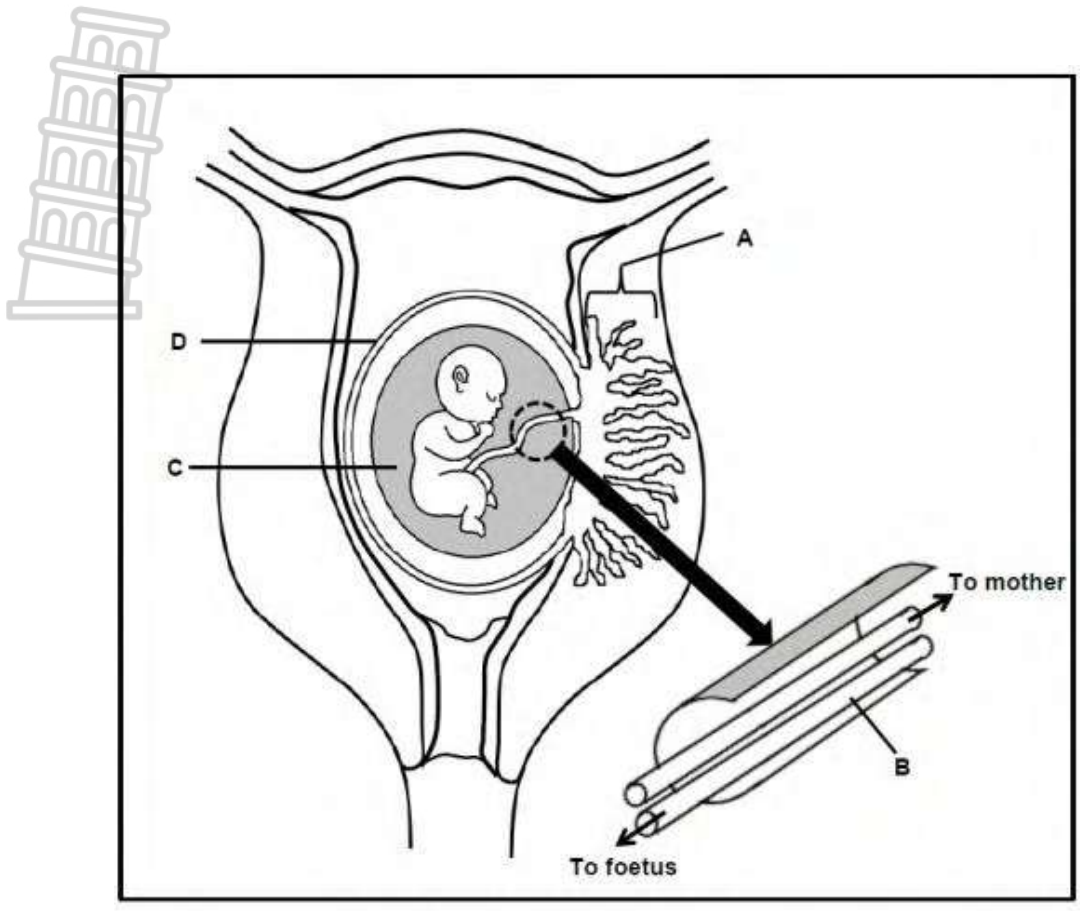
- (a) Fluid **A** (1)
- (b) Structure **C** (1)

33.2 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 34



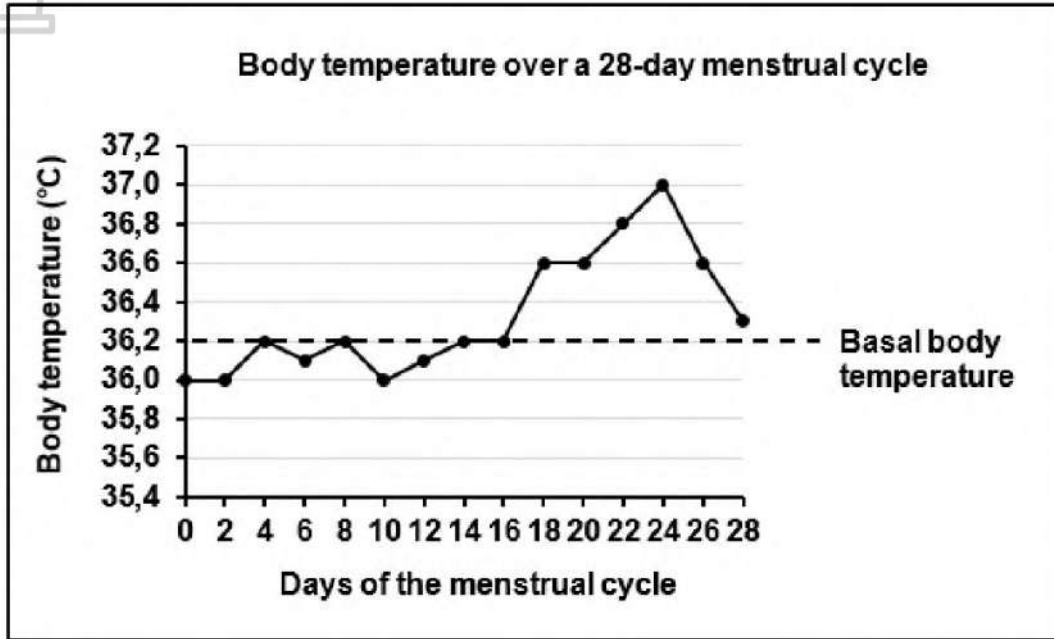
- 34.1 Identify part **D**. (1)
 - 34.2 State TWO functions of the fluid in part **C**. (2)
 - 34.3 Describe the development of the zygote until implantation occurs. (4)
 - 34.4 State TWO ways in which part **A** functions in protecting the developing foetus. (2)
 - 34.5 Identify blood vessel **B**. (1)
 - 34.6 Describe how the nutrition of a human foetus differs from that of oviparous organisms. (3)
- (13)**



Question 35

Basal body temperature is the body temperature while a person is at rest. An increase above the basal body temperature occurs immediately after the day of ovulation. The basal body temperature method can be used by women who want to fall pregnant.

The graph below represents the body temperature chart of a woman with a 28-day menstrual cycle.



- 35.1 Use the graph to identify the following for this woman:
 - (a) Basal body temperature (1)
 - (b) Day of ovulation (1)
 - 35.2. Using evidence in the graph, give a reason for your answer to QUESTION 34.2(b). (2)
 - 35.3 Progesterone is the hormone that causes an increase in the basal body temperature. Explain why the increase in basal body temperature occurs only after ovulation. (2)
 - 35.4 Explain why the basal body temperature is measured when a person is at rest. (2)
- (8)**

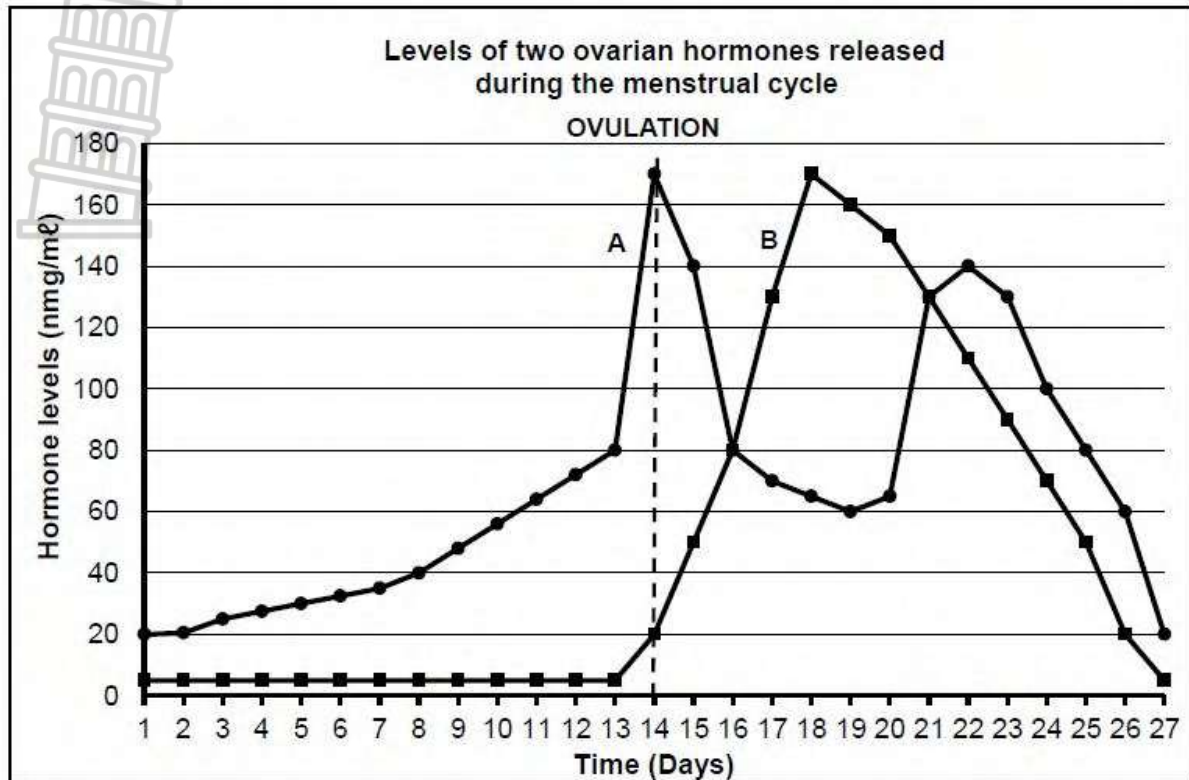
Question 36

Describe the secretion of the ovarian hormones and their role in the menstrual cycle.

(5)

Question 37

The graph below represents ovarian hormones.



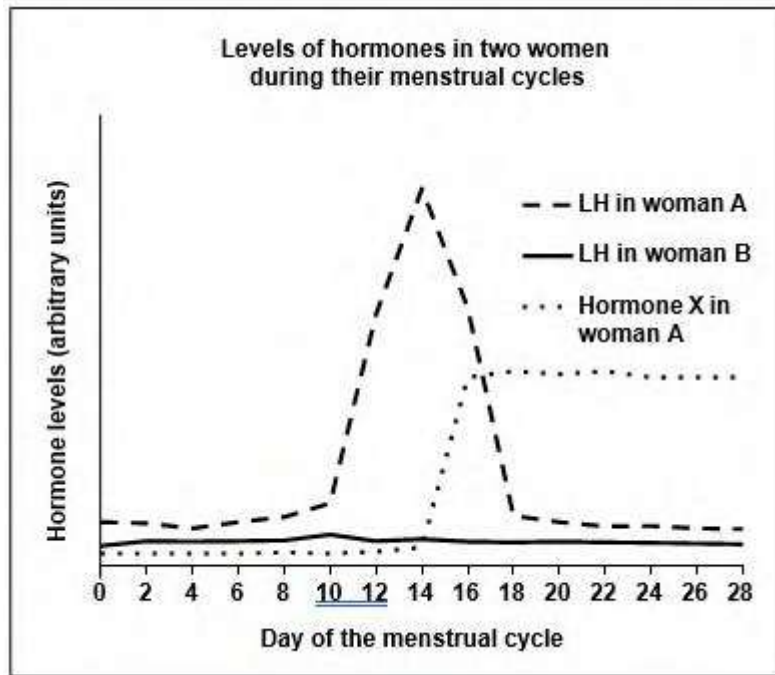
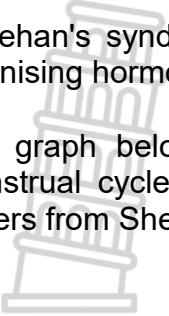
- 37.1 Identify:
- Hormone **A** (1)
 - Hormone **B** (1)
- 37.2 What effect does an increase in hormone **A** have on the endometrium? (2)
- 37.3
- Define ovulation (2)
 - On which day did ovulation take place? (1)
 - Which hormone secreted by the pituitary gland stimulates ovulation? (1)
- 37.4 Explain why high levels of hormone **B** prevent the development of new follicles. (2)
- 37.5 Explain evidence in the graph that indicates that no fertilisation took place during the menstrual cycle shown above (3)
- 37.6 Explain the negative feedback mechanism that occurs between Progesterone and FSH. (4)

(17)

Question 38

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



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



TOPIC : GENETICS

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 masked in the phenotype when found in the heterozygous 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 expressed in a phenotype in the heterozygous condition	
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 an allele in a chromosome	
1.26	The type of dominance which results in an intermediate phenotype in the heterozygous condition.	
1.27	The biotechnological process that produces genetically identical organisms	
1.28	Undifferentiated cells in animals that have the potential to become any type of tissue	
1.29	The deliberate breeding of organisms for desirable characteristics selected by humans	
1.30	The biotechnological process that produces genetically identical organisms	
	(30 x 1)	(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.

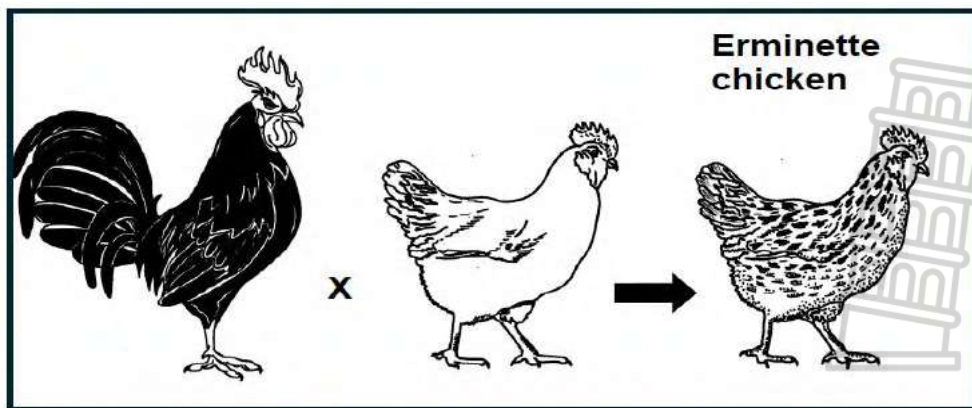
	Column I	Column II
2.1	An advantage of genetic modification	A: Increases shelf life of food B: Increases resistance to disease
2.2	The alleles of a gene separate into different gametes during meiosis	A: Law of independent assortment B: Law of segregation
2.3	The genotype for an individual with blood group AB	A: I ^A B: I ^B
2.4.	Unspecialised cells that have the potential to develop into any other type of cell in the body	A: Stem cells B: Somatic cells

2.5	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
2.6	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
2.7	The separation of alleles during gamete formation	A: Law of Dominance B: Principle of Segregation
2.8	A genetic disorder caused by a chromosomal mutation	A: Hemophilia B: Colour-blindness
2.9	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
	(9 x 2)	(18)

Question 3

In some chickens, feather colour is controlled by two alleles, white feathers (**W**) and black feathers (**B**).

If a homozygous white chicken is crossed with a homozygous black chicken, the offspring have feathers that are both black and white, a phenotype that is known as erminette, as shown in the diagram below.



