PROVINCE OF KWAZULU-NATAL
DEPARTMENT OF EDUCATION

GRADE 12

LIFE SCIENCES

REVISION DOCUMENT

Learner's Book

August 2022

INTRODUCTION

This document has been prepared as revision material for the Final Examinations for Grade 12 Life Sciences.

The materials have been arranged in such a way that studying can be undertaken topic-wise. Within each topic, questions on the different sub-topics are arranged in the same sequence as that in the 2021 Examination Guideline Document.

Questions were selected such that all the core concepts and core skills are assessed.

CONTENTS

TOPIC: REPRODUCTIVE STRATEGIES AND HUMAN REPRODUCTION

Question 1

Various options are provided as possible answers to the following questions.
Choose the correct answer and write only the letter (A to D) next to the question number.

1.1. The list below gives the characteristics of some young birds immediately after hatching.

(i) Eyes are open
(ii) Can move around
(iii) Cannot feed themselves
(iv) No feathers

Which ONE of the following combinations represents the characteristics of precocial development?

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

1.2 The structure in the amniotic egg that removes waste products

A Yolk sac
B Chorion
C Amnion
D Allantois

1.3 The function of the epididymis is to …

A Produce semen.
B Transport sperm to the urethra.
C Produce sperm.
D Store sperm until maturation

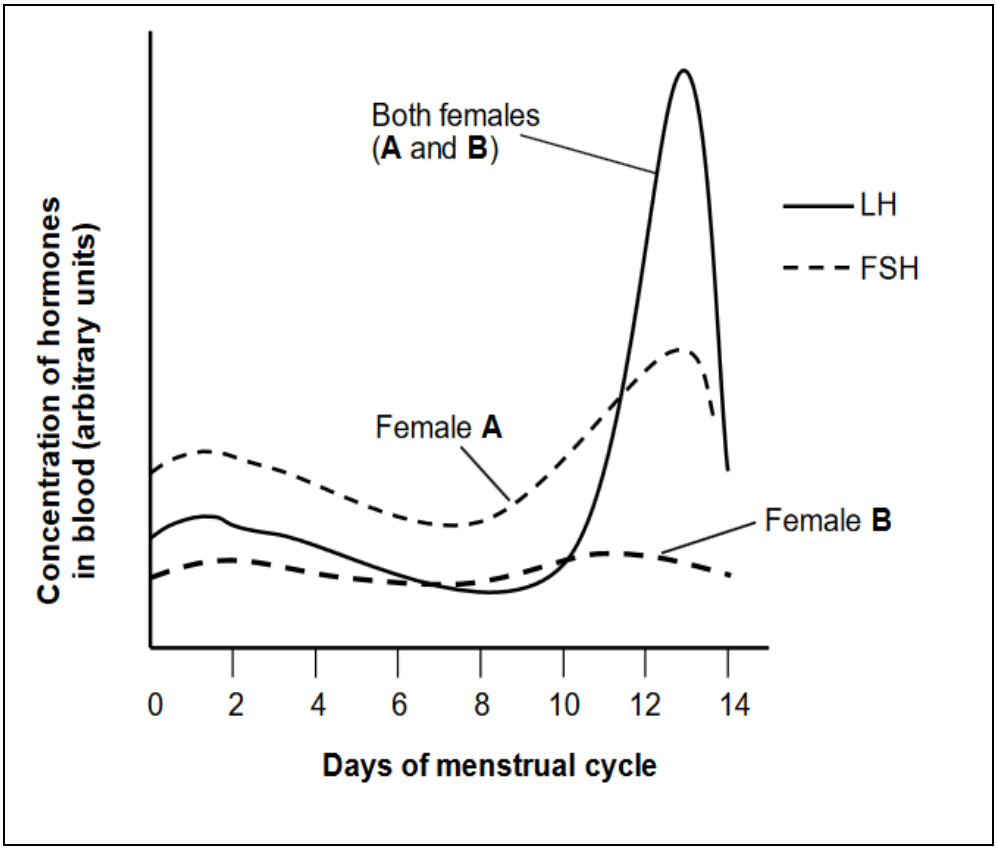
1.4 An acrosome has …

A Mitochondria to produce energy for the movement of sperm.
B Chromatin network that carries genes.
C Enzymes needed to penetrate the ovum.
D A tail to facilitate the movement of sperm.

1.5 Oogenesis takes place in the …

A Uterus.
B Ovary.
C Cervix.
D Vagina.

Questions **1.6** and **1.7** refer to the graph below. The graph shows the changes in the concentration of female hormones (IH and FSH) in two females during the first two weeks of the menstrual cycle.



1.6 Which female will NOT ovulate on day 14?

A Female A , because the FSH levels are high
B Female A , because the LH levels are too high on day 13
C Female B , because LH inhibits the development of a follicle
D Female B , because a follicle did not develop in the ovary

1.7 Which of the following statements is CORRECT regarding female A?

A FSH increases on day 14 because the Graafian follicle is producing progesterone.
B FSH increases after day 9 as the pituitary gland/Hypophysis is producing progesterone.
C FSH decreases after day 14 to ensure that implantation occurs
D FSH increases in the first two days to stimulate development of a follicle.

(7 x 2) **(14)**

Question 2

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

	DESCRIPTION	TERM
2.1	The fusion of the sperm and egg outside the body	
2.2	The development of the embryo inside an incubated egg that is laid.	
2.3	The development of the embryo in the uterus and the young are born alive.	
2.4	The complete development of the embryo inside an egg in the female body.	
2.5	The development of the embryo in which very little energy is used and parental care is required.	
2.6	The development of the embryo in which a lot of energy is used and the young are able to move directly after hatching.	
2.7	Structure that provides nutrition to the embryo in the amniotic egg	
2.8	Fluid filled bag around embryo	
2.9	Structure in the sperm cell that contains enzymes used to penetrate the ovum	
2.10	The liquid that surrounds the human embryo	
2.11	A hollow ball of cells into which the fertilised ovum develops	
2.12	The lining of the uterus which is richly supplied with blood vessels	
2.13	Coiled tubular structure outside the testis that stores sperms	
2.14	The part of the female reproductive system in which fertilisation takes place	
2.15	The name given to the embryo after it reaches 12 weeks	
2.16	The hormone produced by the pituitary which controls growth of the Graafian follicle	
2.17	Layer within the ovary that is responsible for formation of ova through meiosis	
2.18	Another name for the period of pregnancy	
2.19	The process by which the embryo becomes attached to the uterine wall	
2.20	The hormone which converts the ruptured follicle into a corpus luteum	
2.21	Type of cell division by which sperms are produced	
2.22	The 28-day reproductive cycle in females involving changes in the ovary and uterus	
2.23	Tearing away of the endometrium lining of the uterine wall, accompanied by the loss of blood	
2.24	The cell division by which the zygote becomes multicellular	
2.25	Production of ova by meiosis	
2.26	The hormone which starts the preparation of the lining of the uterus for attachment of the fertilised ovum	
2.27	Process by which an ovum is released from the ovary in humans	
2.28	Gland in the brain that produces FSH and LH	
2.29	Combination of foetal and maternal tissue responsible for gas exchange, nutrition and excretion	
2.30	Hormone that maintains pregnancy	
2.31	The stage when sexual maturity is reached in males and females	
2.32	Production of spermatozoa by meiosis	

	DESCRIPTION	TERM
2.33	Hormone responsible for secondary sexual characteristics in males	
2.34	A hollow, rope-like tube which attaches the embryo to the placenta	
2.35	The blood vessel that carries nitrogenous waste from the foetus to the placenta	
2.36	The blood vessel that carries oxygenated blood from the placenta to the foetus	
2.37	The structure where testosterone is produced	
2.38	Sac-like structure that contains testes	
2.39	A gland that lubricates end of penis	
2.40	Common tube for sperm and urine	
2.41	A gland that produces alkaline medium of semen	
2.42	A gland that provides nutrients for the sperms	
2.43	A tube that transfers sperms to the urethra	
		43 x 1 **(43)**

Question 3

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
3.1	Nutrition provided by the egg	A B	Ovipary Ovovivipary
3.2	Unfertilised eggs are released from the female's body	A B	Asexual reproduction External fertilisation
3.3	The blood vessel that transports oxygenated blood from the placenta to the foetus	A B	Umbilical vein Umbilical artery
3.4	The young develops and is nourished in an amniotic egg that is retained in the mother	A B	Ovipary Vivipary
3.5	Eggs incubated in a nest	A B	Ovipary Ovovivipary
3.6	Gestation period required	A B	Ovipary Vivipary
3.7	Offspring are born small and helpless	A B	Altricial Precocial
3.8	Functions in gas exchange	A B	Chorion Allantois
3.9	Serves as a source of nutrition	A B	Amnion Yolk sac
3.10	Leads to wastage of a large number of sperm	A B	Internal fertilization External fertilisation
3.11	Forms the placenta	A B	Chorionic villi Endometrium
3.12	The production of ova by meiosis	A B	Menopause Ovulation
3.13	A hollow ball of cells into which fertilised ovum develops	A B	Amnion Chorion
3.14	The reproductive structures where meiosis occurs	A B	Testes Ovaries
3.15	Place where fertilisation occurs in humans	A B	Cervix Fallopian tube

	COLUMN I	COLUMN II	
3.16	Outer jelly-like layer of the ovum	A B	Cytoplasm Shell
3.17	Hormones secreted by the pituitary gland/hypohysis	A B	Thyroxin FSH
3.18	Stimulates the formation of the Graafian follicle	A B	Progesterone Oestrogen
		(18 x 2)	**(36)**

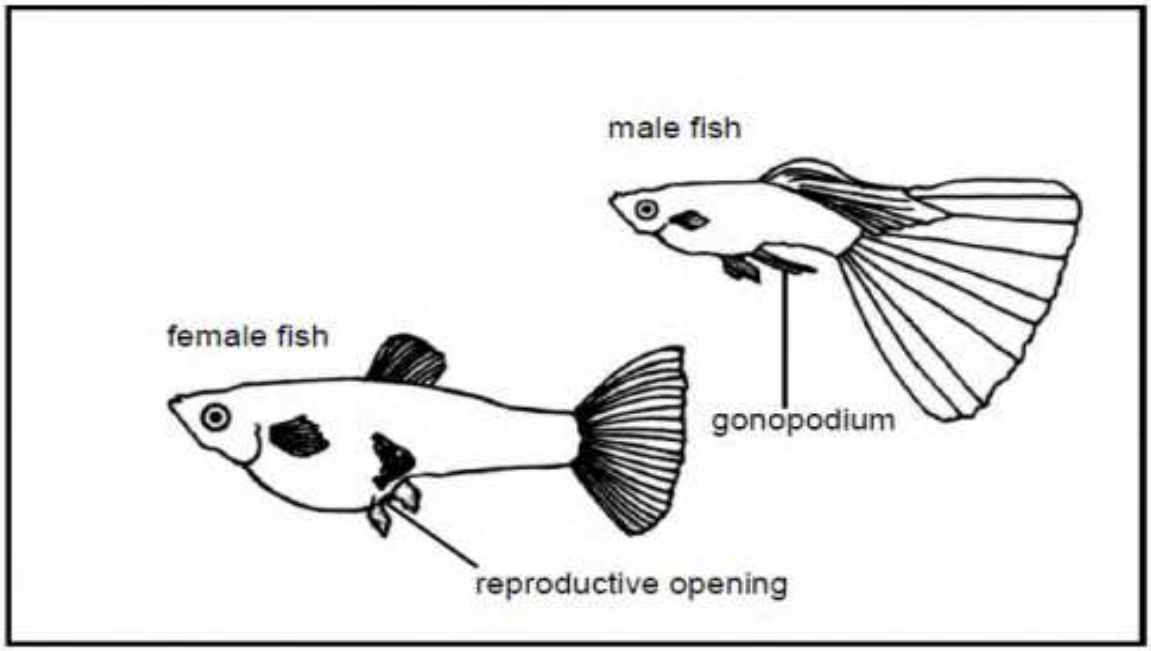
Question 4

Read the extract below.

REPRODUCTION IN GUPPY FISH

Guppy fish have a very interesting method of breeding. During mating the male deposits packets of sperm inside the female's reproductive opening using an organ called the 'gonopodium'. This process takes place several times and the female stores some of the extra sperm.

The fertilised eggs remain in the female's body until they hatch and the young are born live. The gestation period is usually between 22 and 28 days.



4.1 Name the type of fertilisation in guppies. (1)

4.2 Explain TWO ways in which the type of fertilisation named in **QUESTION 4.1** increases reproductive success. (4)

4.3 Why are guppies regarded as being ovoviviparous? (2)

(7)

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)

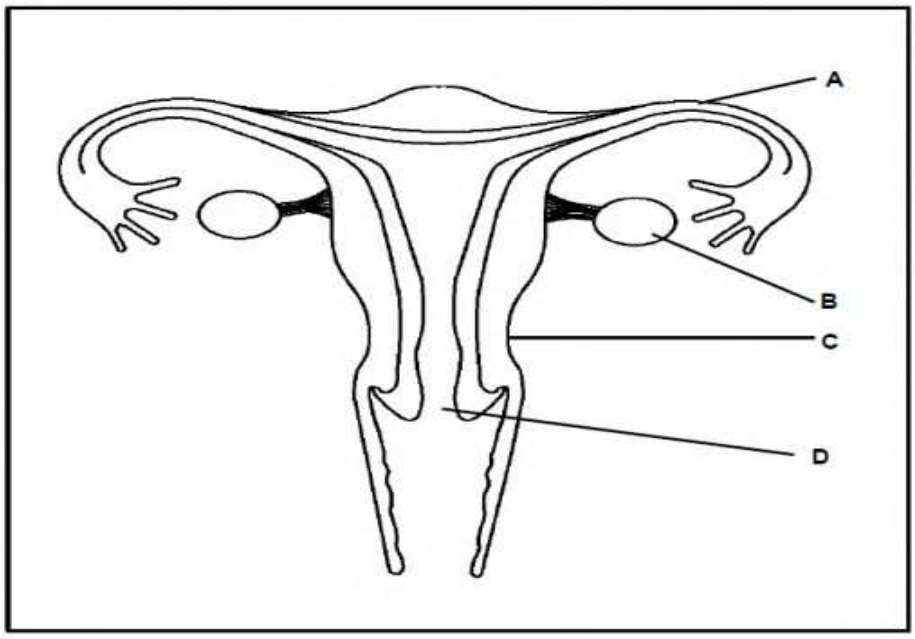
6.2 Explain how TWO of the reproductive strategies of the great white shark increase its reproductive success. (4)

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

(7)