- 3.1 Explain inheritance as an example of co-dominance (2)
- 3.2 The inheritance of which blood group in humans shows the same type of dominance as explained in QUESTION 3.1 (1)

- 3.3 A white chicken is crossed with the eriminette chicken.
 Use a genetic cross to show ALL the possible phenotypes of 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 a plant species, the gene coding for plant height has two alleles. The allele for tall plants (T) is dominant over the allele for dwarf plants (t). The gene for flower colour has two alleles where the allele for red flower colour (R) is dominant over the allele for white flower colour (r).

A dwarf, white-flowered plant is crossed with a plant that is homozygous tall and heterozygous for red flower colour.

- 5.1 State the characteristics that are being investigated in this cross. (2)
- 5.2 Give the genotype of the plant that is homozygous tall and heterozygous for red flower colour. (2)

Below is an incomplete Punnett square representing the cross referred to above.

	TR	Tr
tr	X	Y

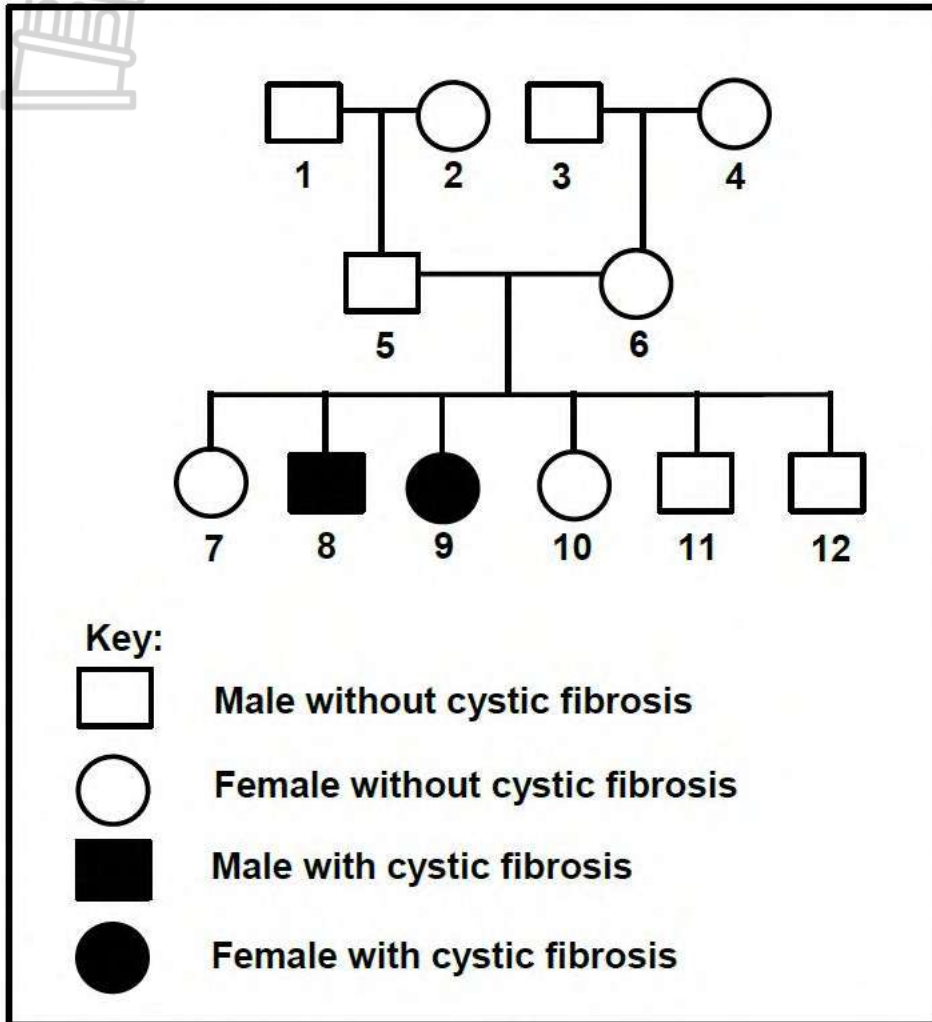


- 5.3 Identify the:
- (a) Genotype of offspring X (1)
- (b) Phenotype of offspring Y (2)
- (7)**

Question 6

Cystic fibrosis is a genetic disorder caused by a recessive allele (b).

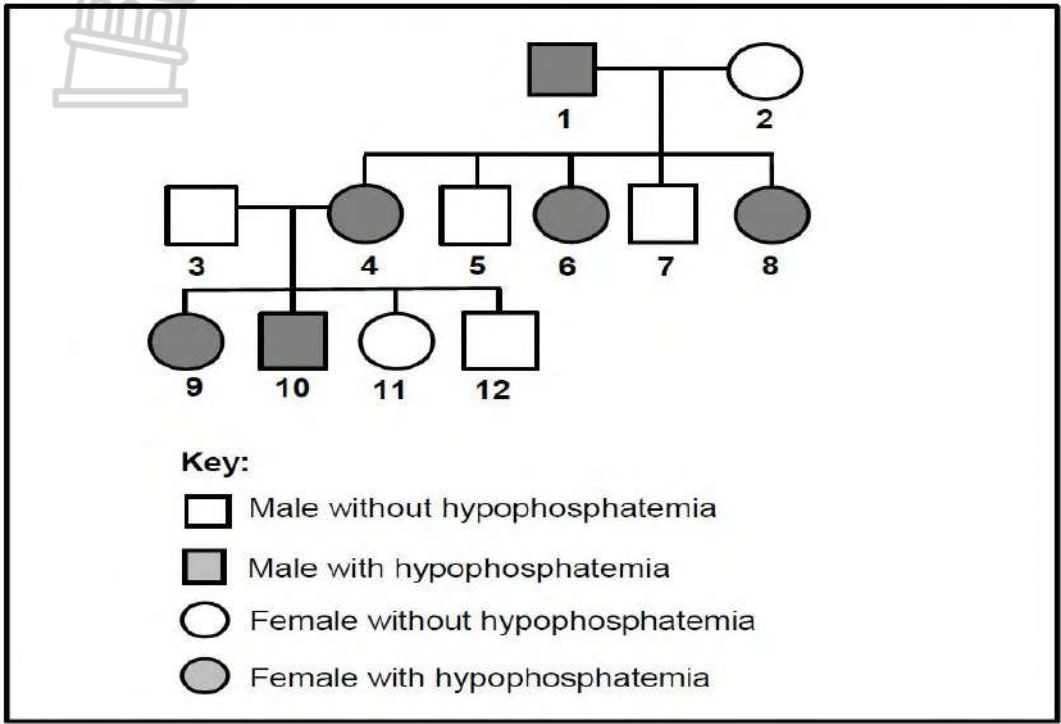
The pedigree diagram below shows the inheritance of cystic fibrosis in a certain family.



- 6.1 How many generations are represented in the diagram above? (1)
 - 6.2 Give the genotype of individual 9. (1)
 - 6.3 Explain why both individuals 5 and 6 must be heterozygous for cystic fibrosis. (4)
 - 6.4 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 7

Hypophosphatemia is a sex-linked inherited condition that is caused by a dominant allele (XH) on the X chromosome. It results in abnormally low levels of phosphate in the blood which can cause rickets. The recessive allele (Xh) codes for normal phosphate levels. The pedigree diagram below shows the inheritance of hypophosphatemia in one family.

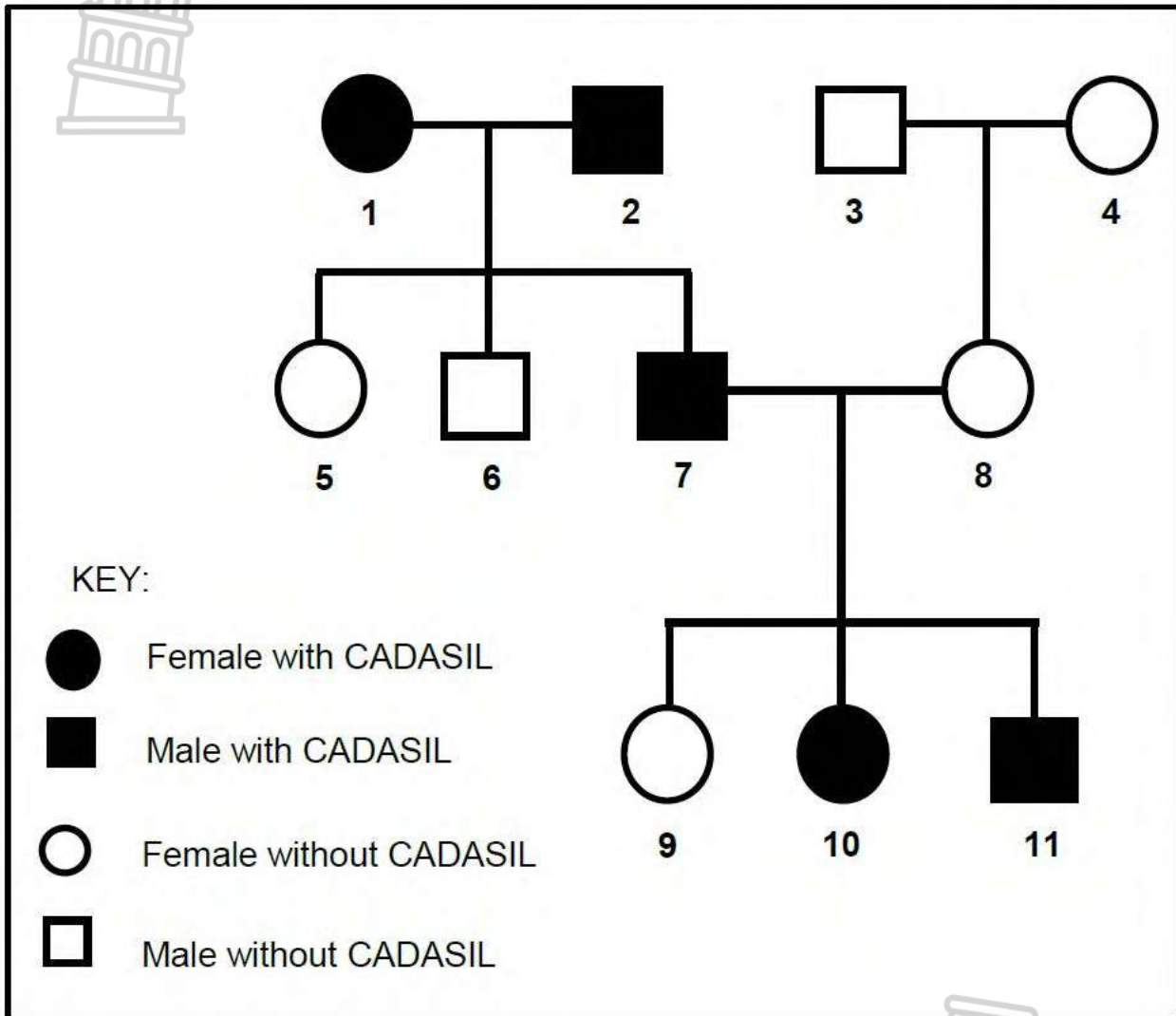


- 7.1 Name the type of:
 - (a) Diagram shown (1)
 - (b) Gonosome found only in males (1)
 - 7.2 State TWO effects of hypophosphatemia in humans. (2)
 - 7.3 How many individuals in the F1-generation have hypophosphatemia? (1)
 - 7.4 Give ALL the possible genotypes of individual:
 - (a) 3 (1)
 - (b) 4 (1)
 - 7.5 Explain why ALL the daughters of individuals 1 and 2 will have hypophosphatemia (6)
- (13)**

Question 8

CADASIL is an autosomal genetic disorder caused by a dominant allele (D). It results in the thickening of the walls of blood vessels.

The diagram below shows the inheritance of CADASIL in a family.



- 8.1 Name the type of diagram represented above. (1)
- 8.2 How many offspring do parents 3 and 4 have? (1)
- 8.3 Give the:
- (a) Phenotype of individual 10 (1)
 - (b) Genotype of individual 5 (1)
- Using evidence from the diagram, explain why individuals 1 and 2 are both heterozygous (4)
- What is the percentage chance of parents 7 and 8 having another child with CADASIL? (1)
- (9)**

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: (1)
- (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)

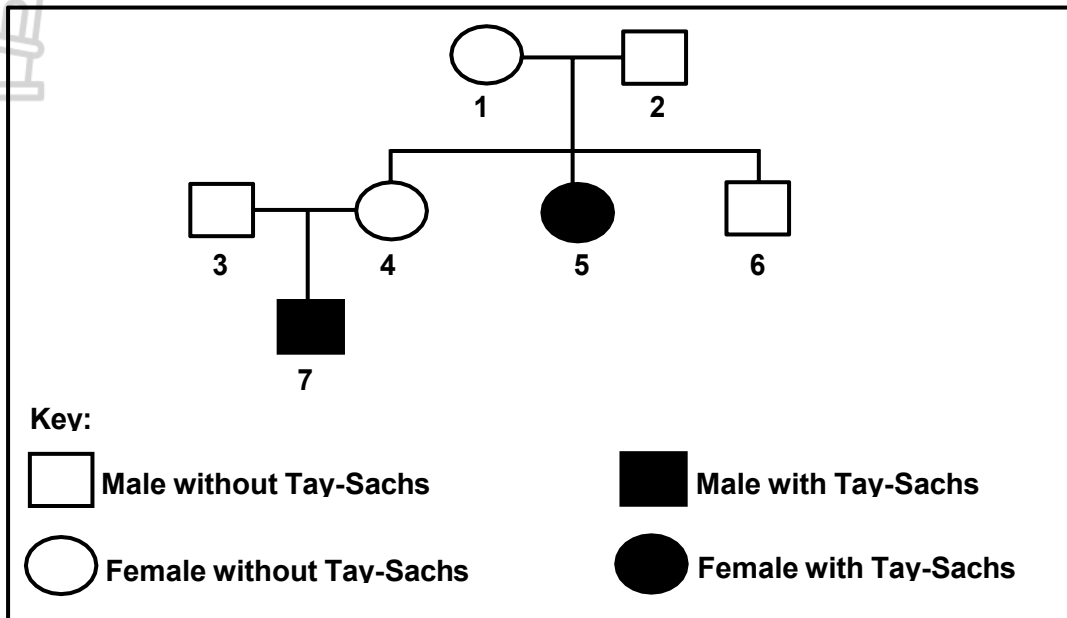
(b) Phenotype of a plant with the genotype $NnRR$ (2)

(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.

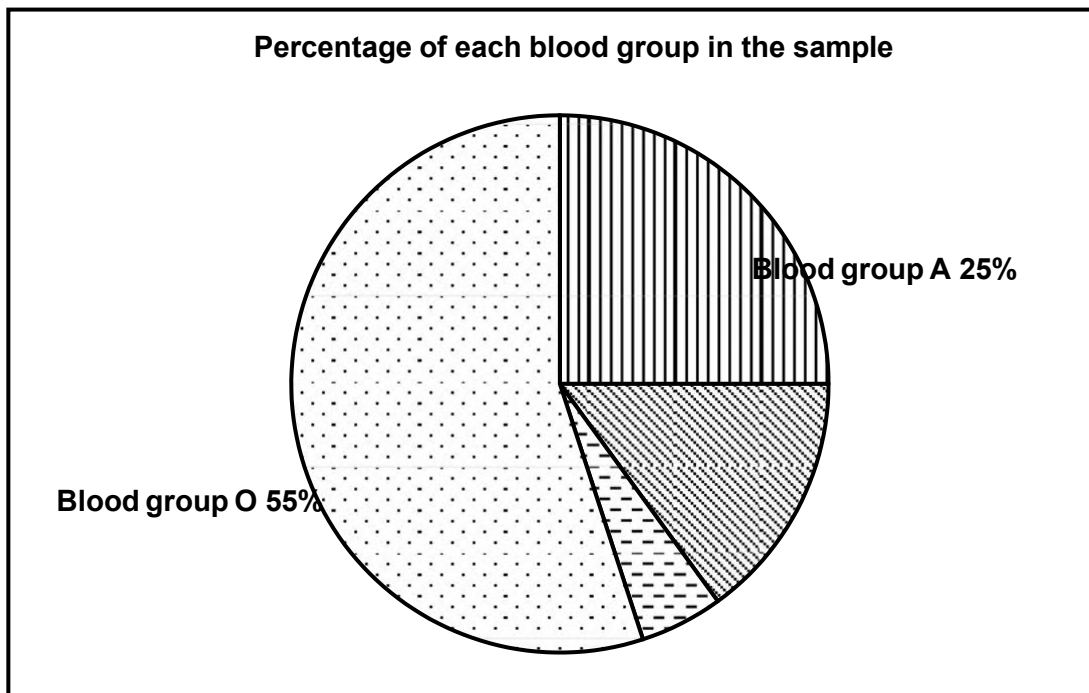
(7)

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.

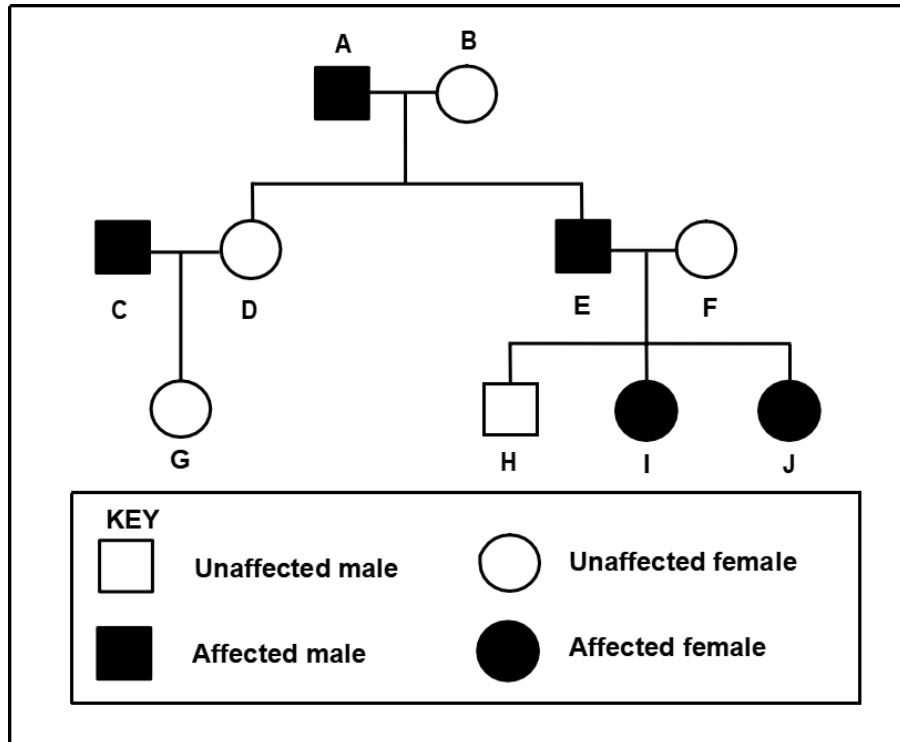


- 19.1 State the aim of the investigation. (2)
 - 19.2 Answer the following questions:
 - (a) State THREE planning steps to consider when conducting this investigation. (3)
 - (b) State ONE way in which the learners ensured the reliability of the results. (1)
 - (c) Give ONE reason why they did not include 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.

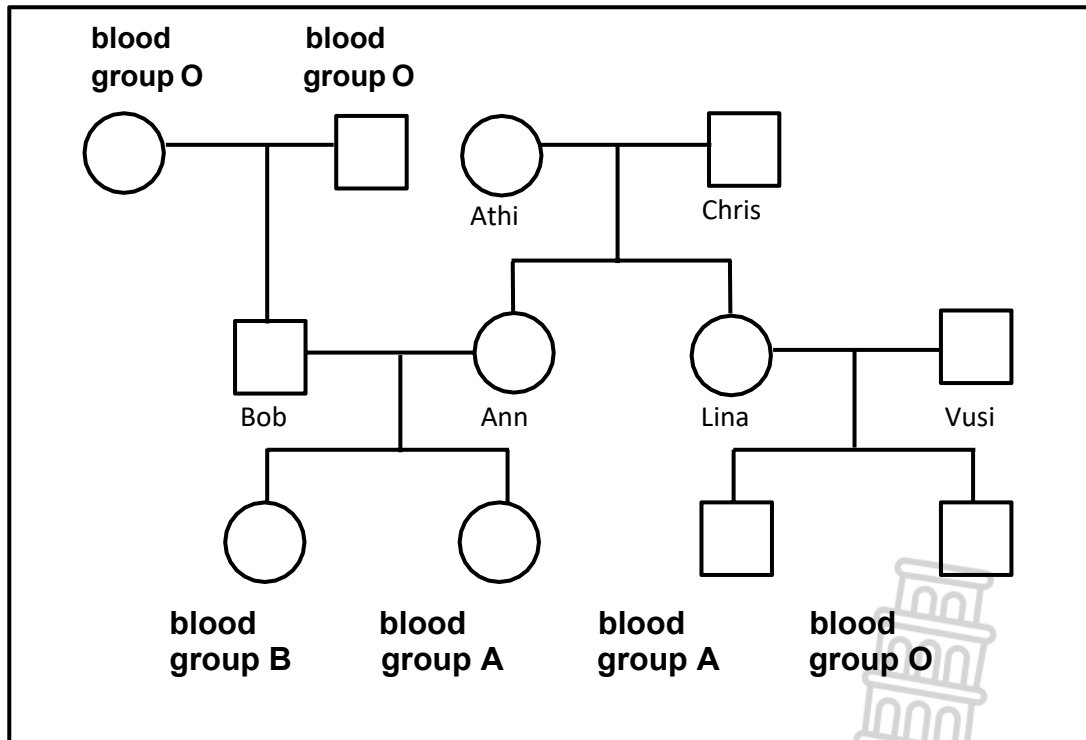
23.1 Explain why more males than females have white teeth. (4)

23.2 A man with brown teeth married a woman with white teeth. (6)

Use a genetic cross to show the possible phenotypic ratio of their children. Use X^B for brown teeth and X^b for white teeth. (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

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 is crossed with a plant that is homozygous for yellow and oval fruit.

26.1 State the:

(a) Genotypes of the P₁-parents (2)

(b) Phenotypes of the F₁-generation (2)

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

(a) Genotypes of the P₁-parents (2)

(b) Phenotypes of the F₁-generation (1)

26.3 Give the possible genotypes of both parents that must be crossed if a 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.

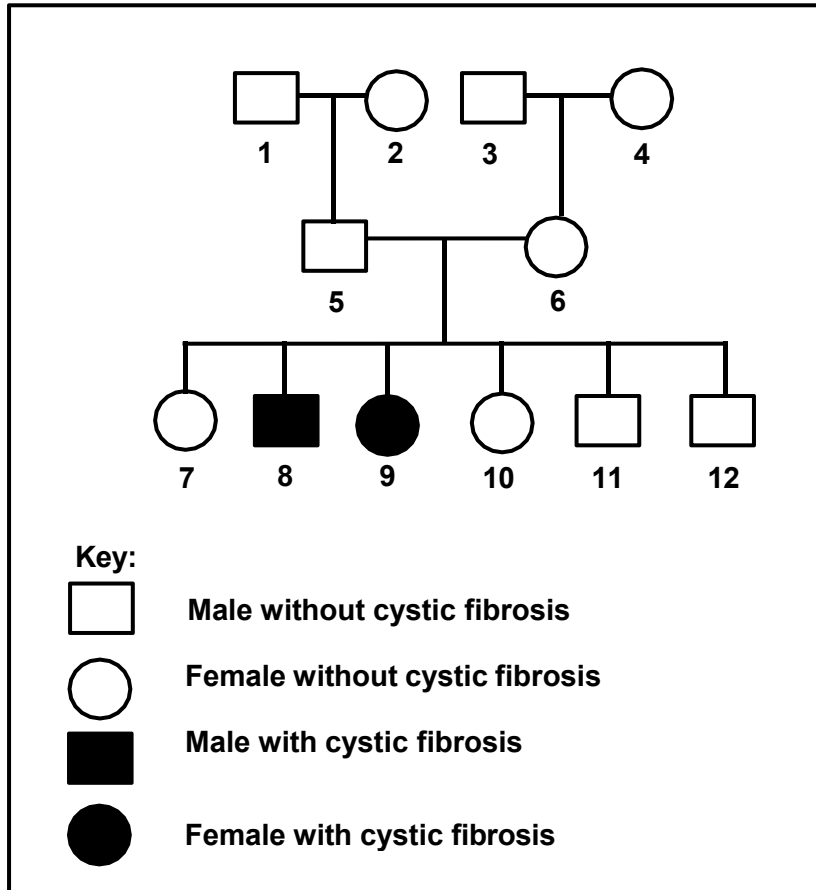
Recently, stem cells have also been obtained from bone marrow. These stem cells are used to treat conditions such as heart disease and spinal injuries.

- 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

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

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

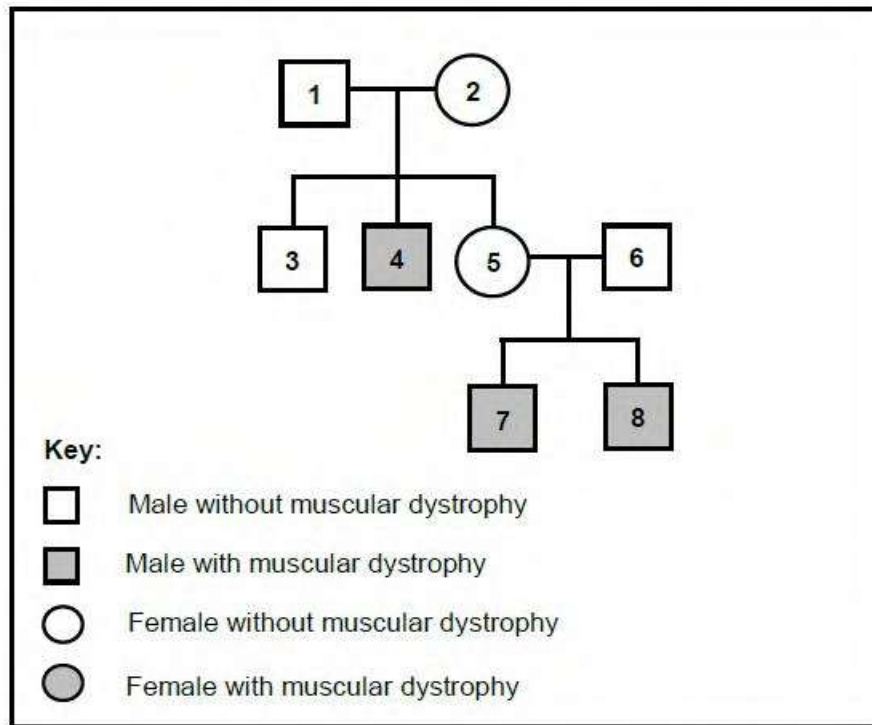
- 30.1 According to the data, which is the most common blood group among the donors? (1)
 - 30.2 Name the type of dominance shown by the inheritance of blood group **A**. (1)
 - 30.3 Explain how it is possible for a man with blood group **A** and a woman with blood group **AB** to have a child with blood 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 (X^d). The dominant allele (X^D) results in normal muscle formation.

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

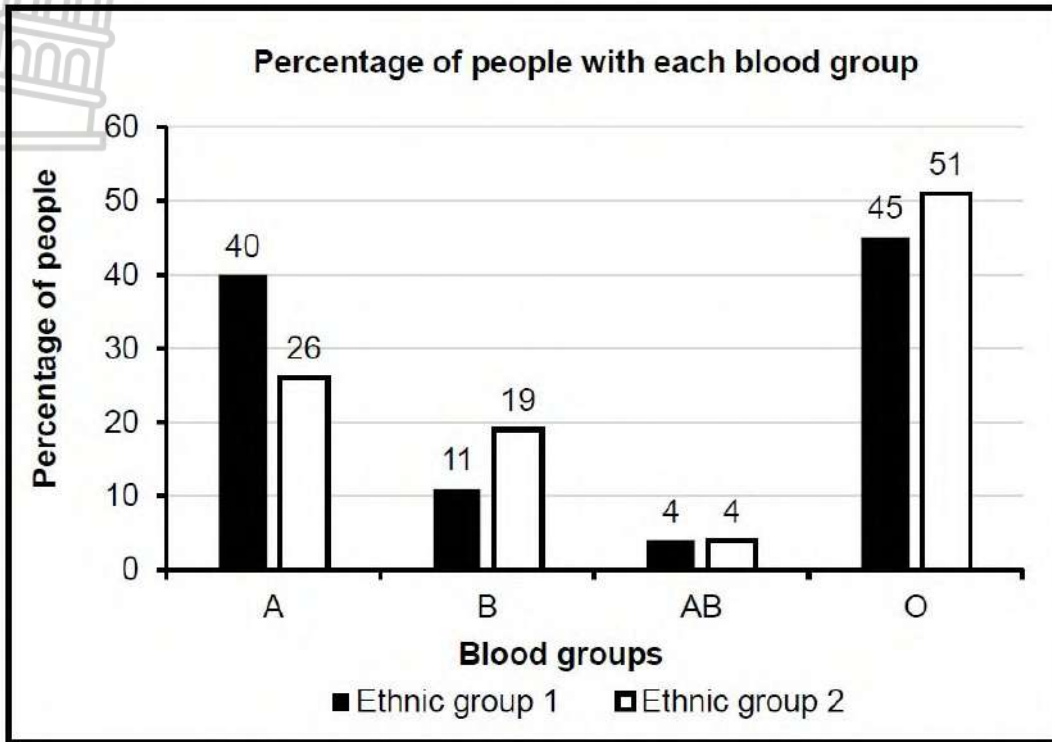


- 31.1 How many offspring do individuals **1** and **2** have? (1)
- 31.2 Give the:
- (a) Phenotype of individual **1** (1)
 - (b) Genotype of individual **2** (1)
- 31.3 Explain why more males than females are likely to have muscular dystrophy. (5)
- 31.4 Parents **5** and **6** plan to have another child.
 Use a genetic cross to show the percentage chance of having a child with muscular dystrophy. (6)

(13)

Question 32

The graph below shows the distribution of blood groups for two ethnic groups (1 and 2) in a certain country during 2021.