Question 7

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



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

7.2 State ONE function of part **A**. (1)

7.3 Describe the process of oogenesis as it occurs in part **B**. (4)

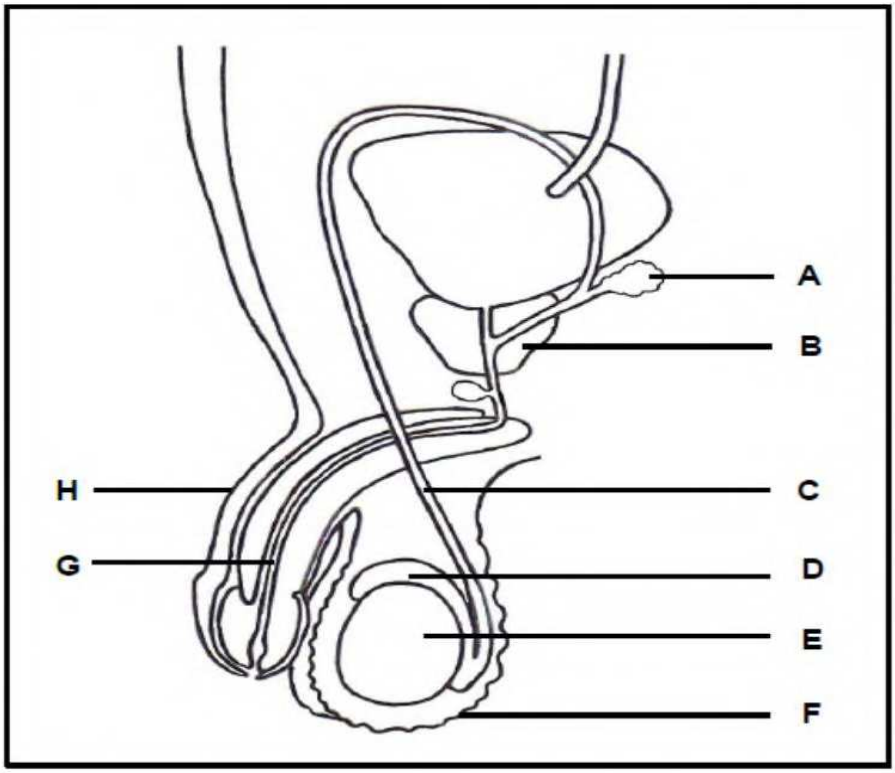
7.4 State ONE way in which structure **C** is suited for its function during pregnancy. (1)

7.5 A person undergoes a surgical operation to remove part **B** on both sides. Explain why this person will not menstruate. (3)

(10)

Question 8

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



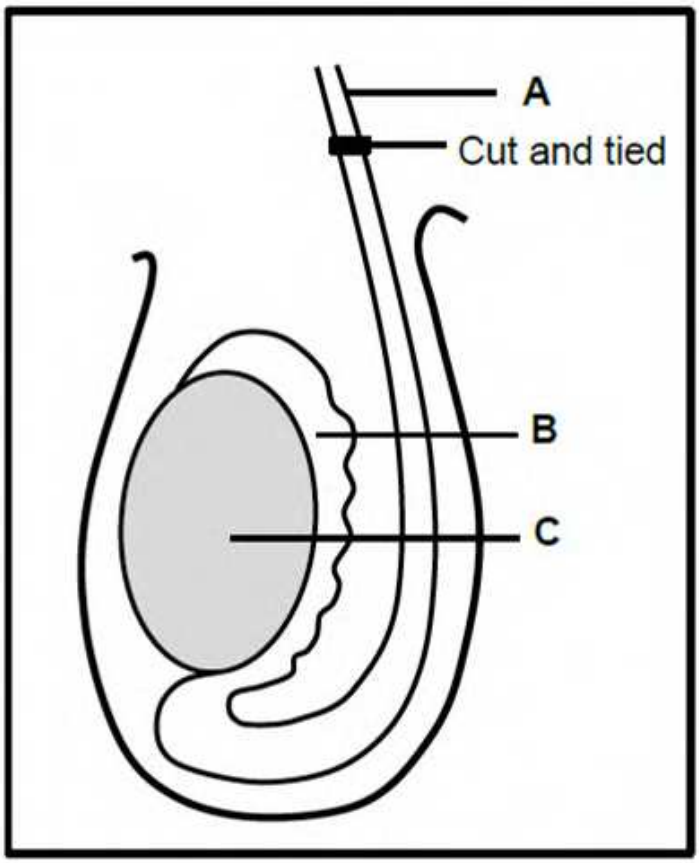
8.1 Identify part:
(a) C (1)
(b) F (1)
(c) H (1)

8.2 Give the LETTER and NAME of the part that:
(a) Stores sperm temporarily (2)
(b) Transports both semen and urine (2)
(c) Produces testosterone (2)

8.3 Give the LETTERS of TWO parts that contribute to the formation of semen. (2)
(11)

Question 9

The diagram below shows part of the male reproductive system.



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

9.2 State ONE function of part **B**. (1)

9.3 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)

9.4 In some rare cases, males are born with part **C** located inside the body because it failed to descend into the scrotum. (3)

9.5 Describe the process of spermatogenesis. (4)

(12)

Question 10

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 are 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

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

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

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

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

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

(12)

Question 11

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.

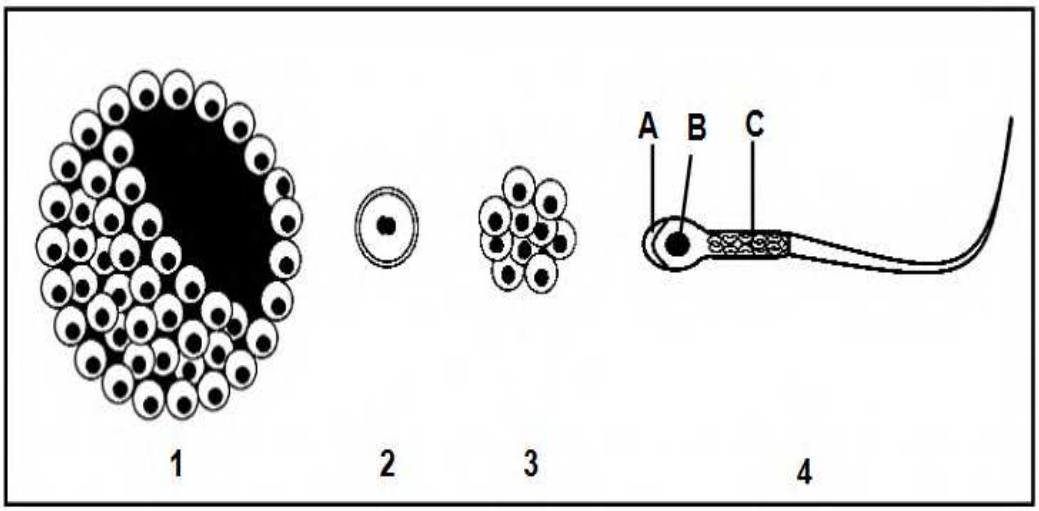
NOTE: Sperm count refers to the total number of healthy sperm per ml of Semen and is an indication of male fertility.

11.1 Identify the dependent variable in the investigation. (1)
11.2 State how the dependent variable in **QUESTION 11.1** was measured. (1)
11.3 Name TWO other factors that should be considered when selecting volunteers. (2)
11.4 Explain how TU reduces fertility. (2)
11.5 Explain why wearing tight-fitting trousers will decrease male fertility. (2)
11.6 Suggest ONE reason for doing the sperm count for an additional 12 months after stopping the TU treatment. (1)
11.7 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 12

The diagrams below show structures formed during human reproduction.



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

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

12.3 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)

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

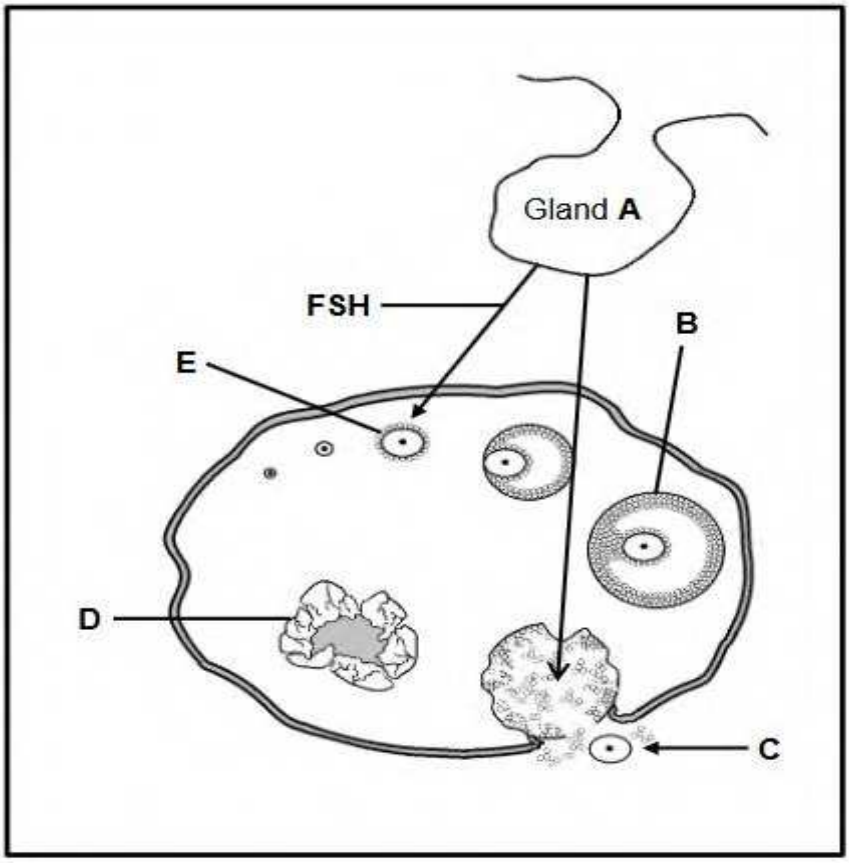
12.5 Name the type of cell division that occurred to produce the structure in diagram **3**. (1)

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

(14)

Question 13

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



13.1 (a) Gland A (1)

13.2 (b) Structure B (1)

(c) Process C (1)

(d) Structure D (1)

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

13.3 State ONE function of LH. (1)

(6)

Question 14

Read the extract and study the diagram below.

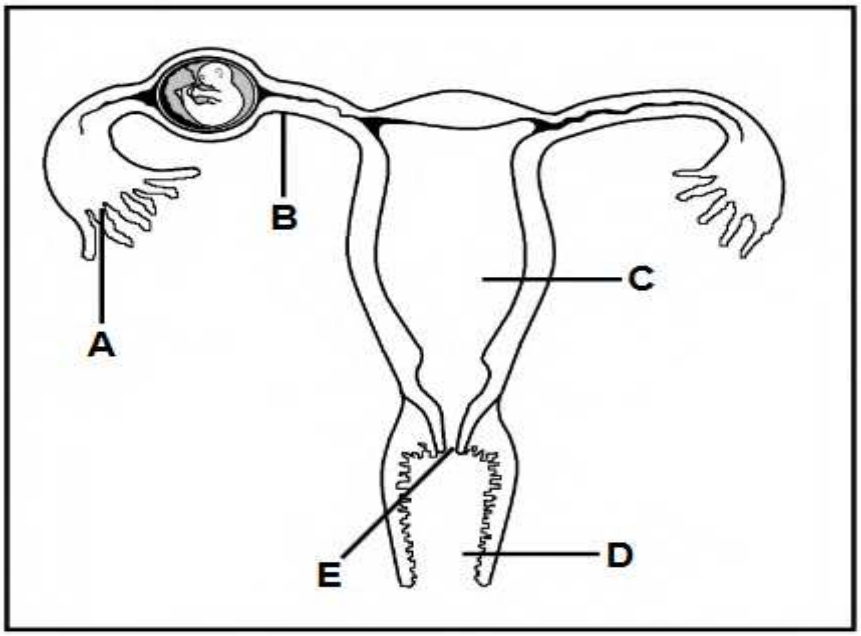
ECTOPIC PREGNANCIES

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.



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

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

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

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

(9)

QUESTION 15

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.

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

15.2 Identify the:

(a) Independent variable (1)

(b) Dependent variable (1)

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

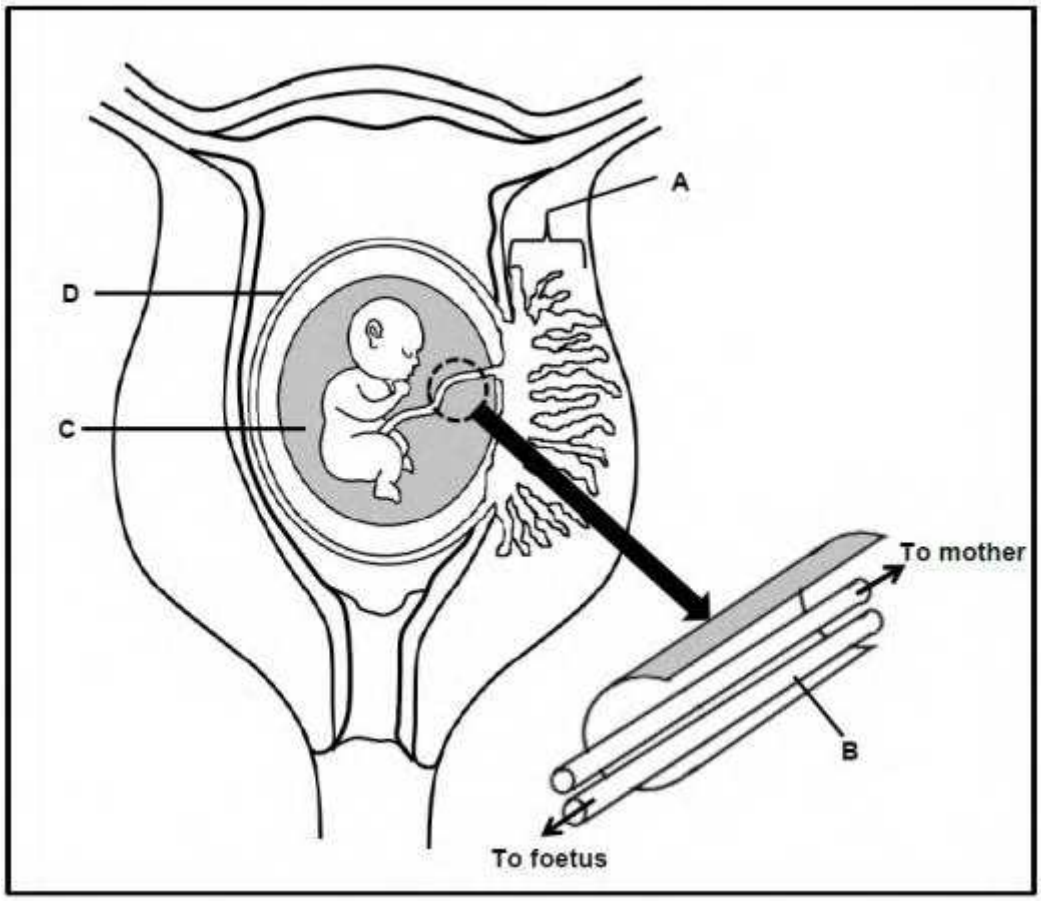
15.4 State TWO factors that were kept constant when the progesterone was administered in Group **A**. (2)

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

(10)

Question 16

The diagram below shows a developing human foetus.