- 32.1 Which blood group: (1)
- 32.2 (a) Is most common in both ethnic groups (1)
- 32.2 (b) Has a higher percentage in ethnic group 1 than in ethnic group 2 (1)
- 32.2 State ALL the possible genotypes of 11% of the people in ethnic group 1. (2)
- 32.3 Ethnic group 1 had a population of 360 000 people in 2021. (2)
- Which blood group (A, B, AB or O) had 39 600 people? (2)
- 32.4 Explain the inheritance of blood group AB. (2)



Question 33

Cloning is a process during which an identical copy of an organism is produced using biotechnology.

- 33.1 Describe the process of cloning. (5)
- 33.2 List THREE benefits of cloning animals. (3)

Question 34

Palomino horses are bred by horse breeders for their coat colour. A palomino has a golden-coloured coat. It is the offspring of a horse with a cream-coloured coat (A) and a horse with a chestnut-coloured coat (G).

- 34.1 Name the type of dominance displayed in the inheritance of coat colour in palomino horses. (1)
- 34.2 Explain your answer to QUESTION 34.1. (2)
- 34.3 The breeding of horses with desired characteristics is a type of biotechnology.
- (a) Name this type of biotechnology. (1)
 - (b) Name the TWO phenotypes of the horses that must be interbred for a 100% chance of palomino offspring. (2)
- 34.4 A horse with a cream-coloured coat was crossed with a palomino horse. Use a genetic cross to show the expected phenotypic ratio of the offspring. (6)
- (12)**



TOPIC: HUMAN RESPONSE TO ENVIRONMENT

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	
	(12 x 1)	(12)

Question 2

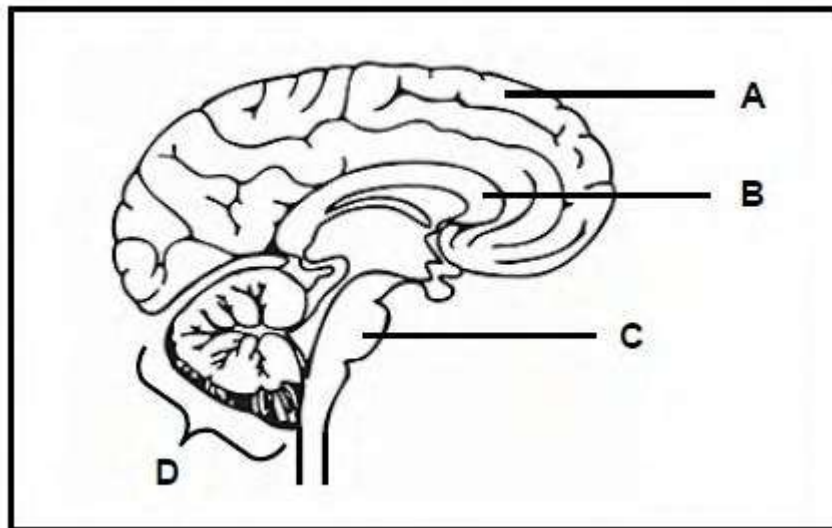
Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number.

	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
		(5x2)	(14)

Question 3

The diagram below represents parts of the central nervous system.

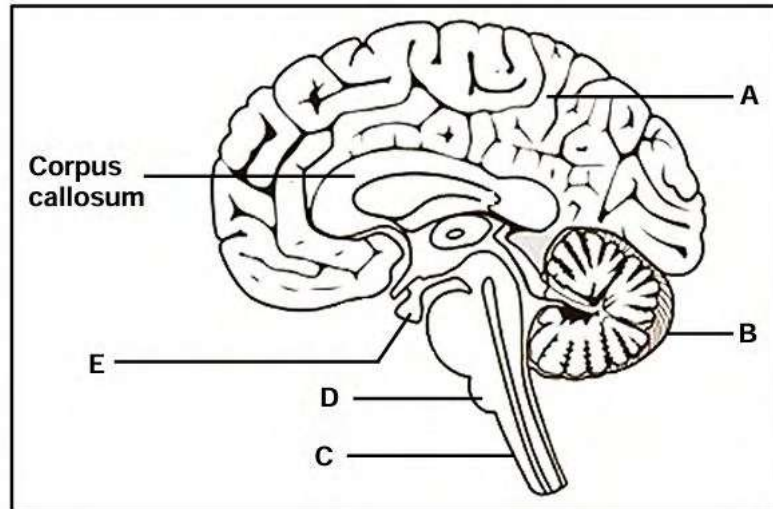


- 3.1 Name the TWO components of the central nervous system shown in the diagram. (2)
- 3.2 Identify part:
 - (a) **B** (1)
 - (b) **D** (1)
- 3.3 Give the LETTER and NAME of the part that controls:
 - (a) The heartbeat (2)
 - (a) Voluntary actions (2)



Question 4

The diagram below represents a human brain.



- 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.

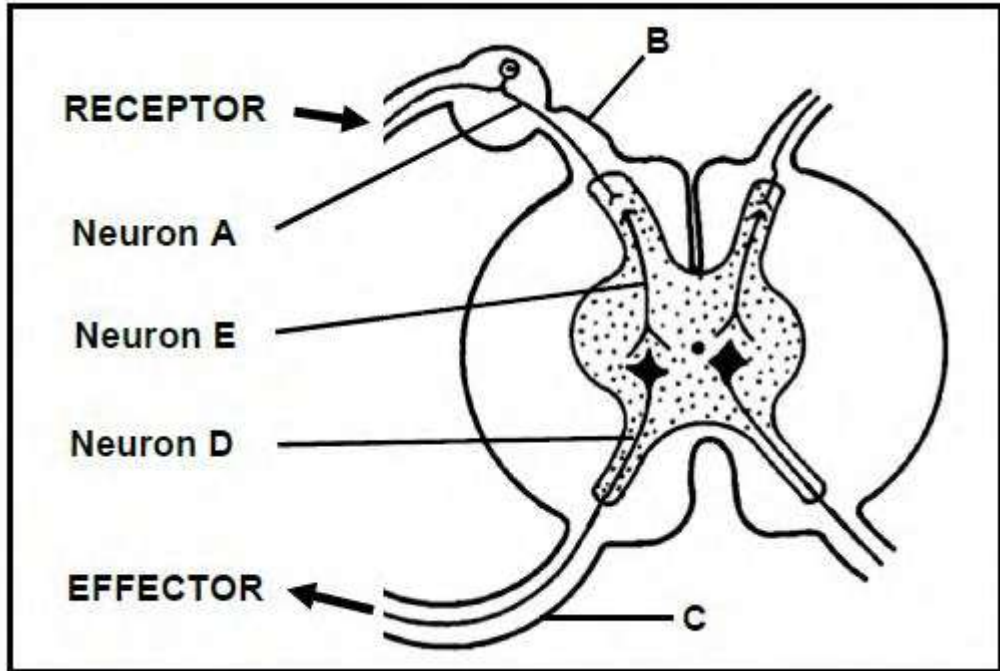
Explain why
 - (a) The learner could still breathe properly (2)
 - (b) It is possible that the injury affected part B (2)
 - (c) The hearing of the learner could also be affected because of the injury (2)

(11)



Question 5

The diagram below represents part of a reflex arc.



- 5.1 Give the LETTER of the part that represents the:
 - (a) Dorsal root (1)
 - (b) Sensory neuron (1)
 - 5.2 Explain the:
 - (a) significance of a reflex action (2)
 - (b) effect on the reflex arc if neuron A is cut (3)
 - 5.3 Draw a labelled diagram to show the detailed structure of neuron D. (5)
 - 5.5 State the significance of a synapse. (1)
- (13)**



Question 6

Read the extract below.

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.

- 6.1 What is meant by a *reflex arc*? (2)
- 6.2 From the extract, state ONE: (1)
- (a) Medical condition that causes hyporeflexia (1)
 - (b) Similarity in the causes of hyporeflexia and hyperreflexia (1)
 - (c) Symptom of hyporeflexia (1)
- 6.3 Describe ONE difference between the causes of hyporeflexia and hyperreflexia. (2)
- 6.4 Name the part of a neuron that degenerates, leading to multiple sclerosis. (1)
- 6.5 Explain how damage to the part named in QUESTION 6.4 can lead to the symptoms of multiple sclerosis, as stated in the extract. (3)
- (11)**

Question 7

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

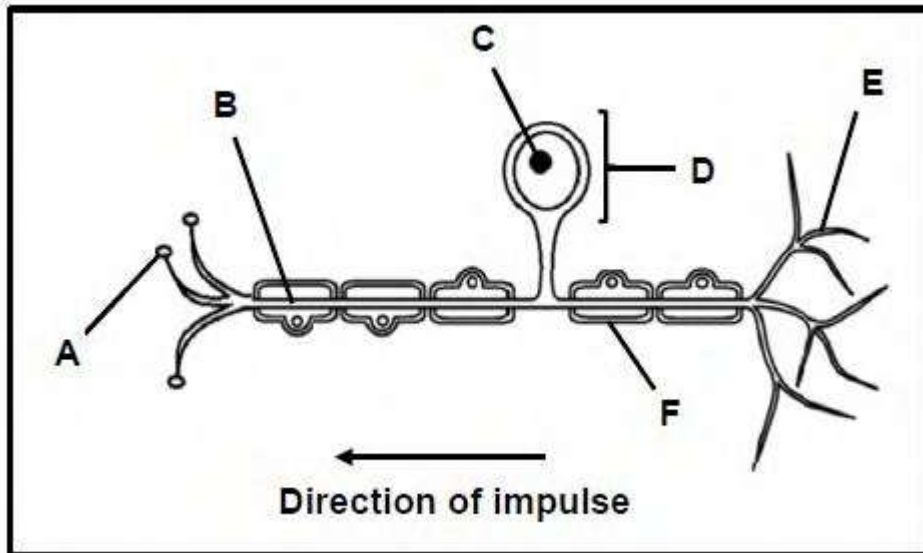
REGIONS OF THE WORLD	NUMBER OF SEVERE BRAIN INJURIES (PER 100 000 PEOPLE PER YEAR)
Latin America	900
USA and Canada	1 300
East Mediterranean	890
Europe	1 010
Africa	800

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

- 7.2 Explain why this data may not be accurate for the region named in QUESTION 7.1 (2)
- 7.3 Draw a bar graph to represent the data in the table. (6)
- (9)

Question 8

The diagram below shows the structure of a neuron.

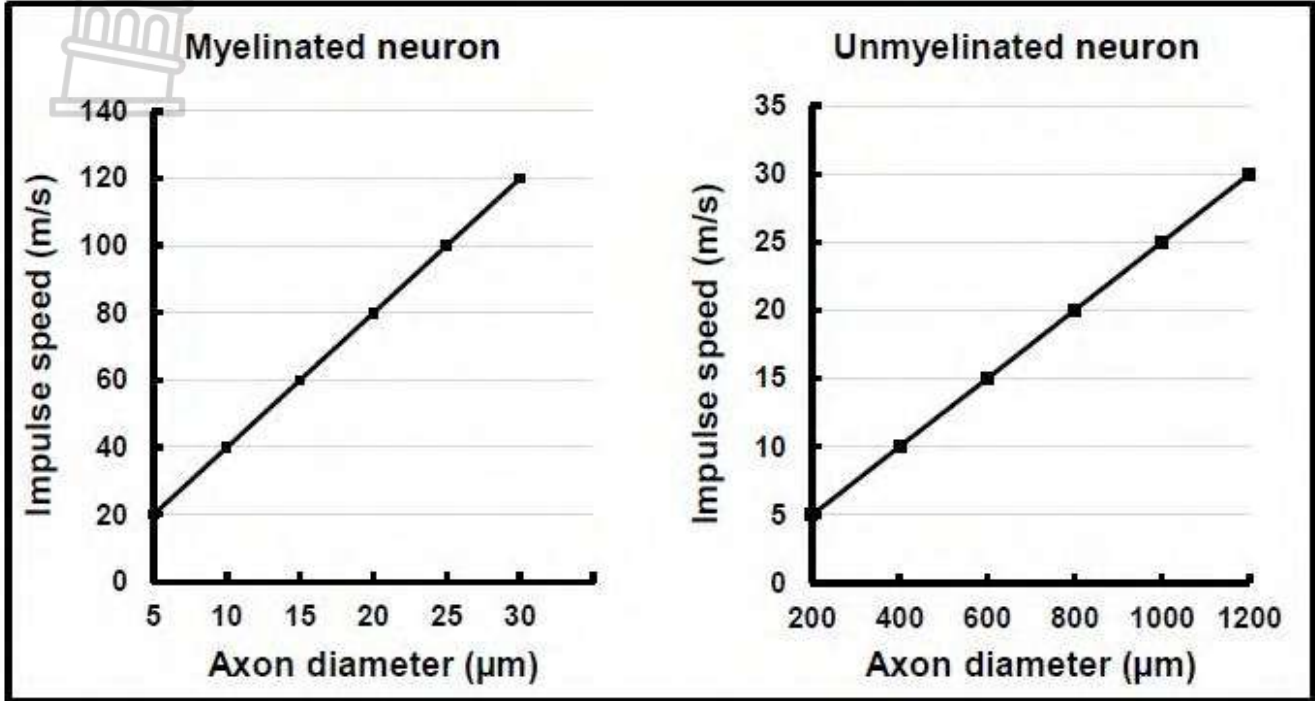


- 8.1 Name the type of neuron represented by the diagram. (1)
- 8.2 Identify part:
- (a) **B** (1)
 - (b) **D** (1)
 - (c) **E** (1)
- 8.3 Give the LETTER of the part that:
- (a) Contains the genetic material of the neuron (1)
 - (b) Insulates the neuron (1)
 - (c) Makes synaptic contact with an interneuron (1)
- 8.4 Name the disorder that is associated with the degeneration of part F. (1)
- (8)

Question 9

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 diameters.

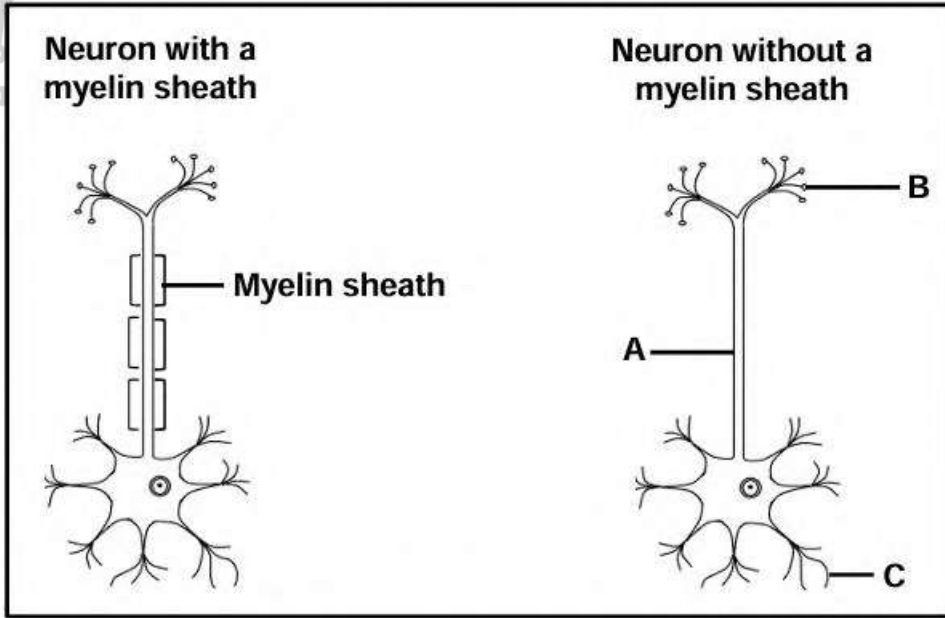
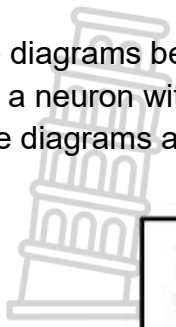


- 9.1 Give the axon diameter (in µm) at which an impulse moves at 20 m/s in:
 - (a) A myelinated neuron (1)
 - (b) An unmyelinated neuron (1)
 - 9.2 Use the graphs to describe the following:
 - (a) Difference in impulse speed for myelinated and unmyelinated neurons (2)
 - (b) Relationship between axon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



Question 10

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.)



- 10.1 Identify the type of neuron shown in the diagrams. (1)
 - 10.2 Give ONE visible reason for your answer to QUESTION 10.1 (1)
 - 10.3 Describe the function of the type of neuron identified in QUESTION 10.1 (3)
 - 10.4 Use the letters A, B and C to indicate the direction in which an impulse moves through the neuron. (2)
 - 10.5 Name the disorder associated with degeneration of the myelin sheaths of neurons. (1)
- (8)**



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	The type of vision in which both eyes are used to see one image	
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	
1.10	The part of the retina that contains no rods and cones	
(10 x 1)		(10)

Question 2

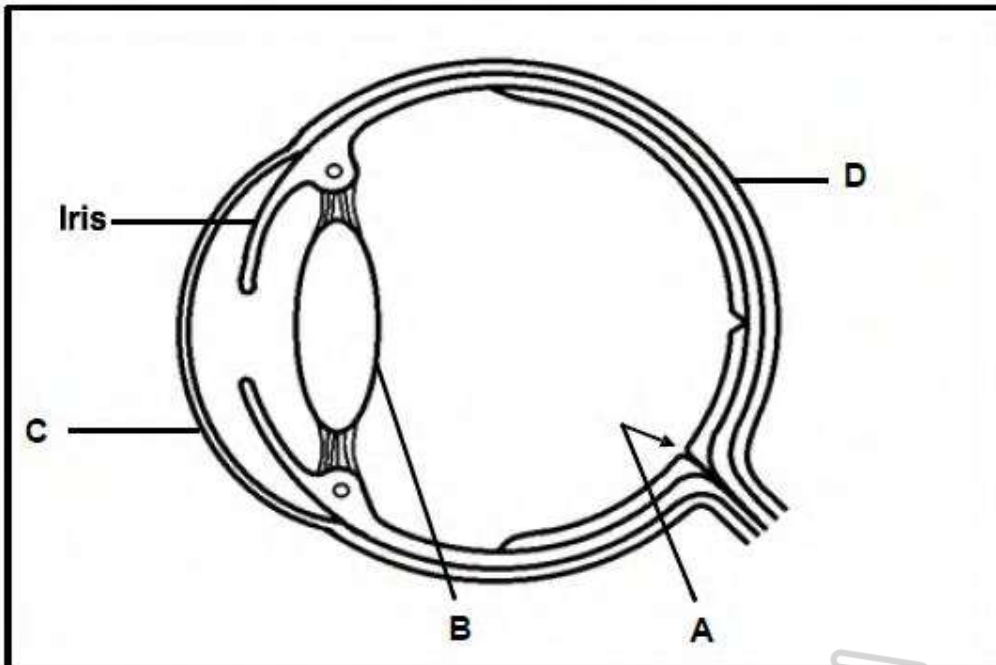
Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number.

	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
2.6.	The area on the retina where there are no rods or cones	A: Blind spot B: Cornea
2.7	Plays a role in the pupillary mechanism	A: Ciliary muscles B: Radial muscles
(7x2)		(14)

Question 3

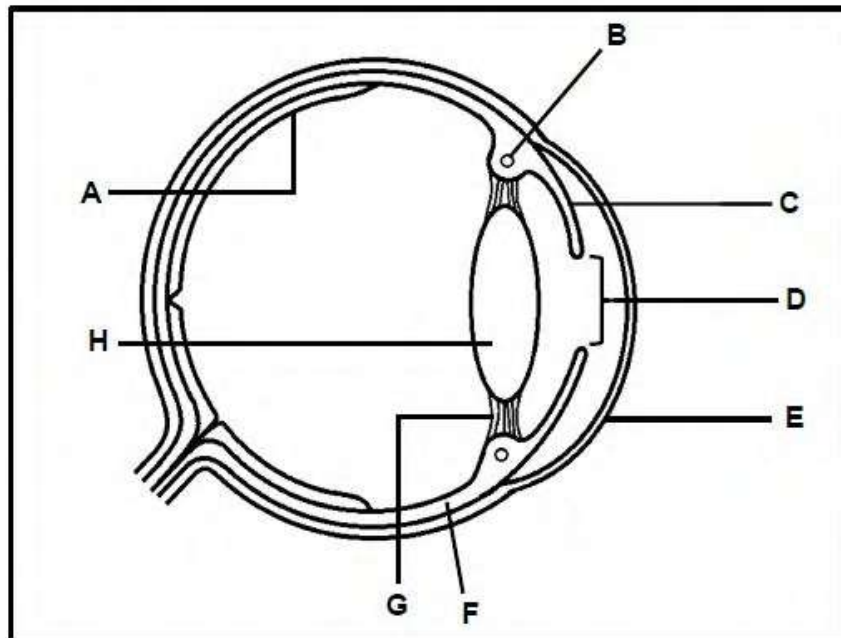
The diagram below represents the structure of a human eye.



- 3.1 Identify part:
- (a) **A** (1)
 - (b) **C** (1)
 - (c) **D** (1)
- 3.2 Describe how the muscles in the iris enable a person to see in dim light. (4)
- 3.3 Name the process that occurs in the eye when a person focuses on objects at different distances. (1)
- 3.4 Explain how the shape of part B enables a person to read a book. (3)
- (10)**

Question 4

The diagram below represents the human eye.

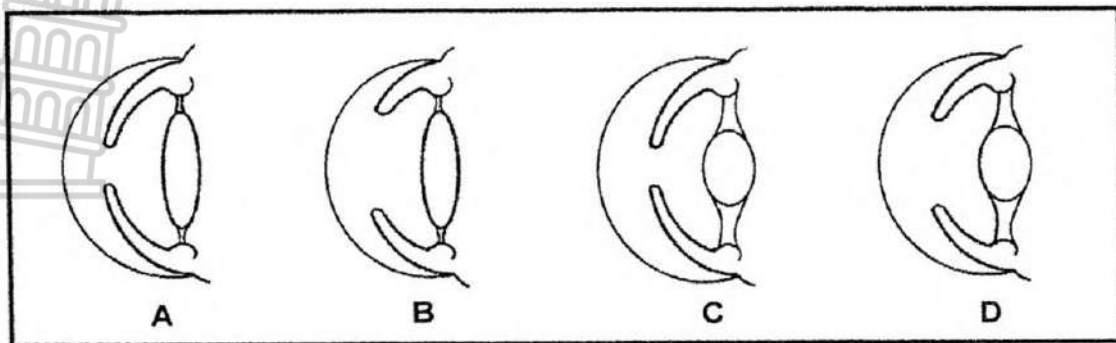


- 4.1 Identify part:
 - (a) **D** (1)
 - (b) **E** (1)
 - 4.2 Give the LETTER of the:
 - (a) Choroid (1)
 - (b) Iris (1)
 - 4.3 Name the TWO different receptors found in part A. (2)
 - 4.4 Give only the LETTERS of THREE parts that are involved in accommodation of the eye. (3)
- (9)**



Question 5

The diagrams below show part of the eye under different conditions



- 5.1 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)
- 5.2 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)
- 5.3 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 6

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.

- 6.1 According to the passage, which type of cataract is associated with a disorder of the pancreas? (1)
- 6.2 Use information in the passage to explain why cataracts cause vision loss. (5)

A man is long-sighted.

Explain how:

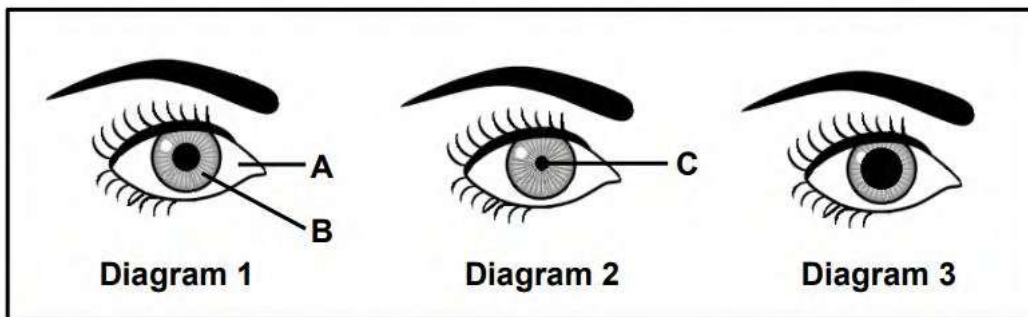
6.3 The structure of his eyeball affects his vision when he reads a book without glasses (3)

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

(11)

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

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

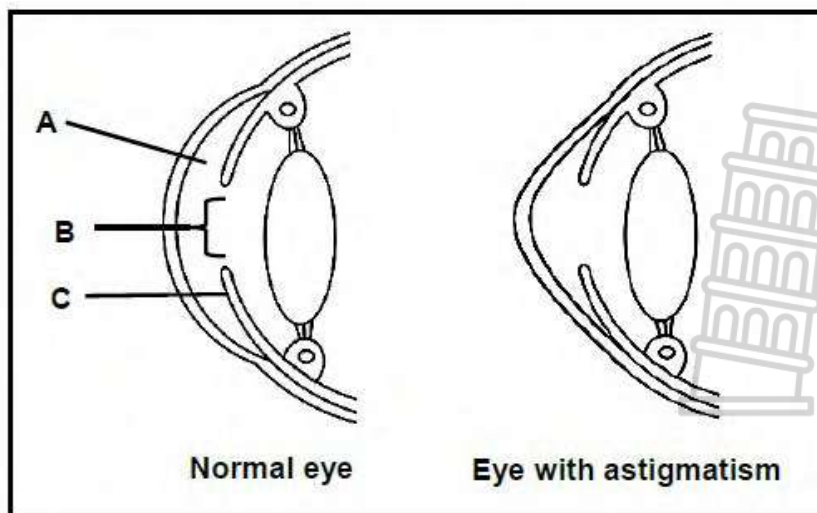
- She sat in a well-lit room
- She covered her one eye with an eye patch
- A pencil was held in front of her uncovered eye for 10 seconds
- She focussed on the pencil until a clear image could be seen and at the same time the curvature of the lens of her eye was measured with an optical instrument
-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

- 8.1 In this investigation identify
- (a) the dependent variable. (1)
 - (b) the independent variable. (1)
- 8.2 State TWO factors that must be kept constant during the investigation (2)
- 8.3 Explain why the factors named in QUESTION 6.2 must be kept constant (2)
- 8.4 Describe the relation between the distance of the pencil from the eye and the curvature of the lens of the eye. (2)
- 8.5 Name TWO structures in the eye that are responsible for the changes in the curvature of the lens. (2)
- (10)**

Question 9

The diagrams below represent the structure of a normal eye and that of an eye with astigmatism.



- 9.1 Identify:
- (a) Fluid A (1)
 - (b) Part B (1)
 - (c) Part C (1)
 - (d) Describe the appearance of the cornea of an eye with astigmatism. (1)

- 9.2 Explain how astigmatism affects vision. (3)
 9.3 Give ONE treatment for astigmatism. (1)
(8)

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 ossicles that transfers vibrations to the oval window	
1.9	The part in the inner ear where the organ of Corti is located	
	(9 x 1)	(9)

Question 2

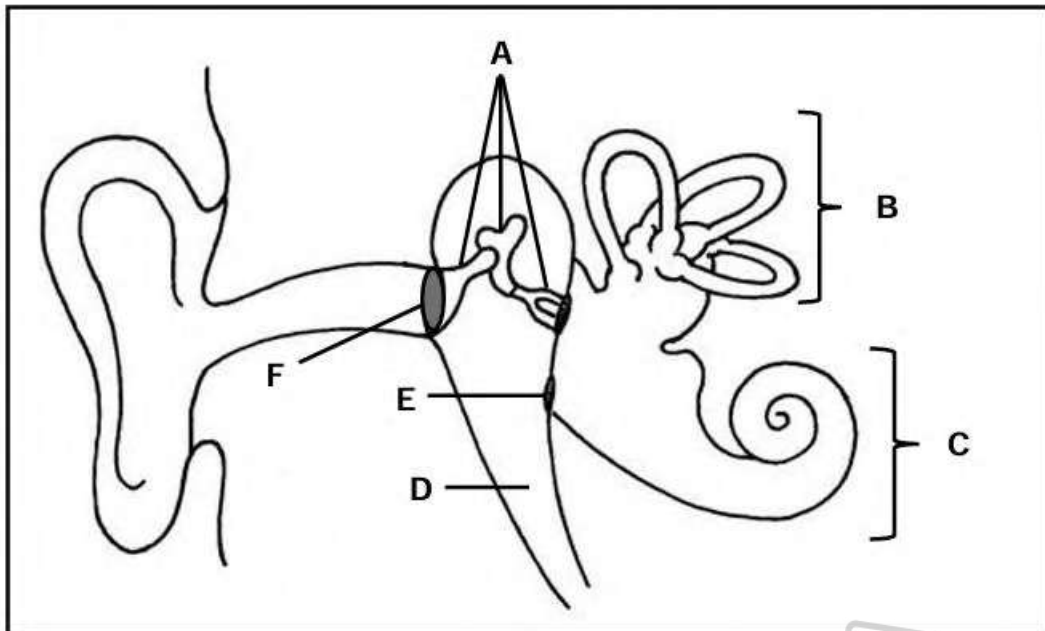
Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number.

	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
2.5	A device that is responsible for the drainage of fluid from the middle ear	A: Grommets B: Hearing aids
(5x2)		(10)

Question 3

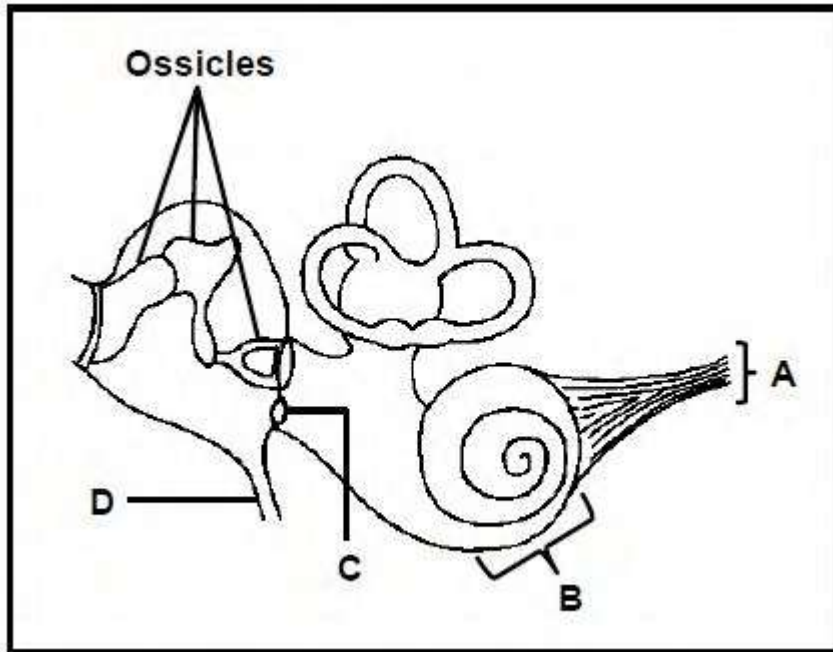
The diagram below represents the human ear



- 3.1 Identify part:
- (a) **B** (1)
 - (b) **E** (1)
- 3.2 Give the LETTER and NAME of the part that:
- (a) Is filled with air (2)
 - (b) Contains the organ of Corti (2)
- 3.3 Give the LETTER of the part:
- (a) Where grommets are inserted (1)
 - (b) That amplifies vibrations (1)
- (8)**

Question 4

The diagram below represents a part of the ear.