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

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

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

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

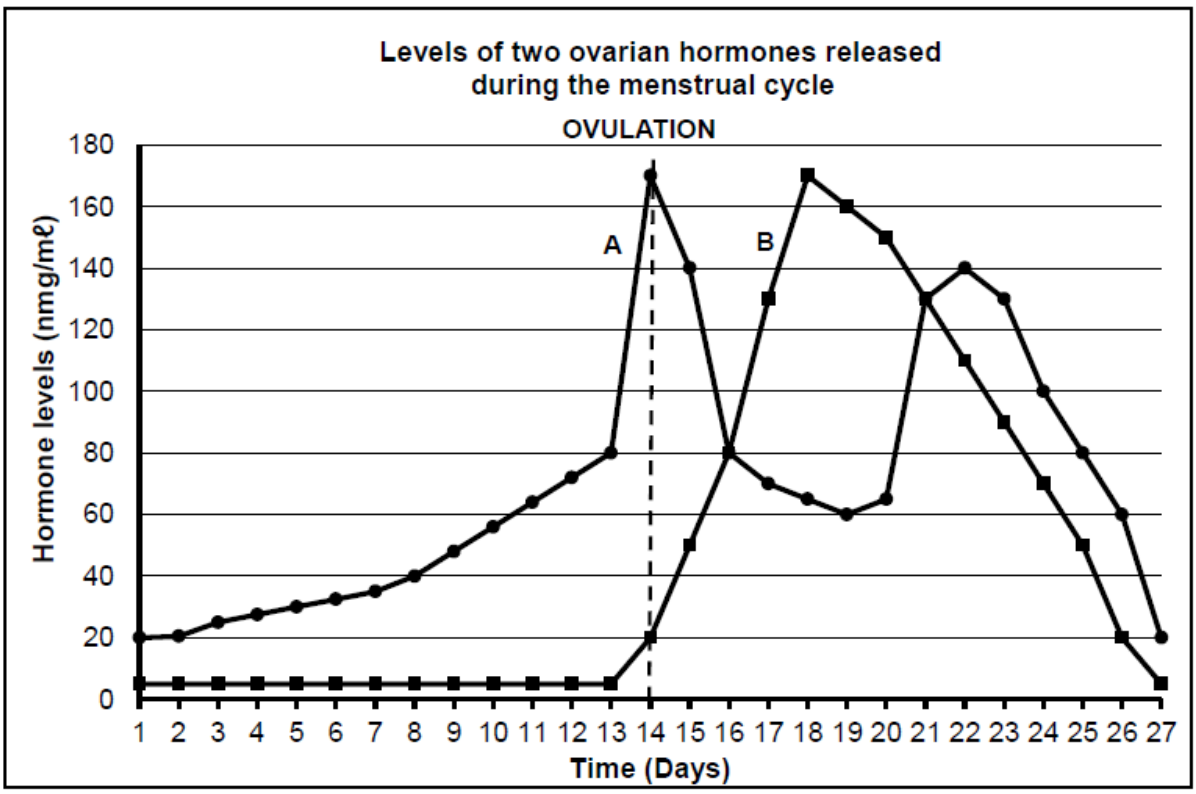
16.5 Identify blood vessel **B**. (1)

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

(13)

Question 17

Study the graph below.



17.1 Identify:
(a) Hormone **A** (1)
(b) Hormone **B** (1)

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

17.3 Ovulation is indicated on the graph.
a) Define ovulation (2)
(b) On which day did ovulation take place? (1)
(c) Which hormone secreted by the pituitary gland stimulates ovulation? (1)

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

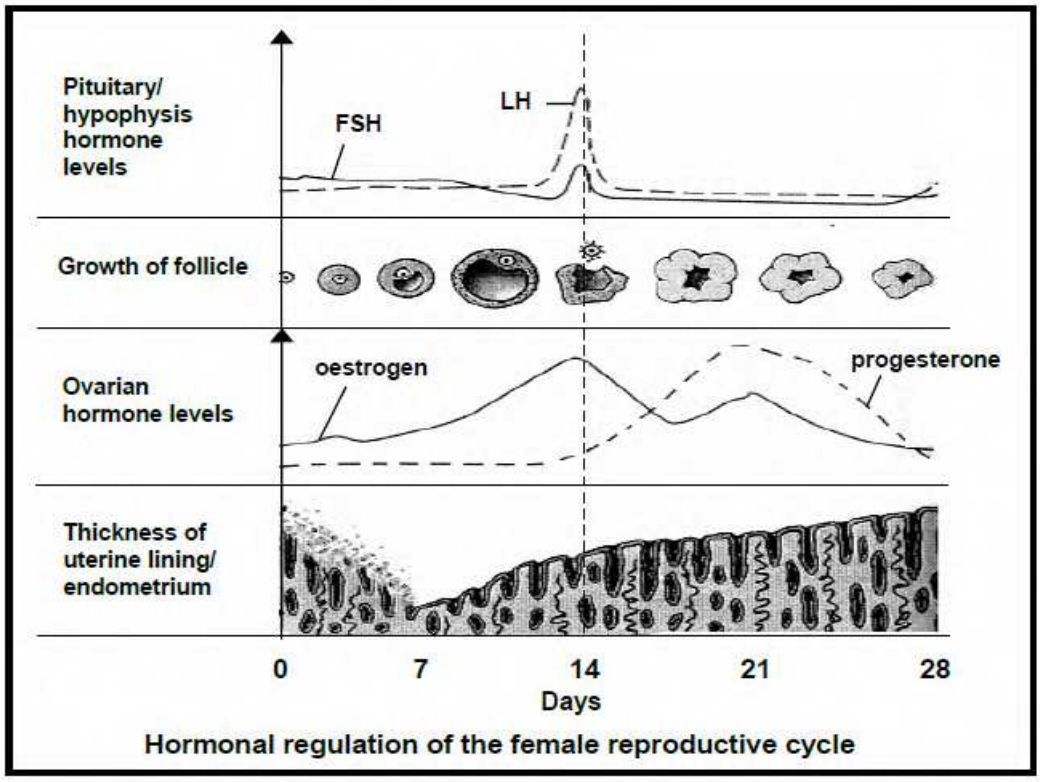
17.5 Explain evidence in the graph that indicates that no fertilisation took place during the menstrual cycle shown above (3)

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

(17)

Question 18

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



Hormonal regulation of the female reproductive cycle

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

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

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

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

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

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

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

18.8 Explain your answer to **QUESTION 18.7**. (2)

(13)

Topic: Human response to environment

Brain

Question 1

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number.

1.1. A list of some compounds of the nervous system is provided below:

(i) Brain
(ii) Cranial nerves
(iii) Spinal nerves
(iv) Spinal cord

Which ONE of the following combinations applies to the central nervous system?

A (i),(ii) ,(iii) and (iv)

B (i) and (iv) only

C (ii),(iii) and(iv) only

D (iii) and(iv) only

1.2.The part of the brain that regulates body temperature is the…

A Cerebellum
B Cerebrum
C Hypothalamus
D Corpus callosum

1.3 Which ONE of the following shows the correct sequence of an impulse from the receptor in a simple reflex arc?

A. Sensory neuron through the dorsal root → motor neuron through the ventral root → effector

B. Motor neuron through the dorsal root → sensory neuron through the ventral root → effector

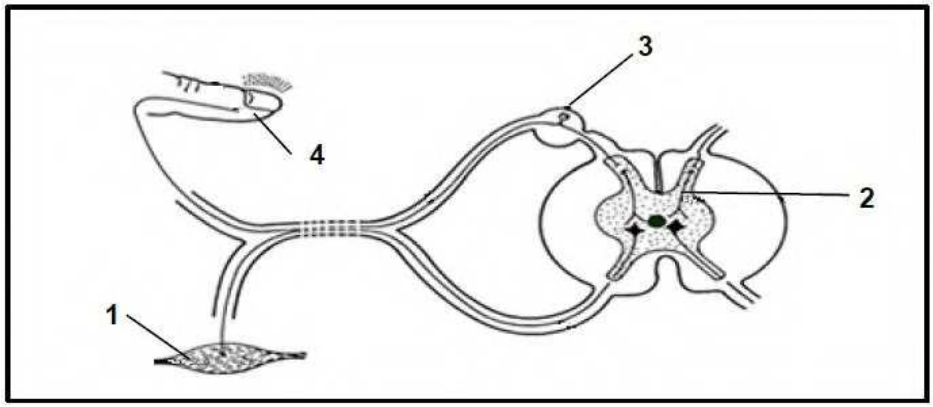
C. Sensory neuron through the dorsal root → effector → motor neuron through the ventral root

D. Effector → interneuron through the dorsal root → motor neuron through the ventral root

1.4 Which part of the neuron transmits impulses towards the cell body?

A. Dendrites
B. Myelin sheath
C. Axon
D. Synapse

1.5 The diagram below shows the reflex arc



Which part represent the effector?

A. 4

B. 1

C. 3

D. 2

(5X2) **(10)**

Question 2

Biological Terms

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

	DESCRIPTION	**TERM**
2.1	The part of the nervous system made up of cranial and spinal nerves	
2.2	The part of the brain that receives impulses from the maculae	
2.3	The structure that connects the left and right hemispheres of the brain	
2.4	The part of the brain that controls body temperature	
2.5	The part of the brain that regulates breathing	
2.6	The branch of the autonomic nervous system that restores an increased heart rate back to normal	
2.7	The part of the nervous system that is made up of spinal and cranial nerves	
2.8	A part of the nervous system that consist of sympathetic and parasympathetic section	
2.9	A functional gal between two consecutive neuron	
2.10	Collective name for the membranes that the brain and spinal cord	
2.11	Neurons that carry impulses from receptors	

2.12	A diseases characterized by the degeneration of brain cells and memory loss	
	(12X1)	**(12)**

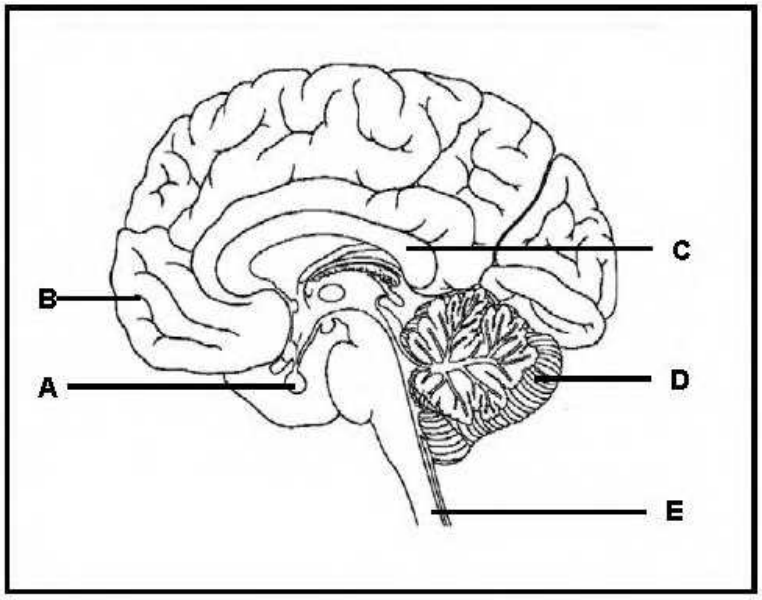
Question 3

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**
3.1	The functional connection between two consecutive neurons	A B	Receptor Synapse
3.2.	The part of a neuron that speeds up the transmission of an impulse	A B	Myelin sheath Axon
3.3.	A component of the peripheral nervous system	A B	Cranial nerves Spinal nerves
3.4.	A disorder of the nervous system characterised by the degeneration of the cells	A B	Goitre Alzheimer's disease
	(4X2)		**(8)**

Question 4

The diagram below represents a human brain.



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

(a) Memorising a cellular phone number (2)

(b) Coordinating all voluntary movements (2)

(c) Secreting hormones (2)

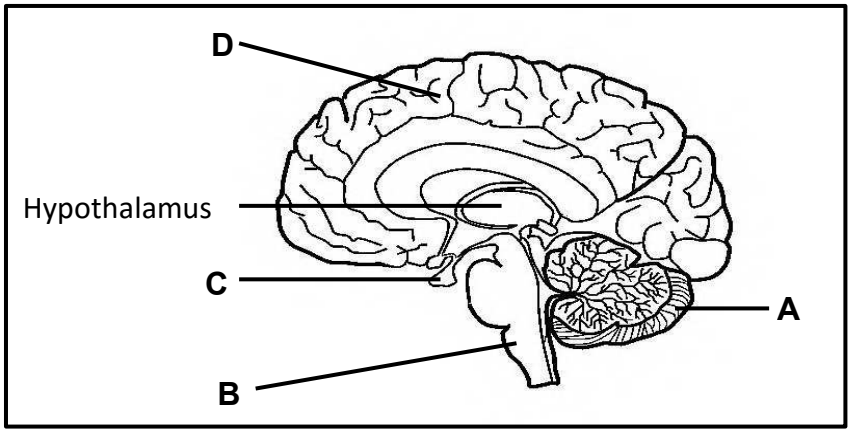
(d) Connecting the hemispheres of part B (2)

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

(10)

Question 5

The diagram below shows the part of the human brain.



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

5.2. State TWO functions of part **D**. (2)

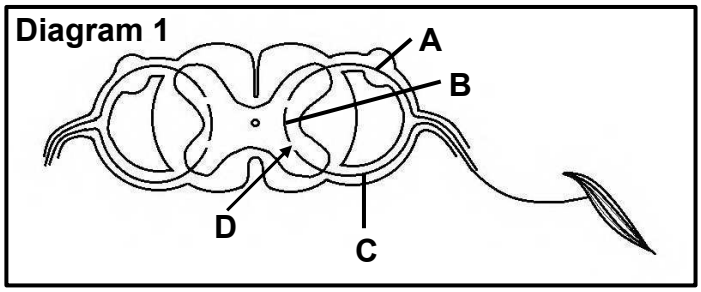
5.3. State ONE way in which the brain is protected (1)

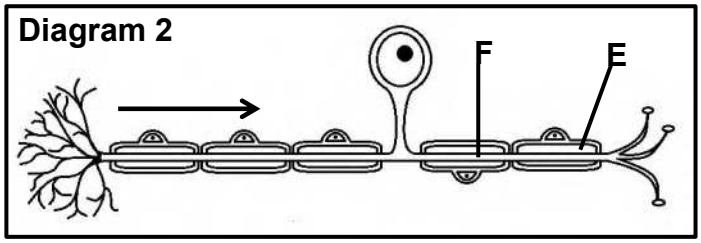
5.4. Name the TWO effectors that part B sends impulses to (2)

(6)

Question 6

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





6.1 Identify :

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

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

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

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

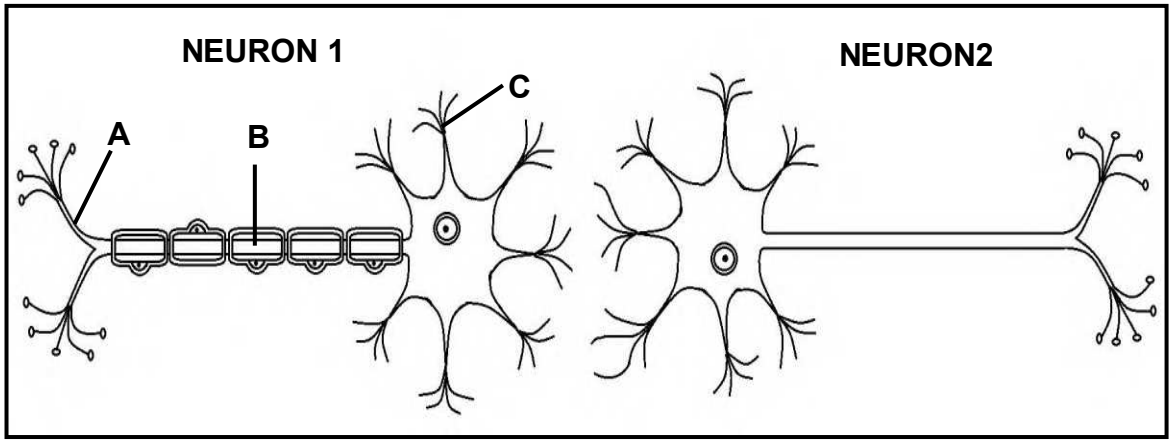
(b) Is damaged when a person can feel the stimulus but cannot respond to it (1)

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

(6)

Question 7

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



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

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

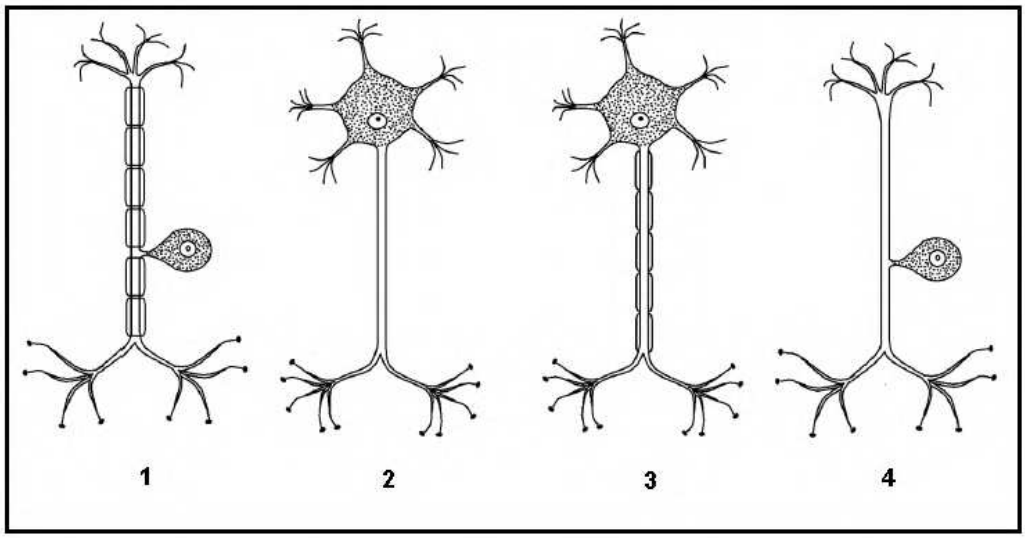
7.3. Explain how the speed of transmission of impulses will differ for neuron **1** and neuron **2.** (3)

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

(9)

Question 8

The diagrams below show different neurons.

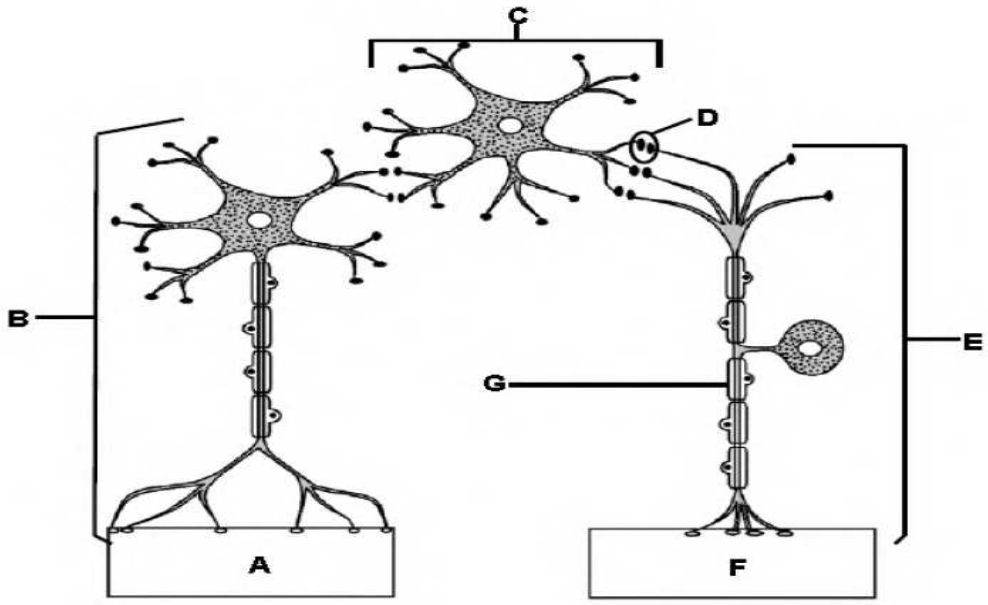


8.1 Give only NUMBERS (1,2,3 or 4) of TWO neurons that:

(a) Transport impulses from the receptor to the central nervous system (2)
(b) Will have a faster transmission of impulses (2)
(c) Are damaged if a person can feel the stimulus but is unable to react (2)
(6)

Question 9

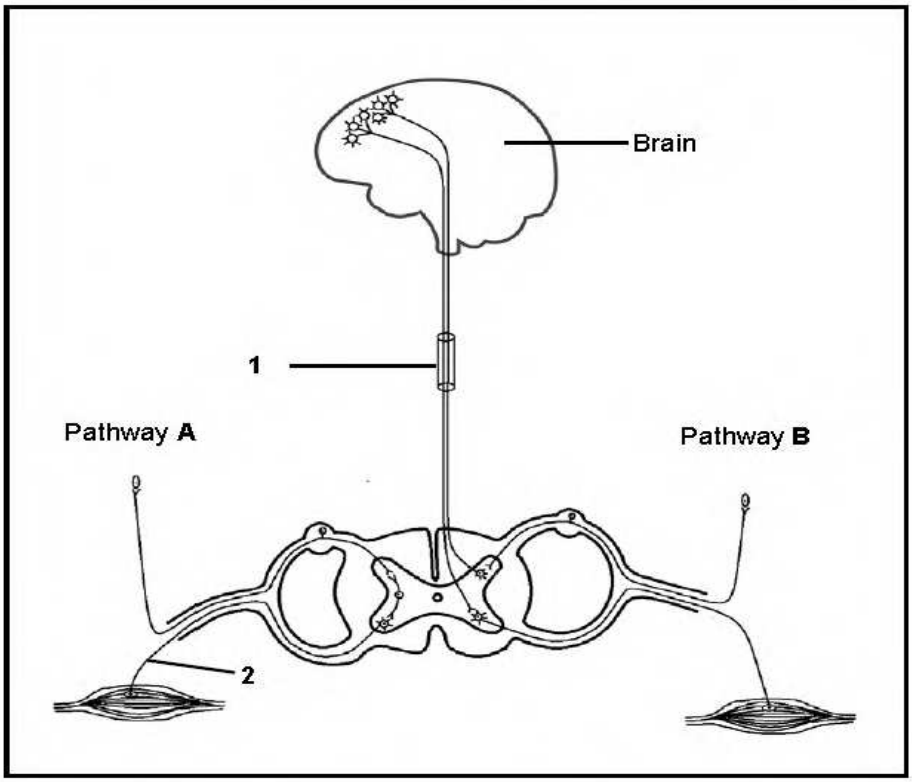
The diagram below represent a possible path followed by an impulse when a person touches a hot plate



9.1 Name the path represented in the diagram (1)
9.2 Identify the type of neuron represented by :
(a) B (1)
(b) C (1)
(c) E (1)
9.3 Give the LETTER only of the part represents the :
(a) Receptor (1)
(b) Effector (1)
9.4 Give the LETTER and the NAME of the:
(a) Region where the impulse is transmitted chemically (2)
(b) Part that has an insulating function (2)
(10)

Question 10

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



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

10.2. Give the visible reason in the diagram for your answer to **QUESTION 10.1.** (1)

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

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

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

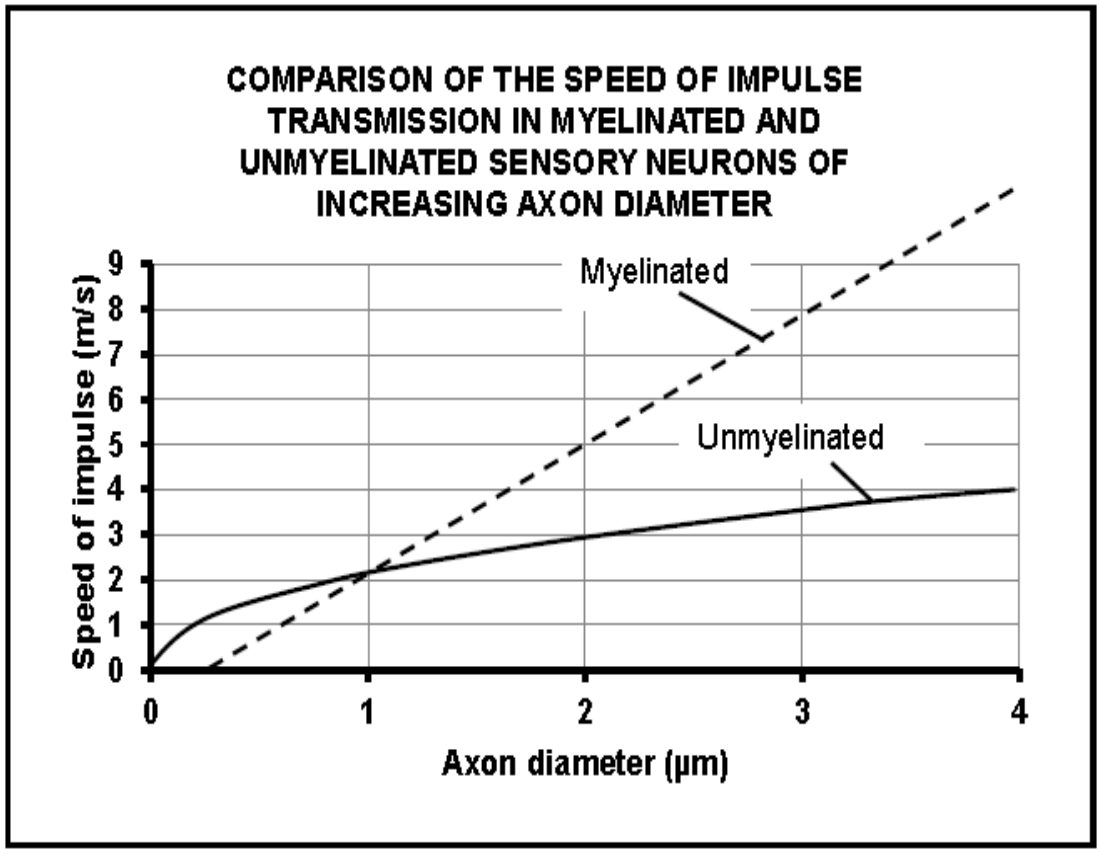
10.6. Describe how the person would be affected if the axon of neuron 2 was cut. (2)

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

(16)

Question 11

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



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

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

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

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

(9)

Eye

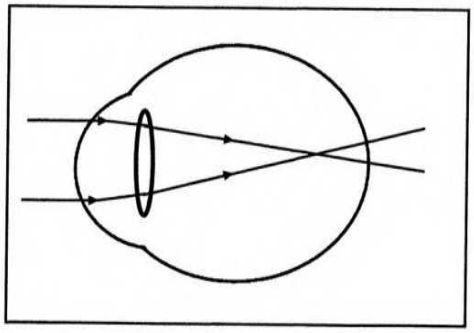
Question 1

1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number.

1.1 A structure in the eye that contains a high concentration of the blood vessels and provides oxygen and nutrients to the retina is the …

A Sclera
B Choroid
C Conjunctiva
D Lens

1.2 The diagram below represents a visual defect.



Which one of the following is correct treatment of the visual defect shown above?

A Glasses with biconvex lenses

B Glasses with biconcave lenses

C Surgery to replace the cornea

D Surgery to replace the retina

1.3 Which ONE of the following is the visual defect that results from the uneven curvature of the cornea?

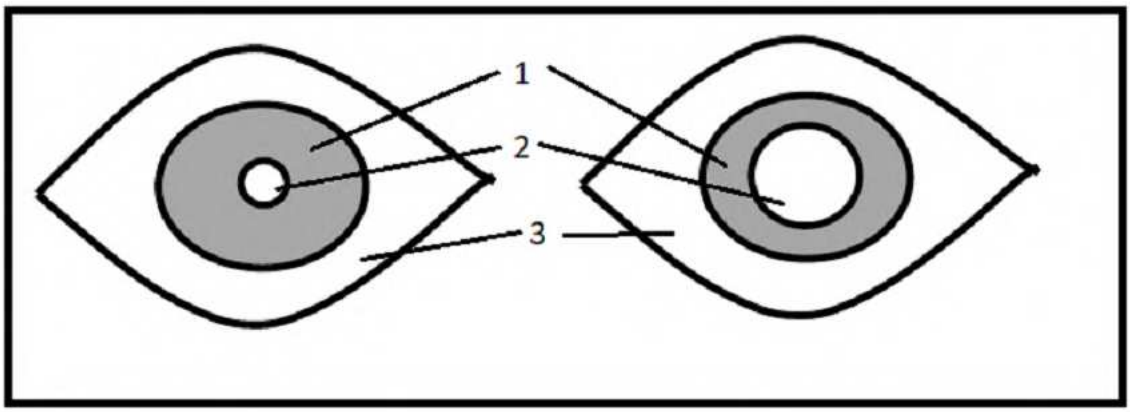
A Cataracts

B Long-sightedness

C Short-sightedness

D Astigmatism

Questions 1.4 and 1.5 are based on the diagram below.



1.4 Which ONE of the following statements is CORRECT regarding the eyes shown in the diagram below?

A Diagram **A** has the cilliary muscles contracted and is looking at a nearby object

B Diagram **B** is looking at a distant object and has circular muscles contracted

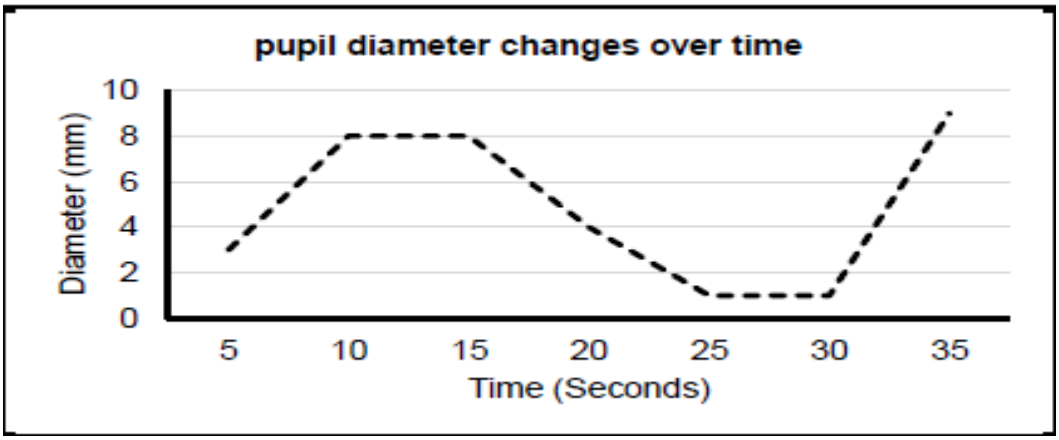
C Diagram **A** is in bright light and has radial muscles contracted

D Diagram **B** is in dim light and has circular muscles relaxed

1.5 Which ONE of the following is the correct part and its function?

	Part	**Function**
A	1	Controls the amount of light entering the eye
B	2	Reflects light entering the eye
C	3	Supplies nutrients to the eye
D	1 & 3	Permits light to pass through

1.6 The diagram below shows the changes in the diameter of the pupil of the eye as a person sat in the room with changing light intensities.



During which period of time did the light intensity increases the fastest?