- 4.1 Identify part:
 - (a) **A** (1)
 - (b) **B** (1)
- 4.2 State the function of part:
 - (a) **C** (1)
 - (b) **D** (1)
- 4.3 Otosclerosis is a medical condition that prevents the ossicles from vibrating. Explain how this condition will affect hearing. (4)
(8)

Question 5

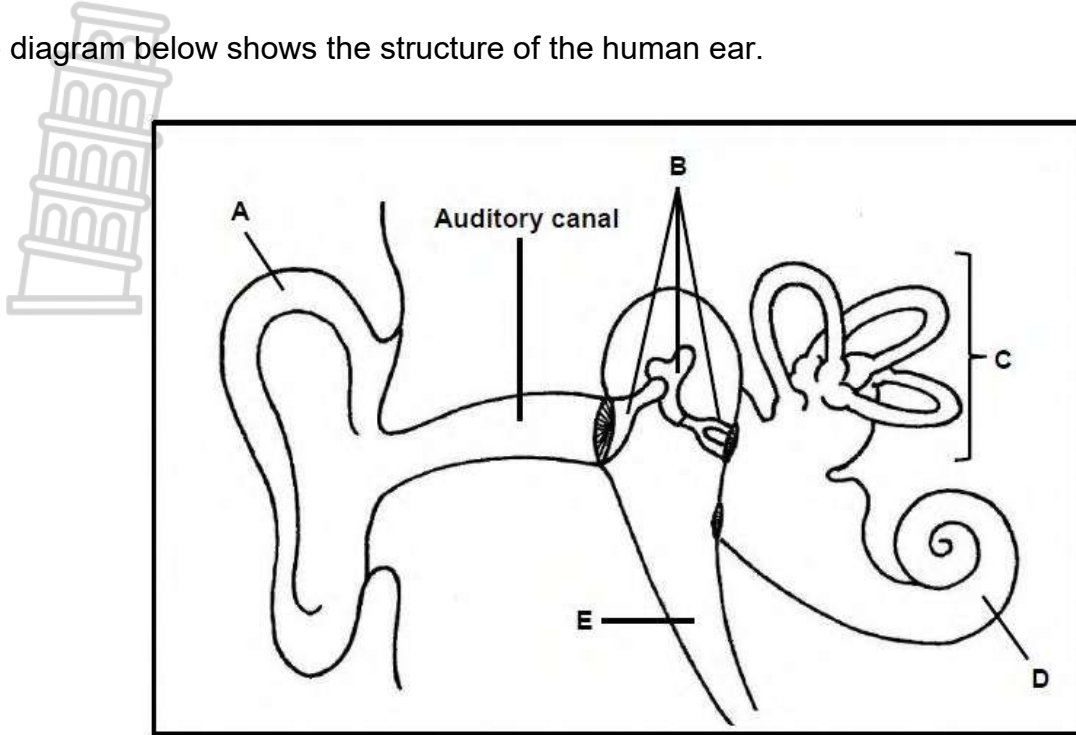
Describe the role of the ear in maintaining balance.



(6)

Question 6

The diagram below shows the structure of the human ear.



- 6.1 Identify part:
 - (a) A (1)
 - (b) B (1)
- 6.2 Give the LETTERS of TWO parts that are normally filled with fluid. (2)
- 6.3 Describe how balance is restored when there is a change in the speed and direction of head movement. (5)
- 6.4 When a person is exposed to loud noise over a long period, it may lead to noise-induced hearing loss (NIHL), which is caused by damage to the hair cells in the organ of Corti. These cells are not repaired when damaged. Placing earplugs in the auditory canal can prevent damage to the hair cells.

Explain how:
 - (a) Damage to the hair cells in the organ of Corti can lead to hearing loss (2)
 - (b) Earplugs can prevent damage to the hair cells in the organ of Corti (3)

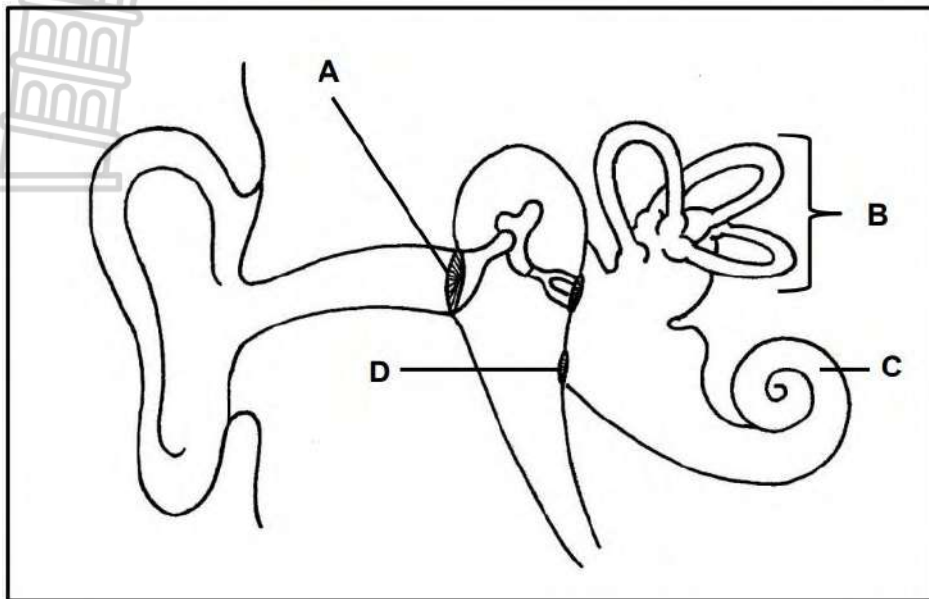


Question 7

- 7.1 Describe the process of hearing. (7)

Question 8

The diagram below represents a part of the human ear.



- 8.1 Identify part C (1)
- 8.2 State ONE function of:
 - (a) the receptors found in part C (1)
 - (b) Part D (1)
- 8.3 Explain why a build-up of ear wax at part A may result in temporary hearing loss. (2)
- 8.4 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)
- 8.5 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 9

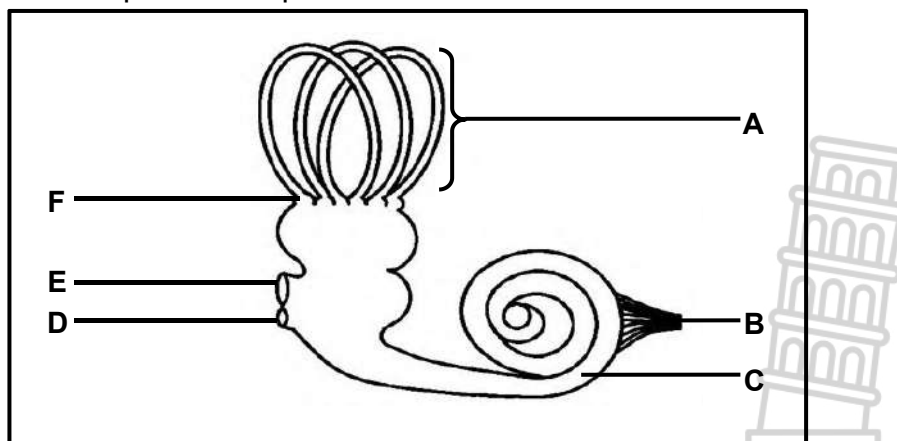
Workers in some factories are constantly exposed to loud noise for long periods. This can destroy the hair cells in the organ of Corti and damage the auditory nerve, resulting in hearing loss. A survey was conducted in a developing country from 2014 to 2018, to establish the number of factory workers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

- 9.1 Name the structure in the ear where the organ of Corti is located. (1)
 - 9.2 Calculate the percentage increase in the number of factory workers with hearing loss between 2014 and 2018. Show ALL workings. (3)
 - 9.3 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)
 - 9.4 Explain why damage to the auditory nerve may result in hearing loss. (2)
 - 9.5 Draw a bar graph to represent the data in the table. (6)
- (13)**

Question 10

The diagram below represents a part of the human ear.



- 10.1 Identify part:
 - (a) A (1)
 - (b) B (1)
- 10.2 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)

10.3 Name the:

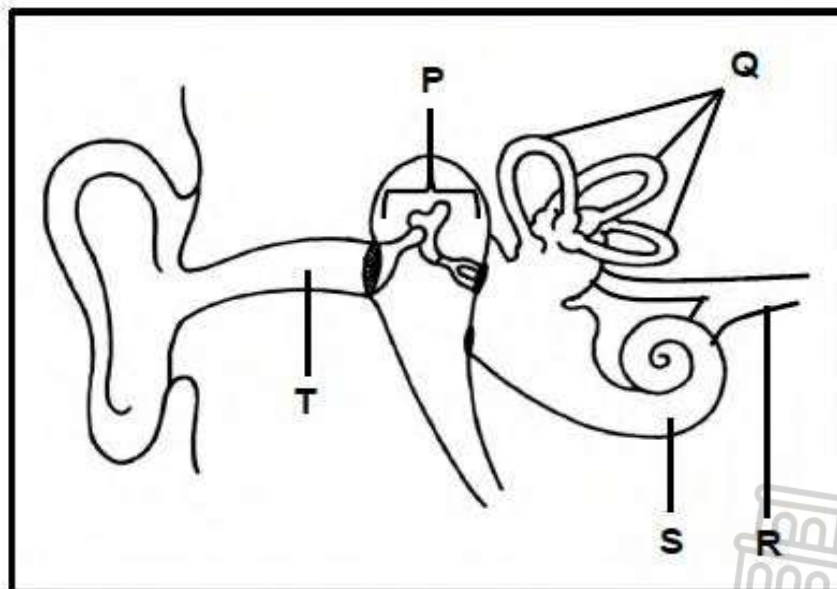
- (a) Part of the brain that interprets impulses from part F (1)
 - (b) Receptors found at C (1)
- (8)**

Question 11

Read the extract below.

HEARING LOSS

There are two main types of hearing loss. Type **A** hearing loss occurs when there is a blockage in the transmission of sound waves and vibrations through the outer and middle ear. Type **B** hearing loss is caused by damage to the hearing receptors of the inner ear or to the nerves that carry sound impulses to the brain.



- 11.1 (a) Type **A** hearing loss (2)
 - (b) Type **B** hearing loss (2)
 - 11.2 Identify part S. (1)
 - 11.3 Describe the role of the hearing receptors when they are stimulated by pressure waves. (2)
 - 11.4 Explain why a person will suffer from hearing loss if the bones at **P** are fused (4)
- (11)**

TOPIC : HUMAN ENDOCRINE SYSTEM AND HOMEOSTASIS

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 maintenance of a constant internal environment within narrow limits.	
1.5	A gland whose secretions are transported through ducts.	
1.6	A hormone that stimulates the production of milk in humans.	
1.7	A hormone that is responsible for osmoregulation in the body.	
1.8	Specialized cells in the pancreas that secrete 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 decreases 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.	
	(20 x 1)	(20)

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.

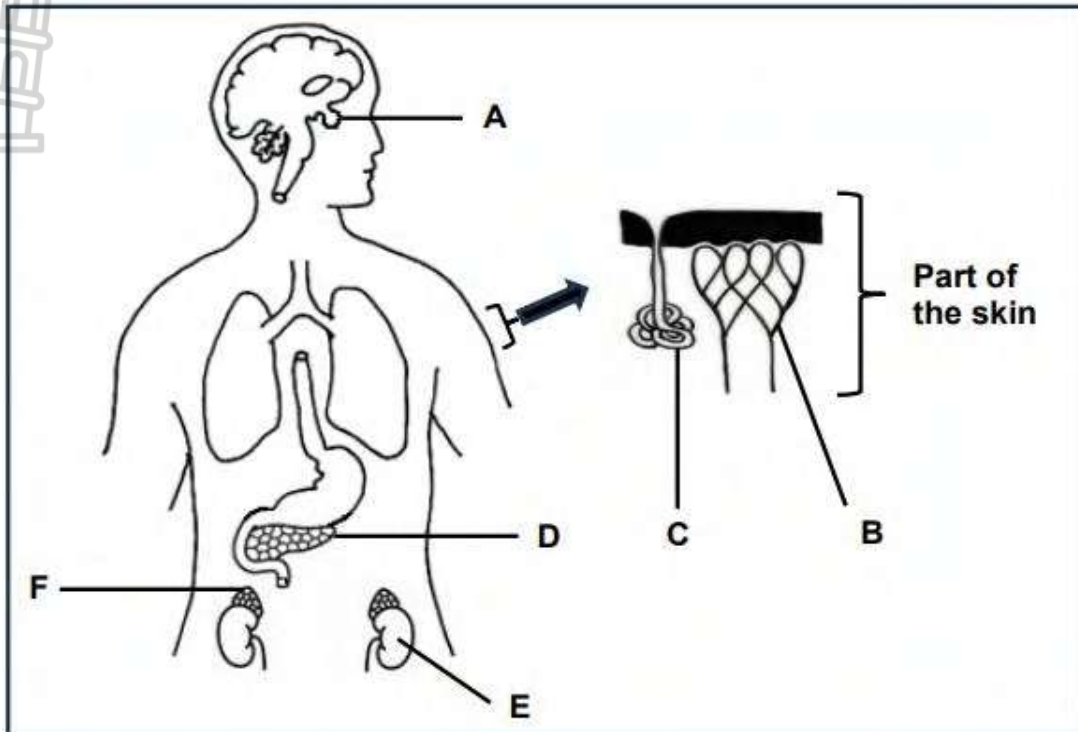
	COLUMN I	COLUMN II
2.1	The hormone that is in excess in a person that grows abnormally tall	A: ADH B: Thyroxin
2.2	A hormone that controls the salt content in a human body	A: Aldosterone B: Adrenalin
2.3	The state of the blood vessels in the skin of a human when the environmental temperature is high	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

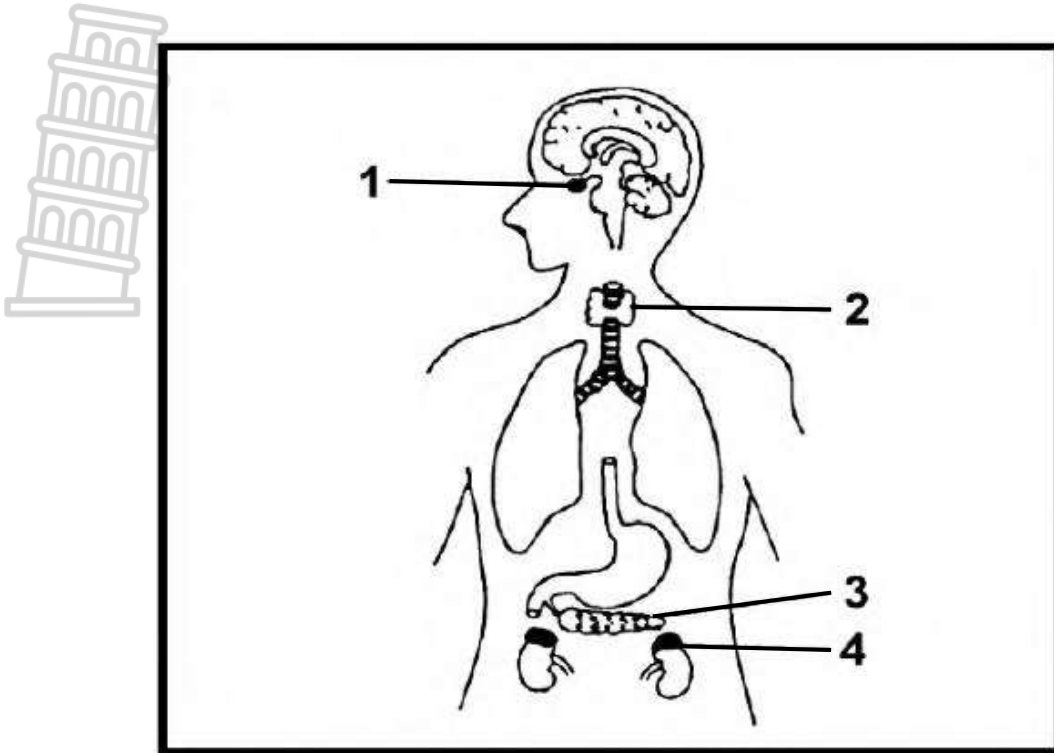
3.1 The diagram below represents some structures involved in homeostasis in the human body.