A 5 – 10 s

B 15-25s

C 15 – 35s

D 30 – 35s

(6 X 2) **(12)**

Question 2

Biological Terms

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

	DESCRIPTION	**TERM**
2.1	A type of vision in which both eyes are used together to focus on an object	
2.2	The watery fluid that supports the cornea and the front chamber of the eye	
2.3	A structure in the eye that absorbs light to prevent internal reflection.	
2.4	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	
2.5	A defect condition of the eye where a person can see nearby objects clearly while distant objects are blurred.	
		5 X 1 **(5)**

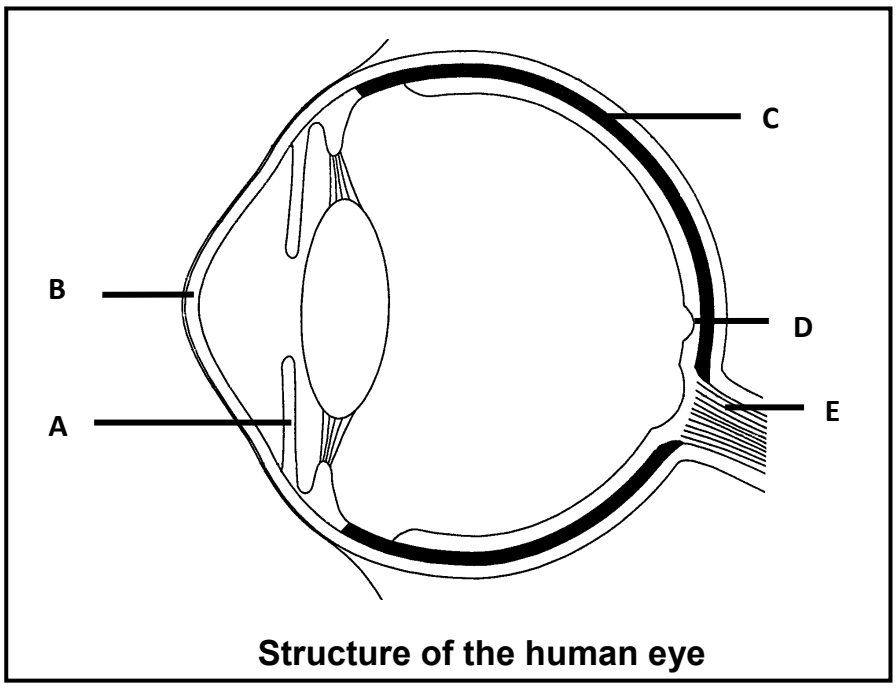
Question 3

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

Question 4

The diagram below shows parts of the eye.



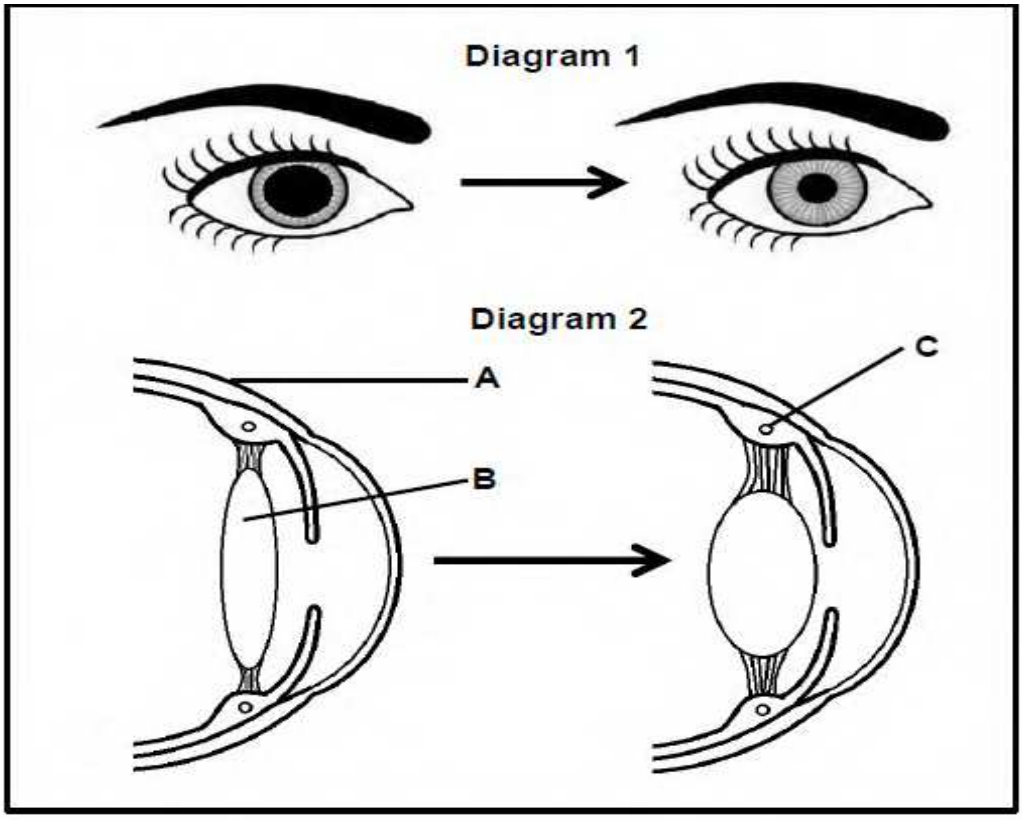
Structure of the human eye

Give the LETTER and the NAME of the part which:

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

Question 5

The diagram below show the response of the human eye to two different conditions



5.1 Identify part
- (a) A (1)
- (b) B (1)
- (c) C (1)

5.2 Name and describe the process in **Diagram 1**. (6)

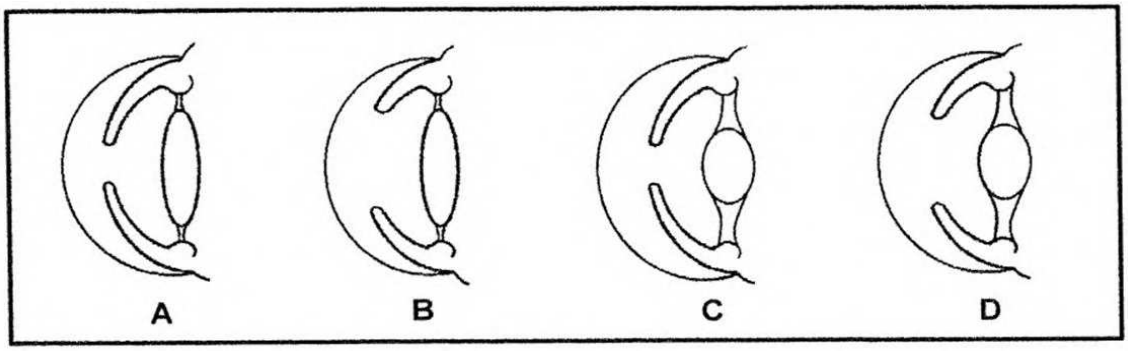
5.3 Name the part of the eye that is responsible for the response in **Diagram 1.** (1)

5.4 Describe the process that is taking place in **Diagram 2.** (5)

(15)

Question 6

The diagrams below show part of the eye under different conditions



6.1 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)

6.2 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)

6.3 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 7

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

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

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

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

7.3 Explain why long-sighted people need to wear glasses with biconvex lenses as a corrective measure (4)

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

7.5 Draw a pie chart to represent the data in the table (6)
(15)

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 8.2** 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. (3)
8.5 Name TWO structures in the eye that are responsible for the changes in the curvature of the lens. (2)
(11)

EAR

Question 1

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number.

1.1 Which part of the ear contains the receptors for hearing?

A Cochlea
B Tympanic membrane
C Oval window
D Round window

1.2 Barotrauma is a common condition that occurs when pressure builds up in the middle ear. This causes the tympanic membrane to bulge. It is most common among deep-sea divers.
Divers are advised against diving when they have a middle-ear infection because the …

A Auditory canal cannot equalise the pressure in the middle ear.
B Eustachian tube is blocked and air cannot enter the middle ear.
C Tympanic membrane is hardened and cannot pass the vibrations onto the middle ear.
D Ossicles are fused together and cannot vibrate freely in the middle ear.

1.3 Which ONE of the following is a consequence if the round window of the ear hardens?

A Pressure waves will not be created.
B Impulses will not be transmitted to the brain.
C Pressure between the outer and the middle ear will not be equalised.
D An echo will occur and the sound will be distorted

1.4 Which part of the ear transmits vibrations of the tympanic membrane to the membrane of the oval window?

A Auditory canal
B Auditary nerve
C Ossicles
D Semi-circular canals

1.5 Which ONE of the following is a consequence of the damaged of utriculus and sacculus?

A Hearing loss
B No balance of the body if the head changes gravitational
C No balance of the body if the head changes speed and direction
D No hearing and balance of the head

5X2 **(10)**

Question 2

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

	Description	**Term**
2.1	Receptors that provide information about the gravitational position of the head	
2.2	A small device that is inserted in the ear to drain fluids caused by a middle-ear infection	
2.3	A structure in the ear that contains receptors that converts pressure waves into nerve impulse in the ear	
2.4	A structure in the ear that absorbs excess pressure waves from the inner ear	
2.5	A structure in the ear that transmits the nerve impulse to the cerebellum for the balance of the body	

5X1 **(5)**

Question 3

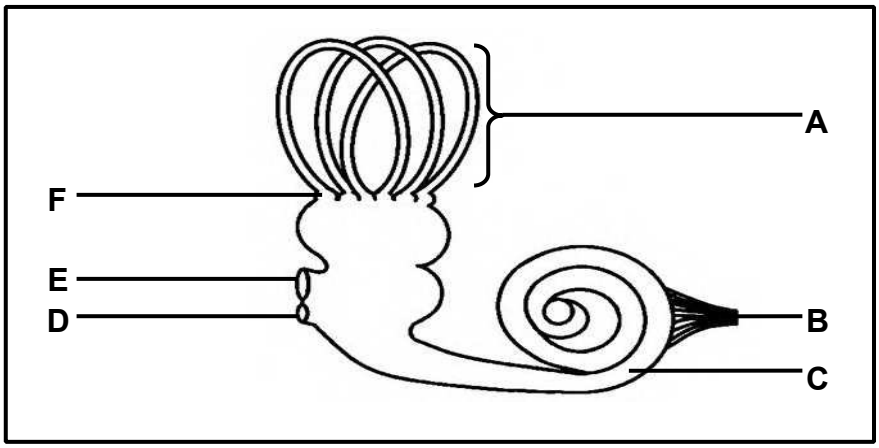
Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number.

	Column I	**Column II**
3.1	The part of the ear that directs the sound waves to the tympanic membrane	A: Pinna B: Auditory canal
3.2	Equalises pressure on either side of the tympanic membrane	A: Eustachian tube B: Round window
3.3	It has membrane that sets up the pressure waves in the inner ear	A: Round window B: Oval window

3X2 (6)

Question 4

The diagram below represents a part of the human ear.



4.1 Identify part:

(a) A (1)

(b) B (1)

4.2 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)

4.3 Name the:

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

(b) Receptors found at C (1)

(8)

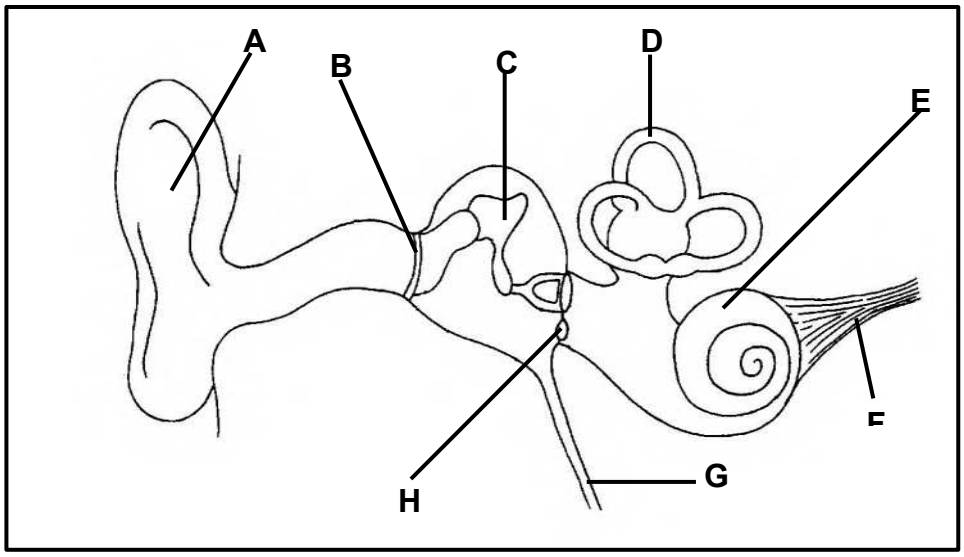
Question 5

TWO types of hearing loss occur in humans:

•Conductive hearing loss – occurs when sound vibrations cannot be conducted through the outer and middle ear

•Sensor neural hearing loss – occurs when sound waves in the inner ear are not converted into nerve impulses or when the impulses cannot be transmitted to the brain

The diagram below represents the human ear.



5.1 Give the LETTER and NAME of the part that:

(a) Transmits impulses to the brain (2)

(b) Allows pressure to equalise between the outer ear and the middle ear. (2)

5.2 Give only the LETTER of TWO structures in the diagram of the ear that, when damaged, would result in the following:

(a) Conductive hearing loss (2)

(b) Sensorineural hearing loss (2)

Middle-ear infections are a common cause of hearing loss. (1)

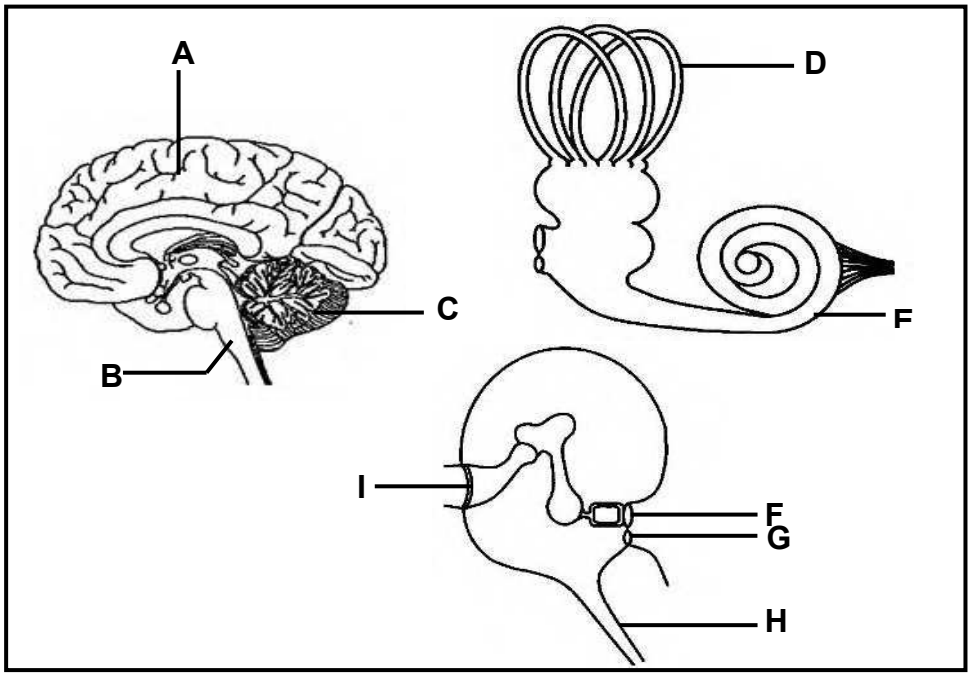
5.3 State ONE way in which middle-ear infections are treated. (1)

5.4 Name the part of the ear where ear wax is produced. (2)

5.5 Explain why hearing loss due to ear wax is usually temporary. **(12)**

Question 6

The diagrams below show different parts of the brain and the ear.



6.1 Identify part:

(a) **A** (1)
(b) **B** (1)
(c) **H** (1)

6.2 Give the LETTER and NAME of the part of the ear that absorbs excess pressure waves from the inner ear. (2)

6.3 Name the receptors found at part **E**. (1)

6.4 Explain why damage to part **B** can lead to instant death. (2)

6.5 Describe how part **C** responds to impulses received from part **D**. (3)

In older people, part **F** of the ear may harden.