- 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)**



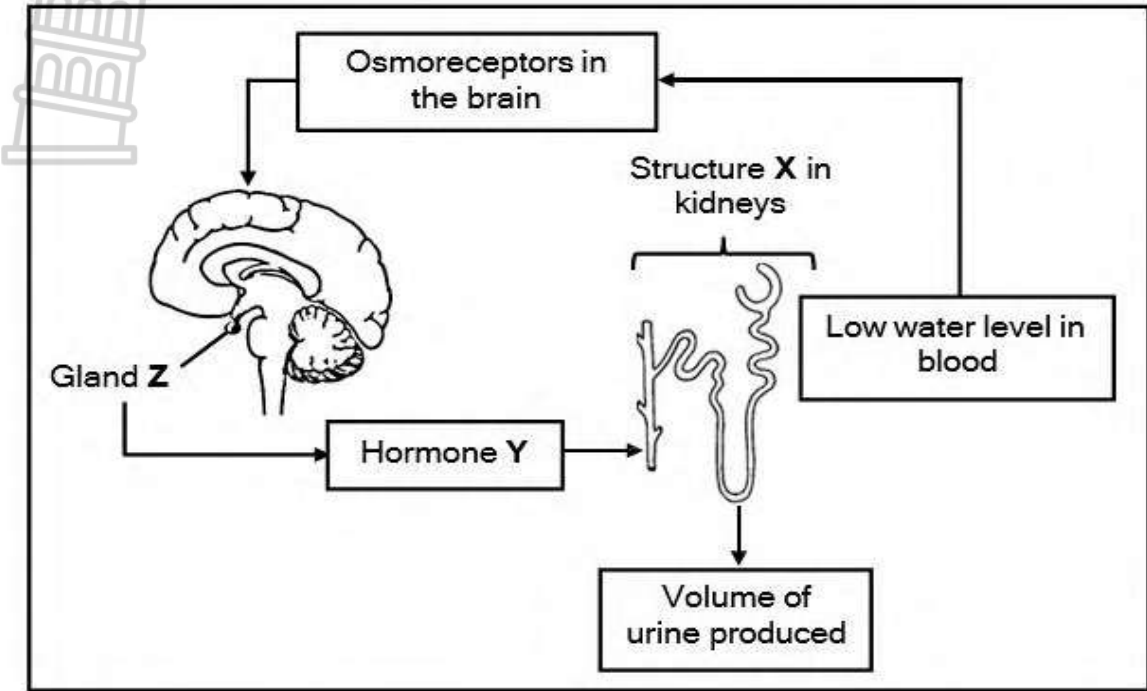
3.2 The diagram below represent human endocrine system



- 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.

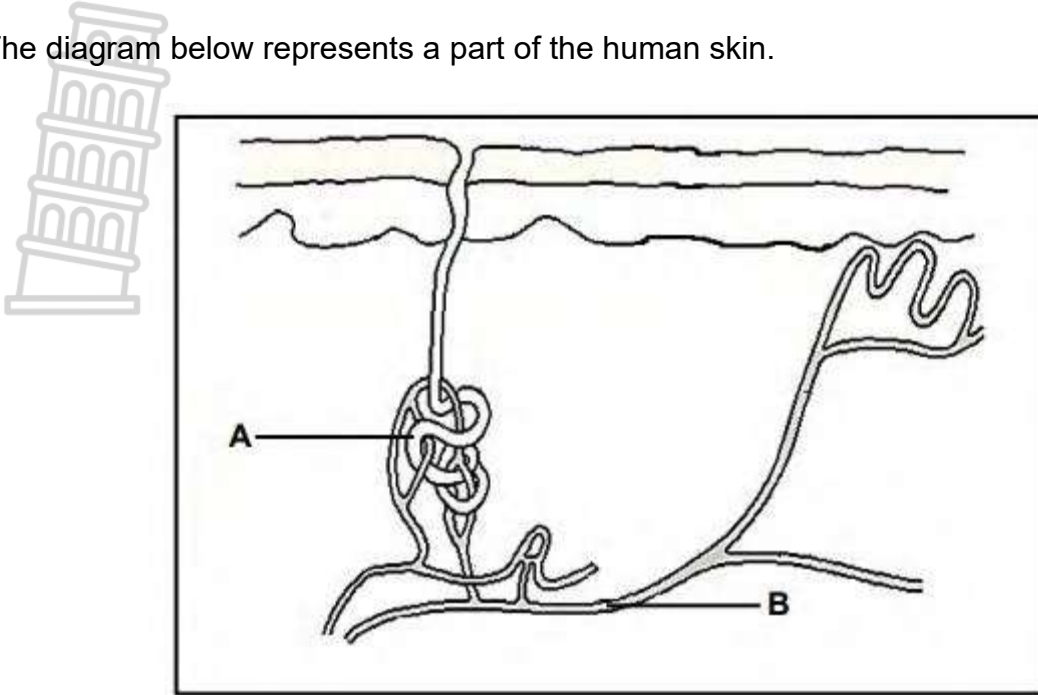


- 4.1 Identify parts:
 - (a) The part of the brain where the osmoreceptors are located (1)
 - (b) Gland Z (1)
 - (c) Hormone Y (1)
 - (d) Structure X (1)
 - 4.2 State whether the volume of urine produced will increase or decrease for this individual. (1)
- (5)**



Question 5

The diagram below represents a part of the human skin.

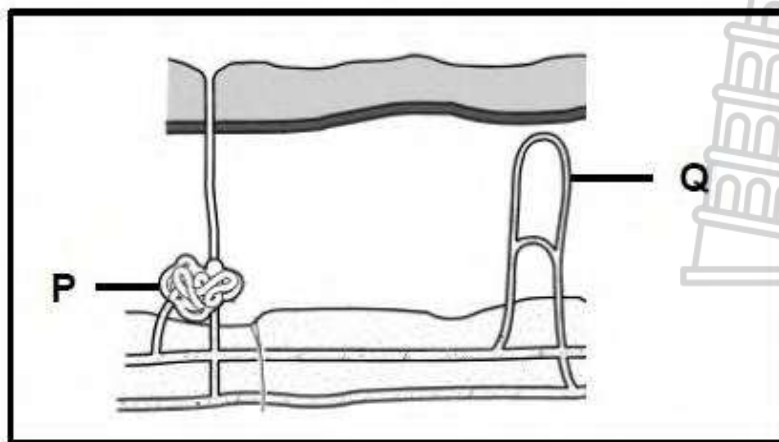


- 5.1 Identify part A. (1)
 - 5.2 Describe how structure B functions during thermoregulation on a cold day. (3)
 - 5.3 Explain why temperature needs to be kept constant in the human body. (2)
- (6)**

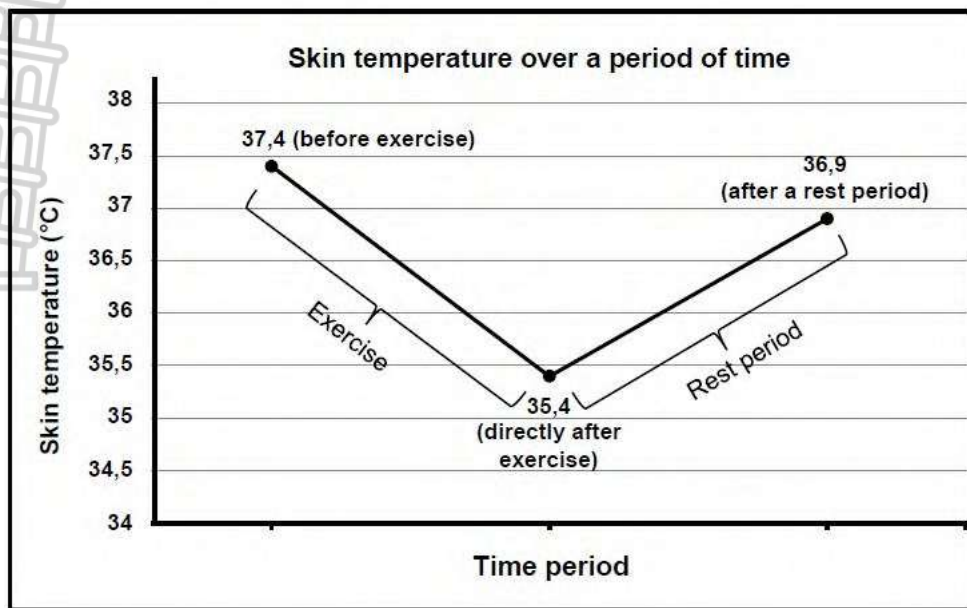
Question 6

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:
- Homeostatic mechanism that brings about the change in skin temperature (1)
 - 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:
- P** (1)
 - 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.

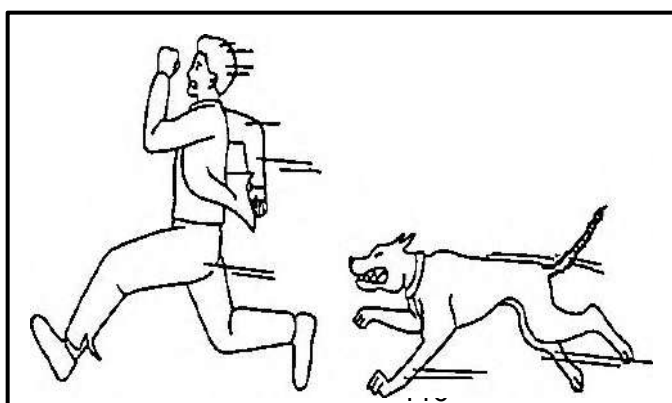
The table below shows the blood glucose levels in a healthy person who ate only one meal.

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

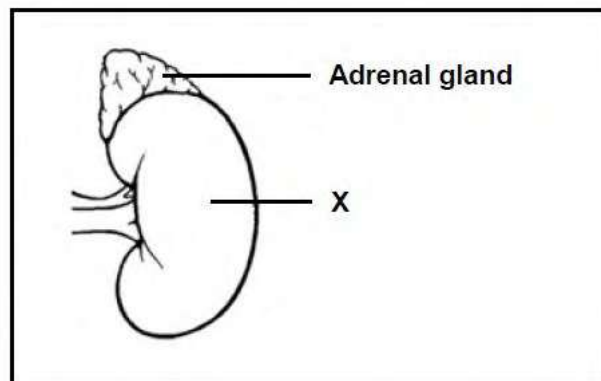
The diagram below represents a 'fight or flight' reaction in humans.



- 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.

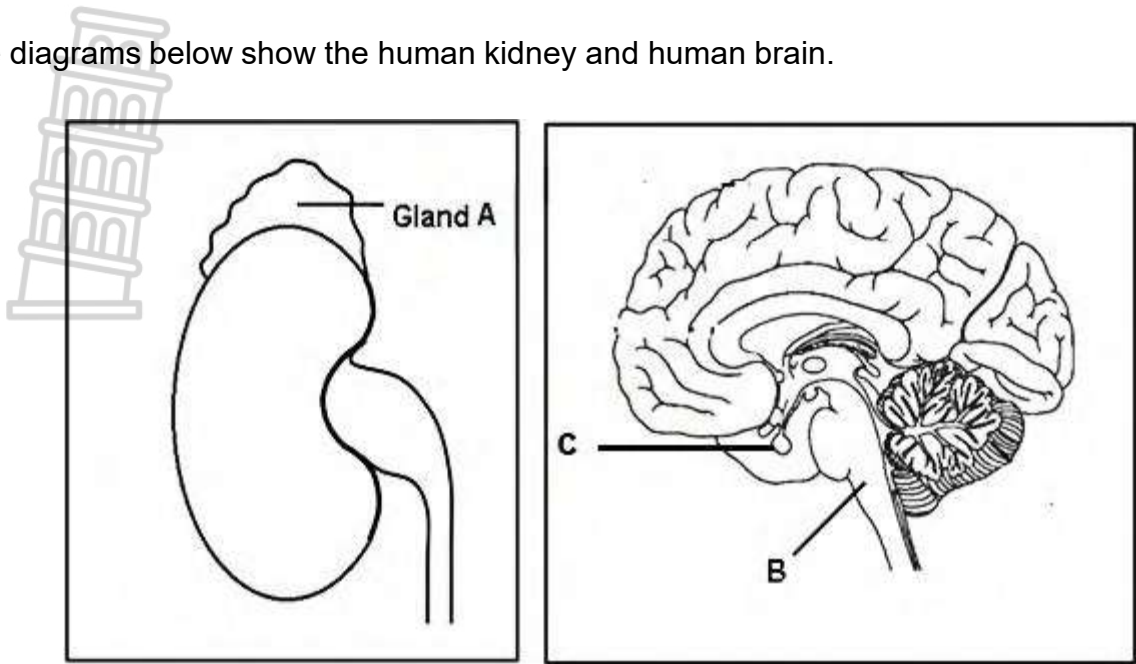


- 9.1 Identify: (1)
- (a) Organ X (1)
 - (b) The system to which the adrenal gland belongs (1)
- 9.2 State TWO characteristics of the type of glands that belongs to the system identified in QUESTION 9.1(b). (2)
- 9.3 Describe the interaction between the adrenal gland and organ X in maintaining homeostasis 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