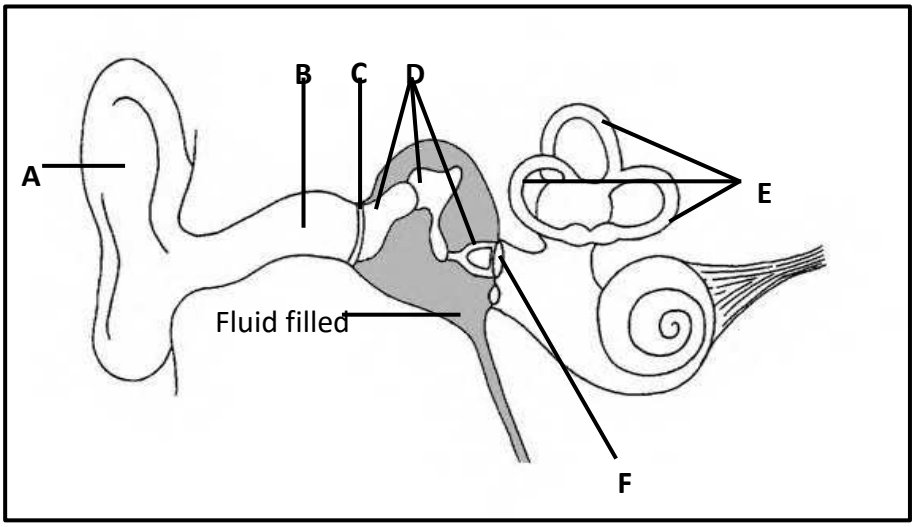
6.6 Explain how this condition may lead to hearing loss. (4)

6.7 Describe how balance and equilibrium is maintained by the ear when a person changes his/her speed and direction (5)

(20)

Question 7

The diagram below represents part of the human ear with a middle-ear infection.



7.1 Identify part :
(a) **B** (1)
(b) **D** (1)

7.2 State ONE function of part A. (1)

7.3 Explain how middle-ear infection could affect hearing. (4)

7.4 Describe the role of the Eustachian tube. (2)

7.5 Name the small device that is used in the treatment of middle-ear infection. (1)

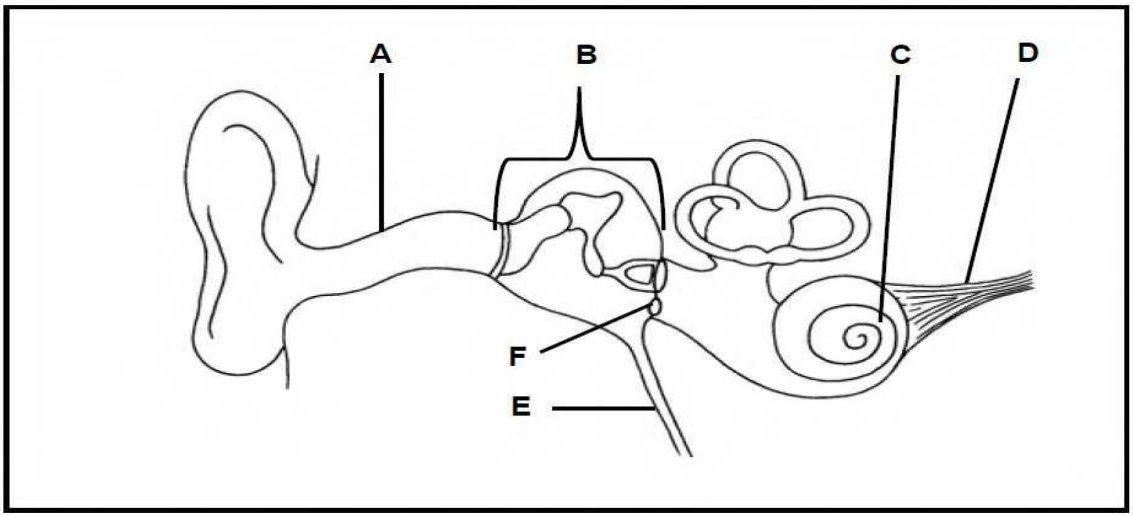
7.6 Write down the LETTER of the part where the small device, named in **QUESTION 7.5** is inserted. (1)

7.7 Describe how part E is involved in maintaining balance when there is a change in the speed and direction of movement of the head. (4)

(15)

Question 8

The diagram below show parts of human ear



8.1 Give ONE function of part:

(a) **A** (1)

(b) **E** (1)

(c) **F** (1)

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

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

(b) An electrical impulse (1)

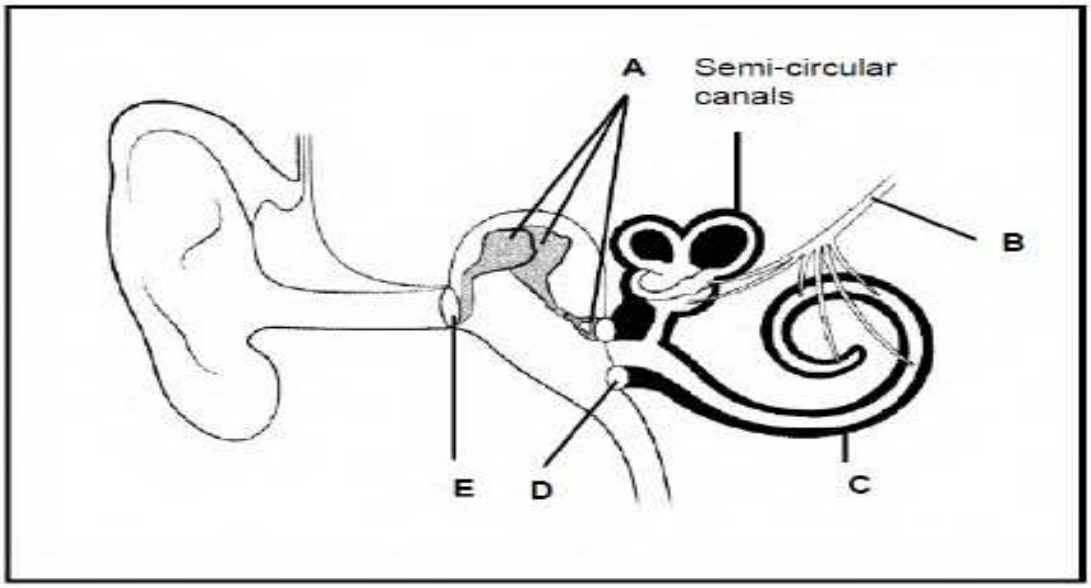
8.3 Explain the effect if the receptors in region **C** are damaged. (3)

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

8.5 Describe the role of the semi-circular canals in maintaining balance. (4)
(15)

Question 9

Study the diagram of the human ear below.



9.1 Identify:

(a) **B** (1)

(b) **D** (1)

9.2 Which part of the brain will receive impulses from part **C**? (1)

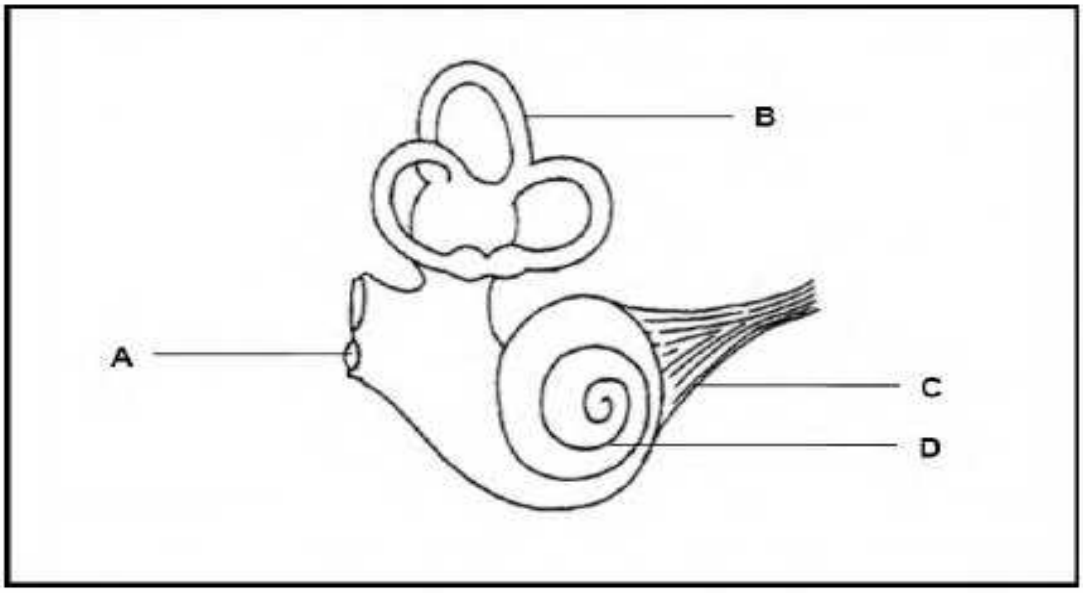
9.3 Describe the role of the semi-circular canals in maintaining balance. (5)

9.4 Describe how an increased production of mucus in the nose and throat may lead to the bursting of part **E**. (3)

9.5 Explain why fusion of the structures at **A** may lead to hearing loss. (2)
(13)

Question 10

The diagram below represents a part of a human ear.



10.1 Identify part:

(a) **A** (1)

(b) **D** (1)

10.2 Name the receptors that are found in part **B**. (1)

10.3 Explain the consequence to the human body if:

(a) Part **C** is damaged (2)

(b) Part **A** becomes hardened (2)
(7)

Question 11

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

TOPIC: Plant Response to the Environment

Question 1

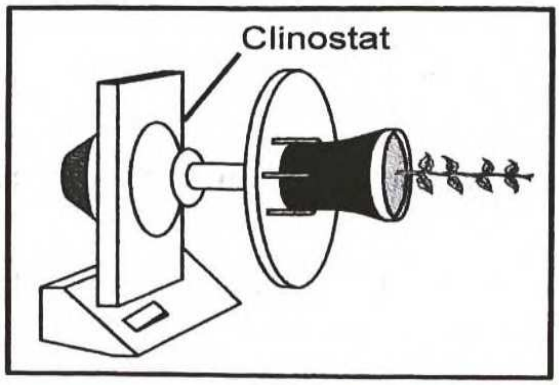
Various options are provided as possible answers to the following questions.
Choose the correct answer and write only the letter (A to D) next to the question number.

1.1 Which ONE of the following plant hormones is responsible for the germination of seeds?

A Growth hormone
B Abscisic acid
C Gibberellin
D Auxin

1.2 An investigation was done in which a potted plant was placed horizontally on a clinostat, as shown in the diagram. The plant was exposed to uniform light from all directions.

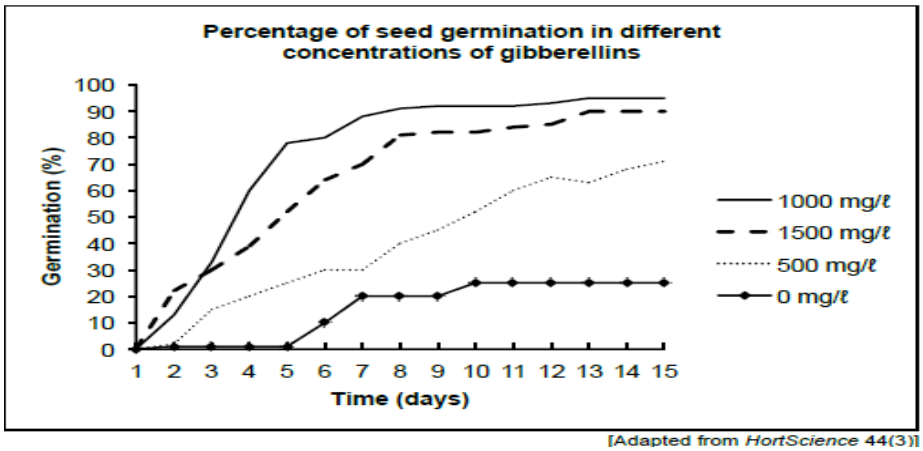
(A clinostat is a device with a disc that rotates when switched on allowing the attached plant to rotate as well.)



The stem grew vertically upwards, which indicates that the clinostat was …

A Stationary and the stem showed negative geotropism.
B Rotating and the stem showed positive geotropism.
C Stationary and the stem showed negative geotropism.
D Rotating and the stem showed positive phototropism.

1.3 The graph below shows the effect of different concentrations of gibberellins on the germination of seeds.



[Adapted from *HortScience* 44(3)]

One possible conclusion drawn from the results shown above, that the …

A Gibberellins concentration has no effect on the germination of seeds.
B Highest percentage of seed germination occurs at gibberellins concentration of 1500 mg//ℓ.
C Highest percentage of seed germination occurs at a gibberellins concentration of 1000 mg//ℓ.
D Lowest percentage of seed germination occurs at gibberellins concentration of 1000 mg//ℓ.

(3 X 2) **(6)**

Question 2

Biological Terms

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

2	Description	Term
2.1	Growth or bending reaction by plants in response to light stimuli.	
2.2	A plant hormone that promote apical dominance.	
2.3	The plant hormone that causes leaves to fall off trees in Autumn.	
2.4	Chemical used by farmers to kill weeds.	
2.5	Promote sprouting of buds.	
2.6	Inhibition of the growth of lateral buds by auxins present in apical buds.	
2.7	A movement of part of a plant in response to gravity.	
2.8	Plant growth responses to external stimuli.	
2.9	A substance containing plant hormones used to kill unwanted plants.	
2.10	Sharp structures found in plants for protection from herbivores.	
	(10 X 1)	**(10)**

Question 3

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**
3.1	The plant hormone that stimulates the germination of seeds.	A: Gibberellins B: Abscisic acid
3.2	Used by plants to reduce the chances of being fed upon by herbivores.	A: Chemicals B: Thorns
3.3	The use of plant hormones to fight alien plant invasions.	A: Mechanical control B: Chemical control
		(3 X 2) **(6)**

Question 4

An investigation was conducted to determine the effect of different concentrations of gibberellins on the average percentage and rate of seed Germination in Penstemon digitalis (a garden plant).
The following procedure was followed:

- Thirty seeds of P. digitalis were used.
- The seeds were divided into three groups of ten (groups A, B and C).
- The seeds in each group were soaked in different concentrations of gibberellins for 24 hours, as shown in the table below:

GROUP	CONCENTRATION OF GIBBERELLINS (mg/ℓ)
A	0
B	500
C	1 000

- The seed mixtures were then filtered and rinsed under cold, distilled water for 2 minutes.
- The three groups of seeds were then placed in a dark growth chamber at a temperature of 21, 3 °C.
- Each day for 10 days, the groups of seeds were given the same amount of water.

The seeds were observed each day. They were considered to have germinated as soon as the shoots and roots first appeared.

The average percentage and rate of seed germination was calculated for each day.

4.1 Identify the TWO dependent variables in the investigation above. (2)
4.2 State THREE factors not related to gibberellins that were kept

constant in this investigation. (3)

4.3 State ONE factor that should have been kept constant with regard to the gibberellins during the investigation. (1)

4.4 Explain the advantage of including many seeds in each group of seeds. (2)

4.5 Explain why the seeds were left to germinate in a dark growth chamber. (2)

(10)

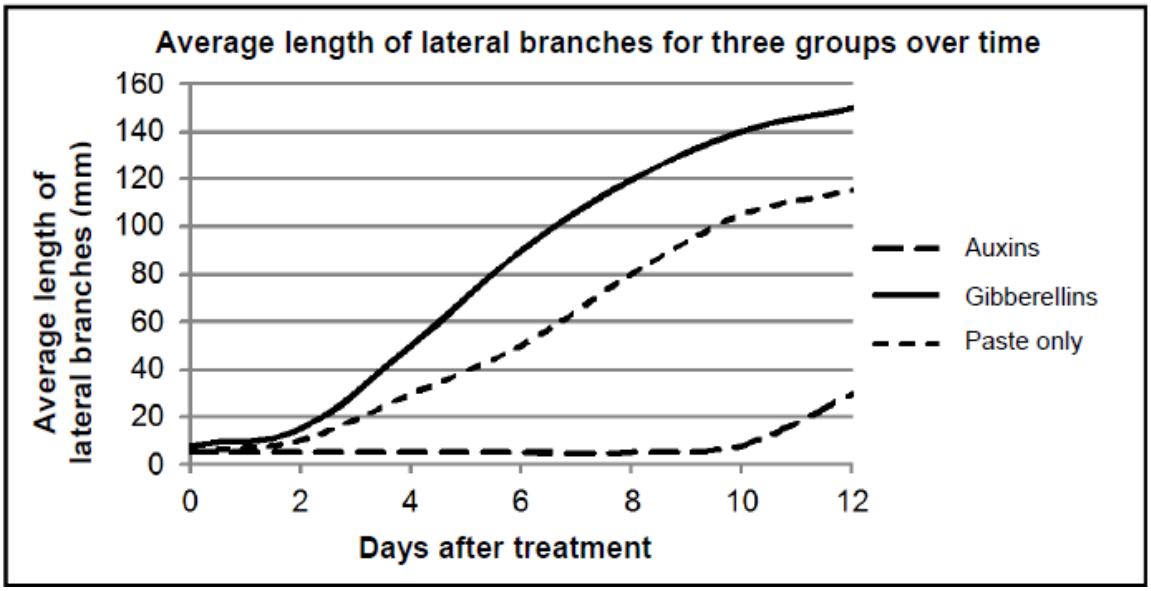
Question 5

A learner investigated the effects of two plant growth substances, gibberellins and auxins, on apical dominance. The apical buds of nine pea plants of the same species, age and height were removed. These plants were then divided equally into three groups. In each group the cut surface of the remaining shoot (growing stem) of the pea plants was treated in one of the following ways:

Group 1: Coated with a paste containing gibberellins of the same concentration
Group 2: Coated with a paste containing auxins of the same concentration
Group 3: Coated with a paste only (containing no plant growth hormones)

The hormones diffuse into the plant until no more hormones remain in the paste. The treated plants were all grown under the same conditions in the laboratory. The length of the lateral branches of each plant was measured after every two days for a period of 12 days. Measurements were taken at the same time for all treated plants and the average for each group was calculated.

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



5.1 State ONE function of the gibberellins that led to the results obtained in the investigation. (1)

5.2 Calculate the difference in the average length of the lateral branches (3)

between the plants treated with gibberellins and the plants treated with the paste only on the 8th day after the treatment. Show ALL working.

5.3 State TWO ways in which the reliability of the investigation could be increased. (2)

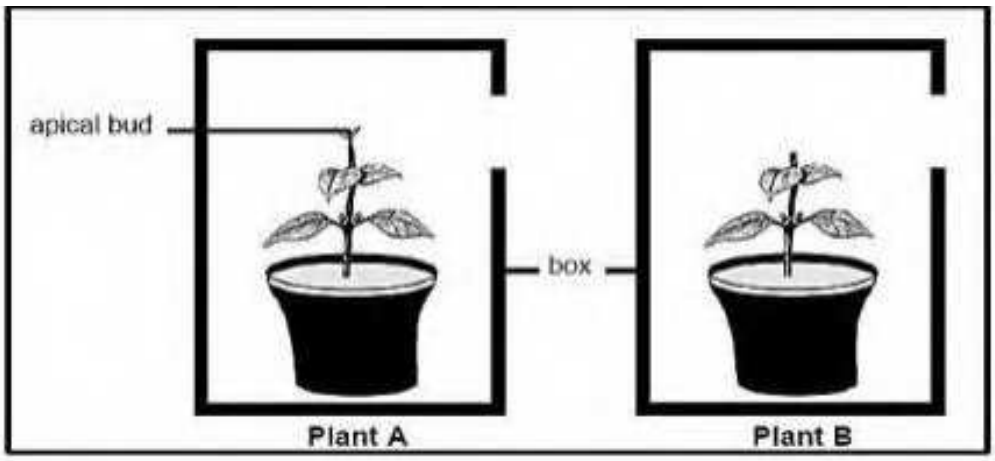
5.4 Use the results to explain the effect of auxins on the growth of the lateral branches. (4)

(10)

Question 6

The diagram below shows two plants (**A** and **B**) at the start of an investigation. The plants were treated in the following ways:

- No changes were made to plant **A**.
- The apical bud of plant **B** was removed.
- Each plant was covered with a box with a single opening, as shown below and placed in the lit room.



6.1 State the role of the boxes in the investigation. (1)

6.2 Name the hormone that is removed by cutting off the apical bud from plant **B**. (1)

6.3 Tabulate TWO differences between plants **A** and **B** you would expect after two weeks. (5)

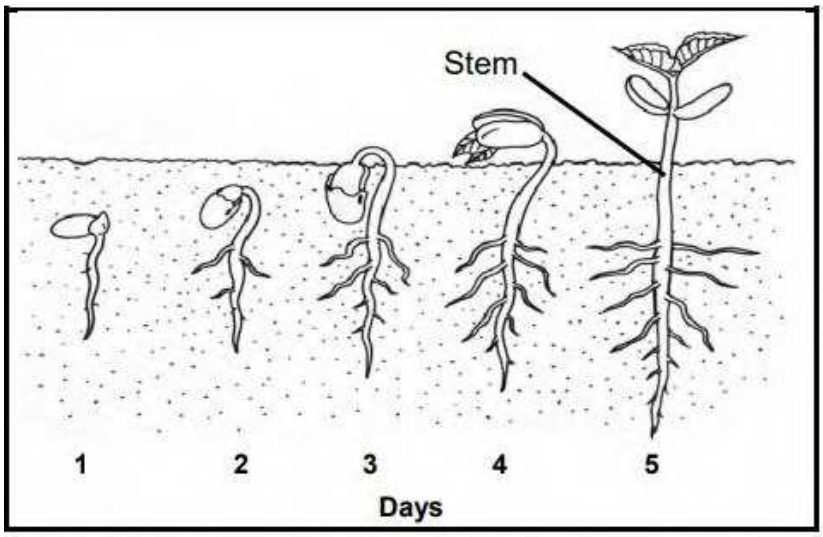
(7)

Question 7

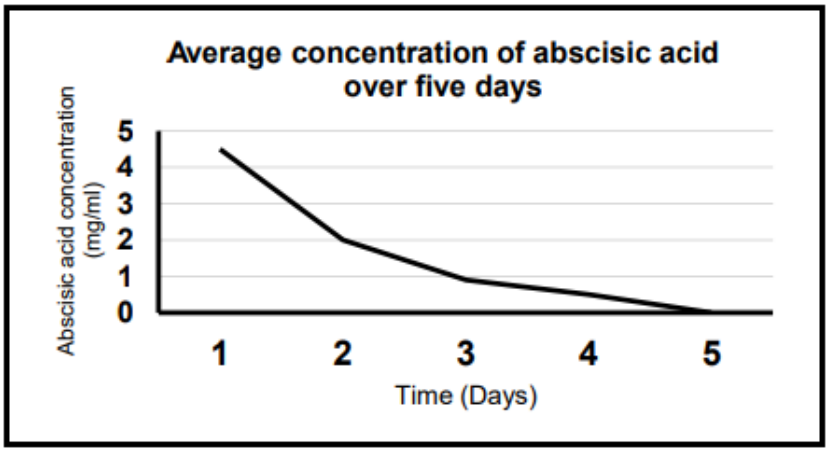
An investigation was conducted to determine the relationship between seed germination and the amount of abscisic acid found in the seed. The procedure was as follows:

- 10 seeds were placed on damp cotton wool on a tray
- The tray was placed in a dark cupboard
- The abscisic acid concentration in the seeds was measured in the laboratory every day for five days.

The diagram below shows one of the seeds that germinated.



The graph below shows the average concentration of abscisic acid in the 10 seeds.



7.1 Identify the:
(a) Independent variable. (1)
(b) Dependent variable. (1)

7.2 State the function of abscisic acid. (1)

7.3 Describe the trend of the hormone concentration as shown in the graph. (2)

7.4 Explain the effect of the trend described in **QUESTION 7.3** on the seed germination. (2)

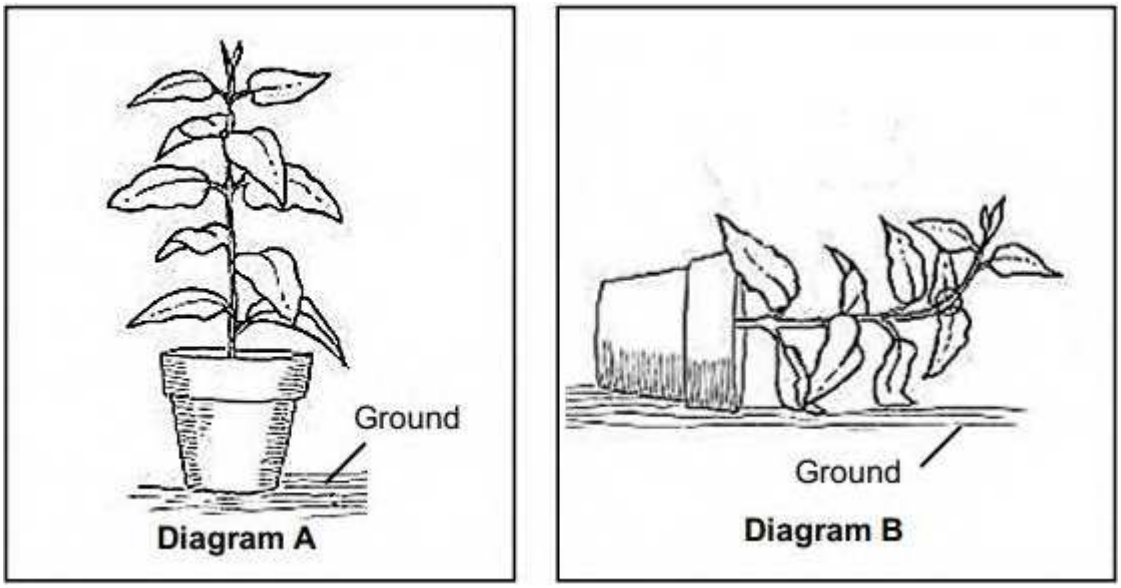
7.5 State TWO ways to increase the validity of this investigation. (2)

7.6 Explain the plant growth response shown by the stem of the seedling on days 4 to 5. (4)

(13)

Question 8

Diagram **A** shows an upright pot plant. Diagram **B** shows the same pot plant one week after falling over. The plant was exposed to uniform light from all directions before and after falling over.



8.1 Which type of tropism is illustrated in **Diagram B**? (1)

8.2 Explain why the stem of the plant bent upwards, as illustrated in **Diagram B**. (4)

8.3 Explain the advantage that the upward bending of the stem could have for the plant (2)

8.4 State how the roots in **Diagram B** would react. (1)

(8)

TOPIC: HUMAN ENDOCRINE SYSTEM AND HOMEOSTASIS

Question 1

Various options are provided as possible answers to the following questions.
Choose the correct answer and write only the letter (A to D) next to the question number.

1.1 Which ONE of the following is an exocrine gland?

A Pituitary
B Prostate
C Adrenal
D Thyroid

1.2 A person produces a smaller volume of urine most probably because …

A ADH levels are high in the blood and the renal tubules are more permeable to water.
B ADH levels are high in the blood and the renal tubules are less permeable to water.
C ADH levels are low in the blood and the renal tubules are more permeable to water.
D ADH levels are low in the blood and the renal tubules are less permeable to water.

1.3 When a person runs a race, sweating helps to …

A regulate the amount of salts in the body.
B control the amount of glucose in the body
C cool the body through evaporation.
D regulate the amount of water in the body.

Questions 1.4 refer to the investigation below.

A scientist did an investigation on a healthy individual to determine the effect of drinking water on urine production.

The participant was requested not to eat or drink for four hours before the investigation began. The investigation was conducted over a period of three days.

The procedure was as follows:

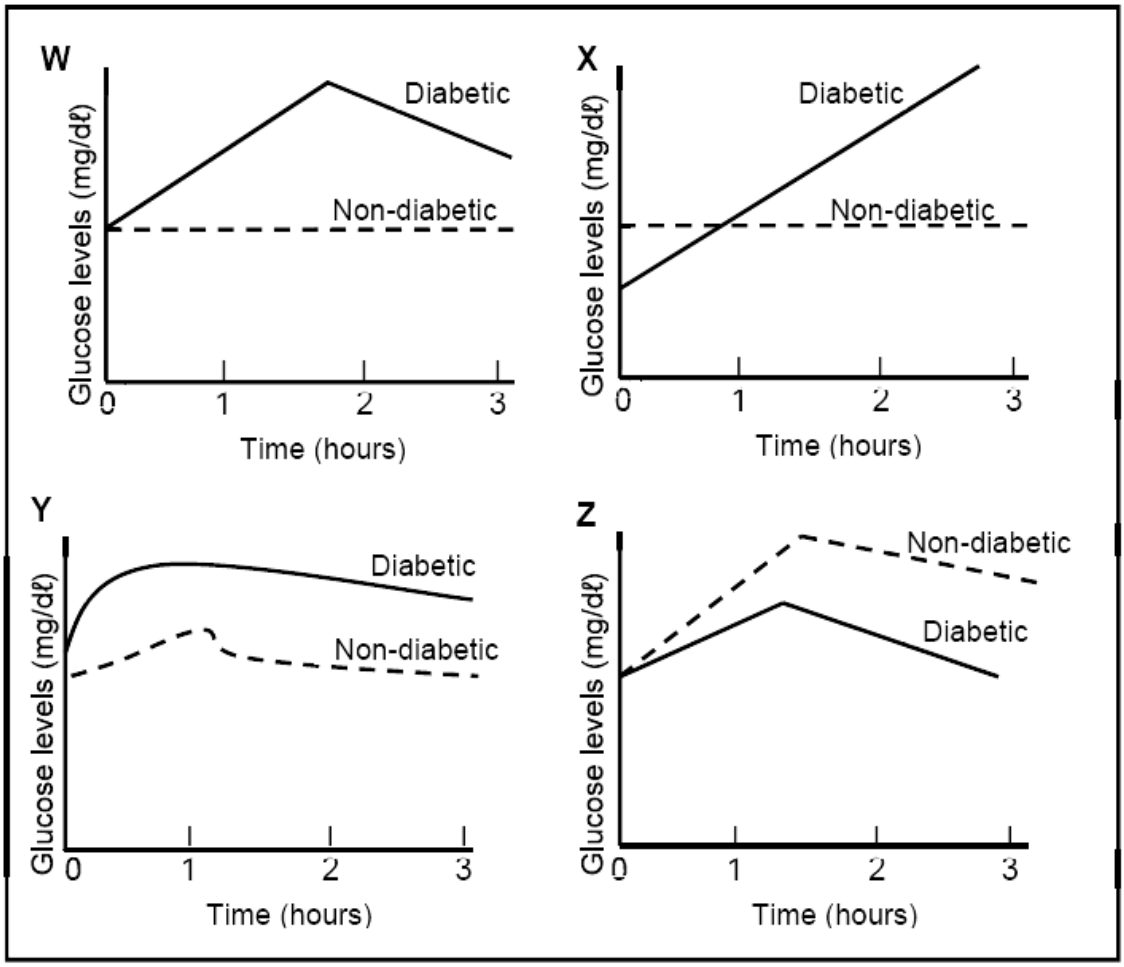
- On day 1 the participant was given 600 ml of water to drink.
- On day 2 the participant was given 800 ml of water to drink.
- On day 3 the participant was given 1 000 ml of water to drink.
- For each day the amount of urine produced by the participant was measured and recorded over the next four hours, and an average was calculated.