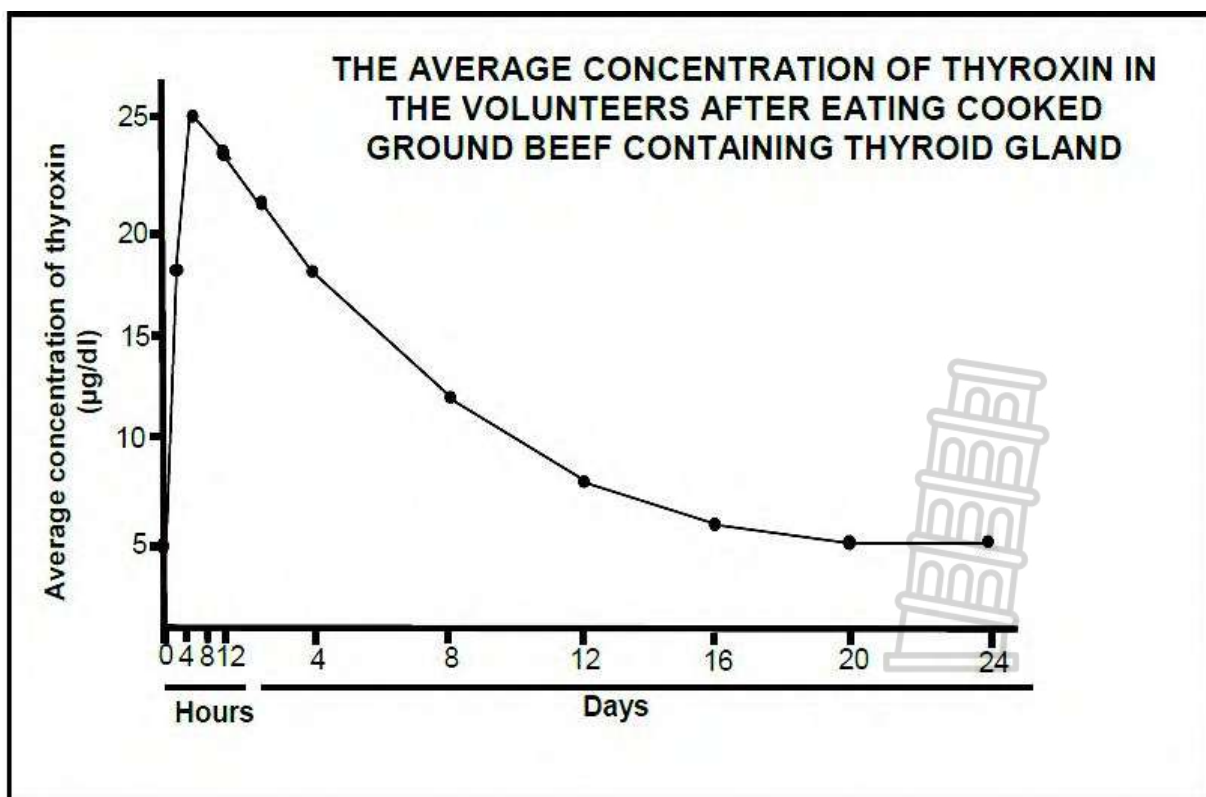
Read the extract below.

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.

Use the data from the table to explain why tissue may die. (2)
- (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)

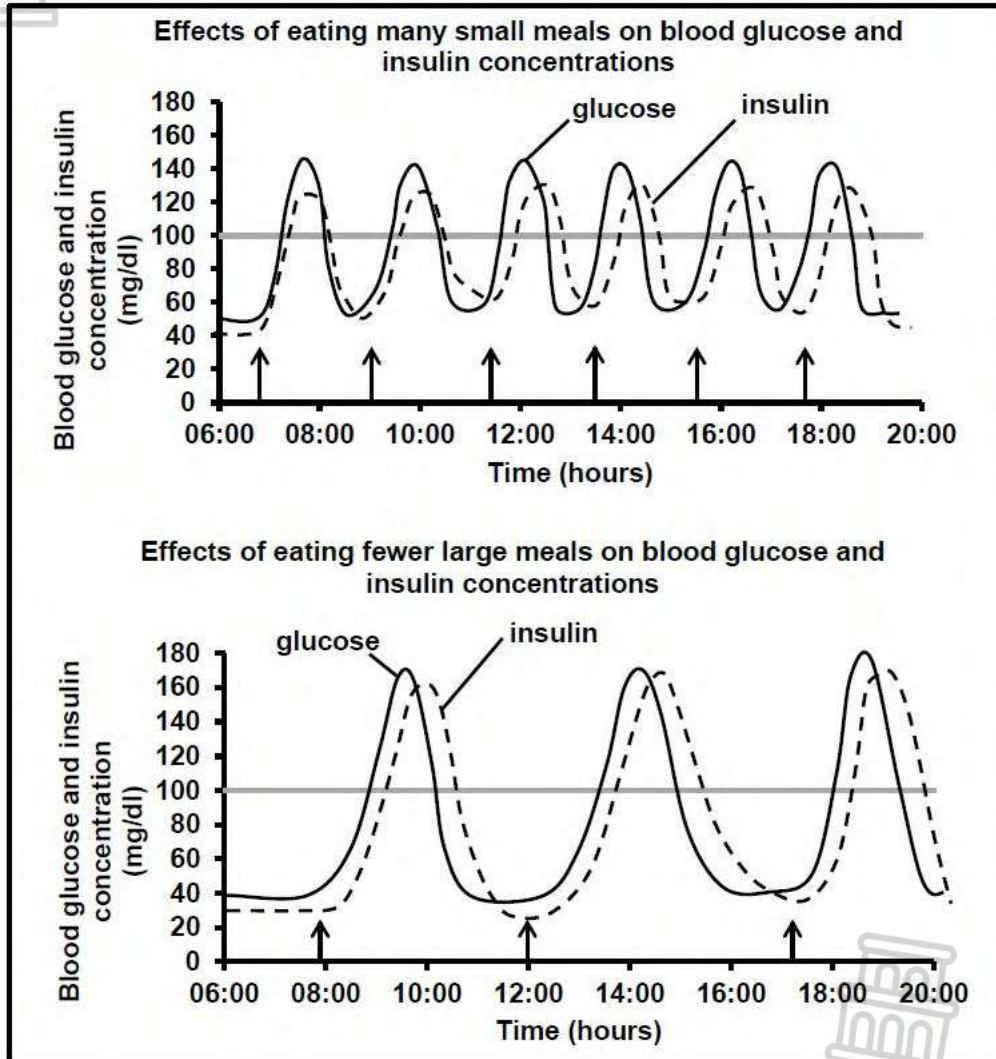
(9)



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 Tabulate TWO ways in which eating fewer large meals and eating many small meals affect the blood insulin levels differently. (5)

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

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.

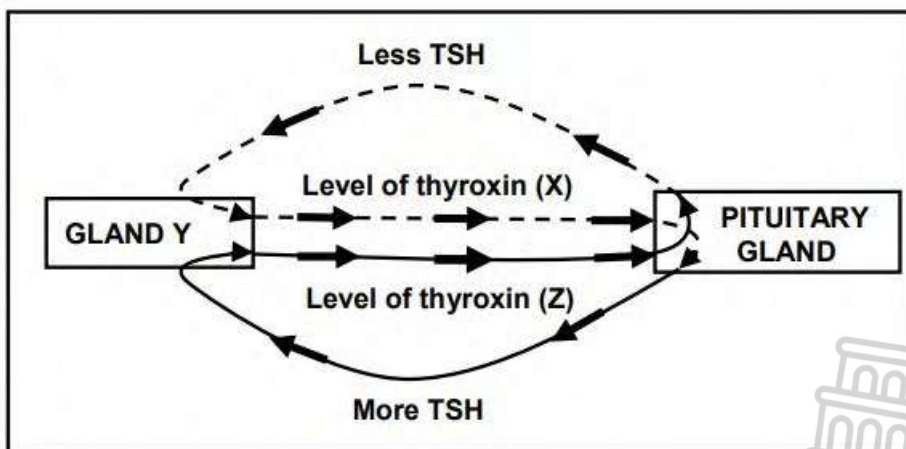
The results are recorded in the table below.

	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 thyroxine 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 thyroxine. (1)
 - 18.3 Describe the role of the pituitary gland in correcting the level of thyroxine at X. (4)
 - 18.4 Explain why a continuous under-secretion of thyroxine may lead to an increase in body mass. (2)
- (10)**

Question 19

Describe how the human body maintains 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)

Question 21

Read the extract below.

INSULIN PUMPS

In people with diabetes mellitus, the beta cells in the pancreas are unable to secrete sufficient amounts of insulin. These people are treated with regular injections of insulin.

Electronic pumps have been developed as an alternative to injections. They pump insulin into the blood according to different blood glucose concentrations. The pump can be clipped to a piece of clothing or fastened to the skin with an adhesive patch. These pumps then infuse insulin through the skin into the blood.

- 21.1 Identify the: (1)
- (a) Groups of cells in the pancreas that contain the beta cells (1)
 - (b) Signal for the pump to turn on and start pumping insulin (1)
- 21.2 State why the cells identified in QUESTION 21.1(a) have endocrine characteristics. (2)
- 21.3 Describe the effect of insulin on the liver and the muscles. (2)
- 21.4 Explain why electronic pumps are more effective in controlling blood glucose levels than insulin injections. (2)
- (8)**

Question 22

Describe the role of the human skin in the regulation of body temperature on a cold day. (6)

Question 23

Knowing the salt level in the blood of humans can provide information on their health and lifestyle. The normal salt level in the blood is between 136 mmol/l and 145 mmol/l. Salt levels in the blood below 136 mmol/l are an indication of hyponatremia, and salt levels in the blood higher than 145 mmol/l are an indication of hypernatremia.

A group of people with the same diet had their blood salt levels tested.

The table below shows the results.

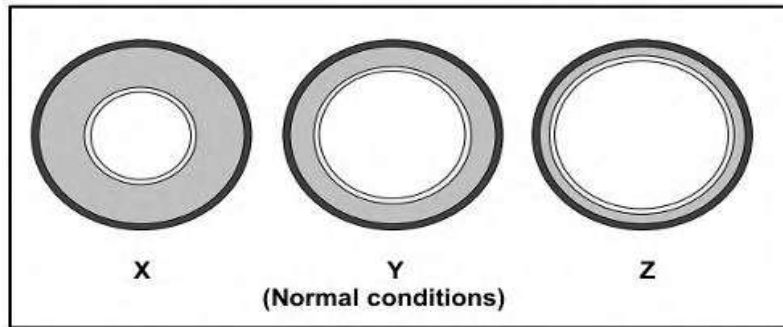
SALT LEVELS IN THE BLOOD (mmol/l)	NUMBER OF PEOPLE
Lower than 136	5
136 to 140	15
141 to 145	21
Higher than 145	4

- 23.1 Use data in the table to determine how many people have:
 - (a) Hypernatremia (1)
 - (b) Normal blood salt levels (1)
 - 23.2 Describe how the human body increases a salt level lower than 136 mmol/l to the normal level. (6)
 - 23.3 Draw a histogram to show the results in the table. (6)
- (14)**



Question 24

The diagrams below represent the differences in the diameter of an arteriole (small artery) close to the surface of the skin. These differences are due to changes that occur during thermoregulation under different environmental conditions. Diagram Y shows the arteriole under normal conditions.



- 24.1 Name the part of the brain that controls thermoregulation. (1)
 - 24.2 Give the LETTER of the diagram which represents the arteriole on a cold day. (1)
 - 24.3 Explain the significance of the change in the diameter of the arteriole from normal conditions to the condition in diagram Z. (4)
- (6)**

Question 25

Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles.

Scientists investigated the effect of added growth hormone on the height of children with ISS.

The procedure was as follows:

- Consent was obtained from the parents of a group of two-year-old boys with ISS.
- The boys were divided into two groups.
- The participants in Group **A** received human growth hormone at a daily dosage of 0,028 mg per kg of body weight.
- The participants in Group **B** did not receive the hormone treatment.
- The height of the participants was measured and recorded monthly until each participant reached the age of 18 years.

At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

- 25.1 State the dependent variable of this investigation. (1)
- 25.2 List THREE variables that were kept constant and which contributed to the validity of the investigation. (3)

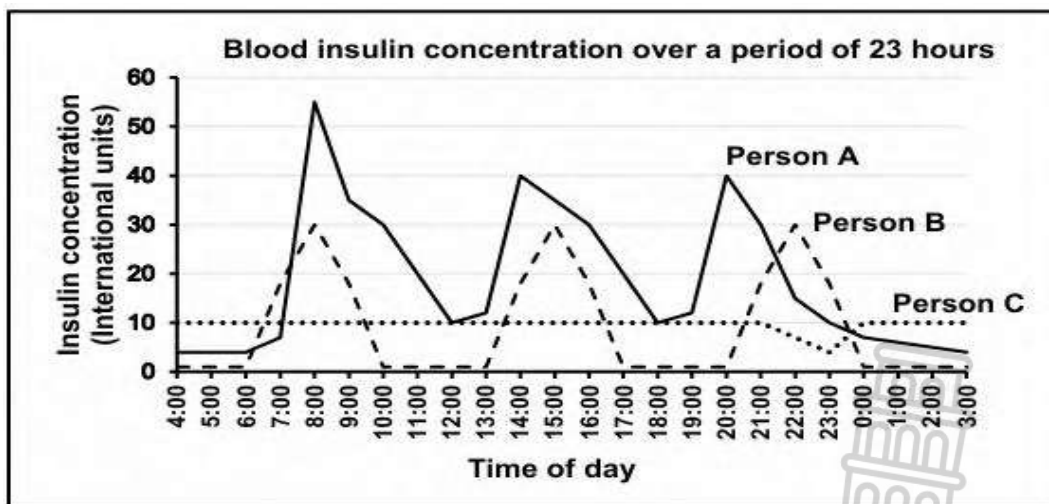
- 25.3 Explain the purpose of Group **B** in this investigation. (2)
 - 25.4 Calculate the daily amount of added human growth hormone that was given to a boy with a mass of 25 kg. Show ALL your working, INCLUDING the correct unit. (3)
 - 25.5 Give a conclusion for this investigation. (2)
- (11)**

Question 26

The graph below shows the insulin levels of three people over a 23-hour period, who were treated as follows:

Person A:	A healthy person who received no treatment
Person B:	A person with diabetes mellitus who received a rapid-acting insulin injection before each meal
Person C:	A person with diabetes mellitus who received a daily injection, containing long-acting insulin, at 23:00

All three people received the same meals at the same time of the day.



- 26.1 Name the organ that secretes insulin. (1)
 - 26.2 State the number of meals that were eaten during the 23-hour period. (1)
 - 26.3 Tabulate TWO differences between long-acting insulin treatment and rapid-acting insulin treatment over the 23-hour period. (5)
 - 26.4 Name the type of insulin treatment that is similar to insulin secretion in a healthy person. (1)
 - 26.5 Explain why person **B** may experience a lack of energy after receiving a rapid-acting insulin injection if NO meal is taken. (2)
- (10)**