1.4 Which ONE of the following CORRECTLY indicates the dependent and the independent variables?

	INDEPENDENT VARIABLE	DEPENDENT VARIABLE
A	The amount of urine produced	Time in hours
B	The amount of water drunk	The amount of urine produced
C	The amount of urine produced	The amount of water drunk
D	The people participating	Time in hours

1.5 Two men were given a glucose-rich meal at the same time (0 hours). One man is diabetic and the other is non-diabetic. The diabetic did not receive any medical treatment. Their blood glucose levels were measured over a period of 3 hours.

The graphs below show the possible blood glucose levels of the two men during this time.



Which ONE of the graphs correctly represents the blood glucose levels of the two men?

A W
B X
C Y
D Z

(5 x 2) **(10)**

QUESTION 2

Biological Terms

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

	DESCRIPTION	TERM
2.1	A gland whose secretions are transported through blood streams.	
2.2	A system that is responsible for chemical coordination in the body.	
2.3	A hormone that stimulates ovulation in humans	
2.4	The process of maintaining a constant internal environment in the human body	
2.5	A gland whose secretions are transported through ducts.	
2.6	A hormone that stimulates mammary gland to produce milk.	
2.7	A hormone that is responsible for osmoregulation in the body.	
2.8	Specialized cells in the pancreas that secretes insulin and glucagon.	
2.9	A hormone responsible for secondary sexual characteristics in males	
2.10	A hormone that is responsible for maintaining salt balance in the blood.	
2.11	A gland that secretes FSH and LH in females.	
2.12	Chemical messengers produced by endocrine glands.	
2.13	A gland located in the neck that secretes thyroxin hormone.	
2.14	A hormone that controls the metabolic rate in the body.	
2.15	A hormone that increases the blood glucose level in the body.	
2.16	A hormone that lowers the blood glucose level in the body.	
2.17	Promotes the secretions of hormones produced by thyroid glands.	
2.18	A mechanism that detects imbalances and restores balance in the internal environment	
2.19	A hormone responsible for growth and development in the body.	
	19x1	**(19)**

Question 3

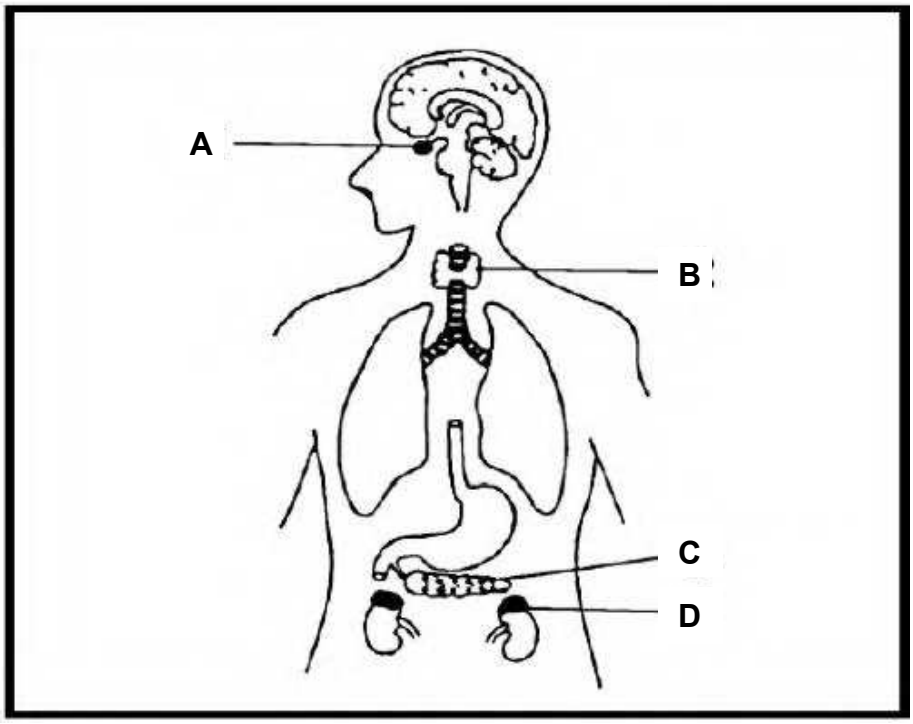
Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number.

	Column I	Column II
3.1	The hormone that is in excess in a person that grows abnormally tall	A: ADH B: Thyroxin
3.2	A hormone that controls the salt content in a human body	A: Aldosterone B: Adrenalin
3.3	The state of the blood vessels in the skin of a human when the environmental temperature is high	A: Dilated B: Constricted
3.4	May cause a decrease in the pH of the blood	A: excess carbon dioxide B: excess glucose

3.5	Acts both as an endocrine and exocrine gland	A: Adrenal B: Pancreas
		(5x2) **(10)**

Question 4

The diagram below represent human endocrine system



4.1 Identify parts **A** and **D** (2)

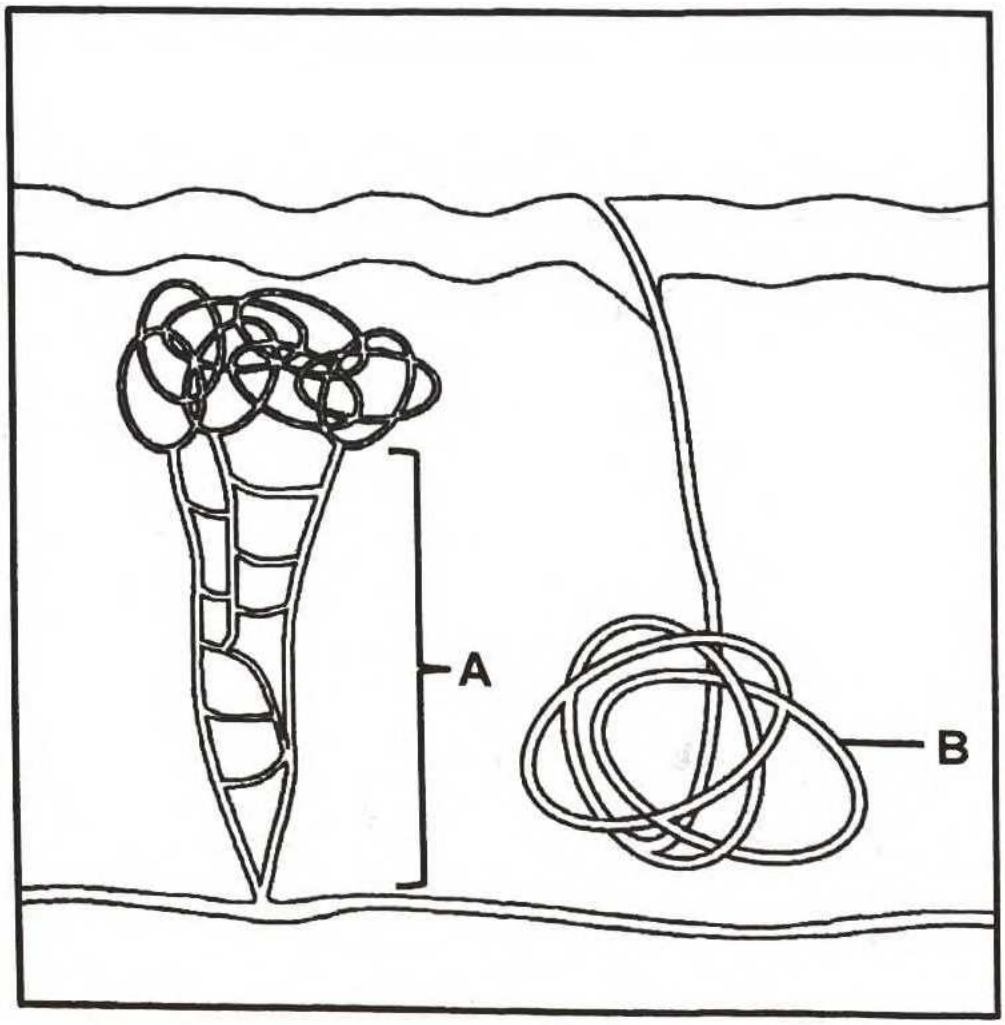
4.2 Write down the **LETTER** and the **NAME** of the part that:

(a) Produces the hormone glucagon
(b) Produces a hormone that controls the growth of long bones
(c) Produces an iodine-containing hormone
(d) Produces a hormone that is involved in the re-absorption of some salts by the kidneys (8)

4.3 State TWO similarities between hormones and nerves with regard to their functions. (2)
(12)

QUESTION 5

The diagram below represent a part of the human skin



5.1 Identify part **B**. (1)

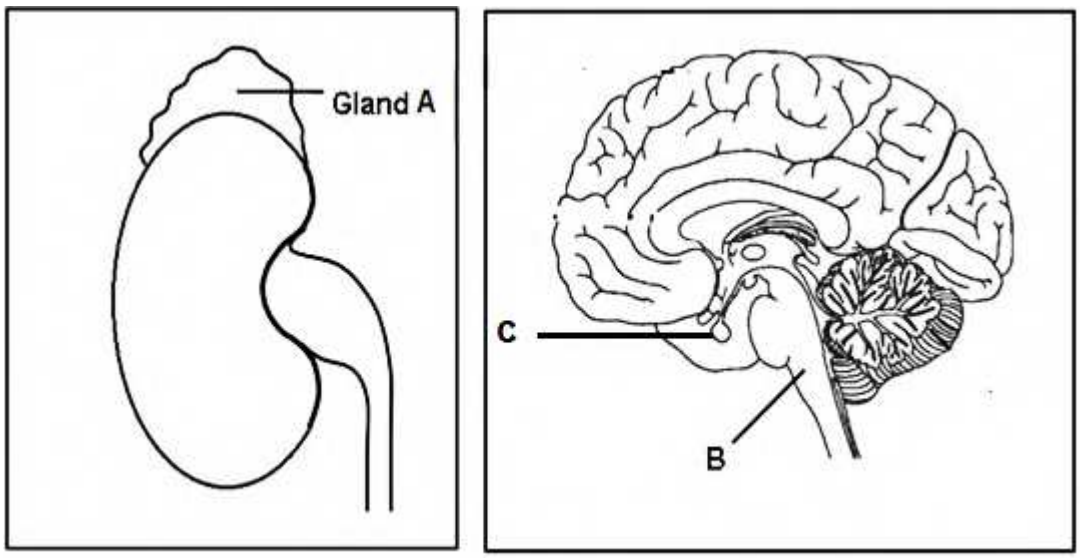
5.2 Describe how structure **A** functions during thermoregulation on a cold day. (3)

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

(6)

QUESTION 6

The diagrams below show the human kidney and human brain.



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

a) Long bones (1)
b) Mammary glands in the breasts (1)

6.2 During an emergency situation, 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)

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

(11)

QUESTION 7

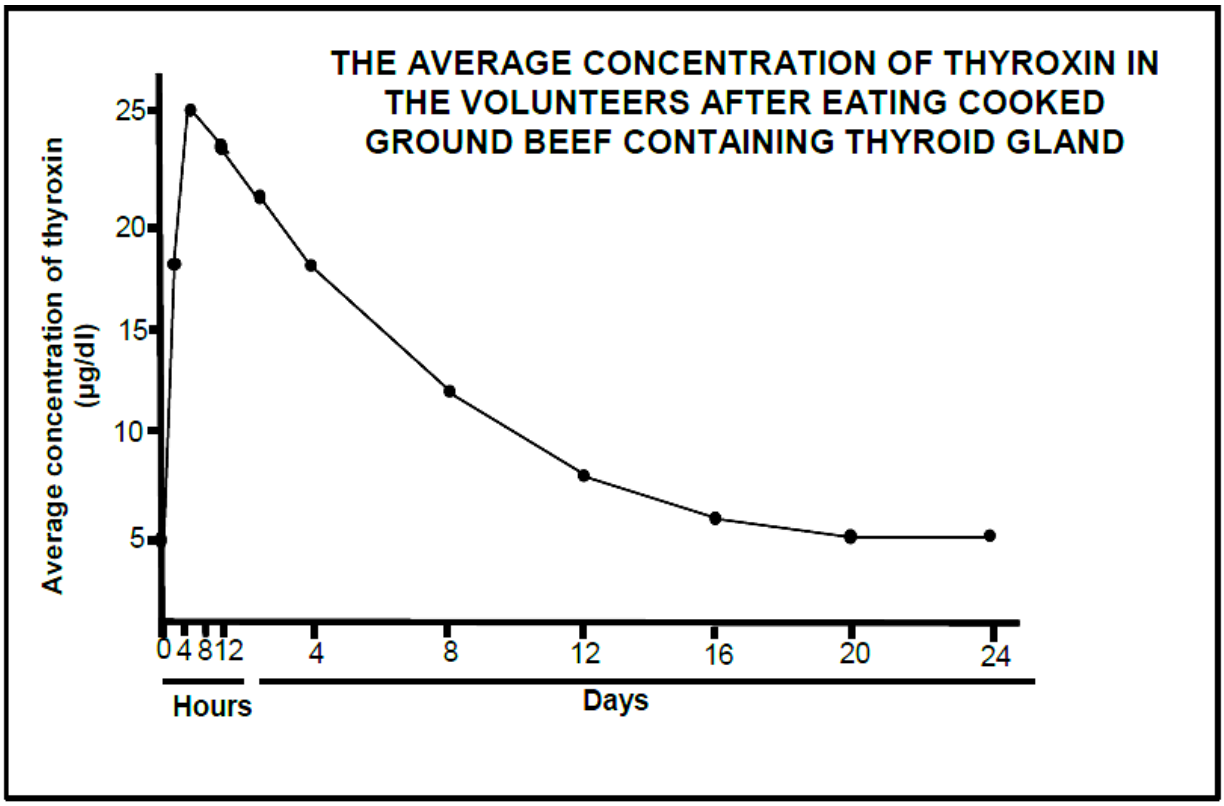
Read the extract below.

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.



7.1 Give the average normal thyroxin concentration (µg/dl) in the blood of the volunteers. (1)

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

7.3 Explain why thyrotoxicosis causes weight loss. (3)

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

(11)

QUESTION 8

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

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

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

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

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

8.5 Frostbite is a condition where long term exposure to extremely cold conditions (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 9

An investigation was carried out to determine the influence of alcohol on the volume of urine produced.
12 healthy, 23-year-old males of similar height and mass participated in the investigation.

The investigation was conducted as follows:

- The men were divided into two groups of six each, Group A and Group B.
- The two groups ate the same food and did the same exercise for the 24-hour-period before testing.
- Each group was given the following to drink after the 24-hour-period:
  - Group A: 1 litre of alcohol-free beer (beer that does not contain alcohol)
  - Group B: 1 litre of alcoholic beer
- Urine was collected from each man every hour.

Assume that the volume of urine collected is equal to the volume of urine produced.

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

TIME OF COLLECTION	AVERAGE VOLUME OF URINE COLLECTED (mℓ)	
	GROUP A	GROUP B
After 1 hour	599	643
After 2 hours	413	504
After 3 hours	112	132

9.1 State:

(a) The dependent variable in this investigation (1)

(b) TWO planning steps the investigators had to take before the investigation could start (2)

(c) TWO factors that need to remain constant, other than the ones already mentioned (2)

(d) TWO steps that the investigators took to ensure the reliability of the investigation (2)

9.2 Based on the results, explain how the intake of alcohol influences the secretion of ADH and consequently the volume of urine that is produced by the kidneys. (4)

(11)

Question 10

An investigation was carried out to determine the effect of caffeine on 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 rate 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.

The table below shows the results of the investigation.

TIME (minutes)	AVERAGE TEMPERATURE (°C)	AVERAGE PULSE RATE (BPM)
0	36,6	76
15	37,4	91
30	38	95
45	37,8	89
60	37,4	89

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

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

10.3 Caffeine causes vasoconstriction and an increase in metabolism.

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

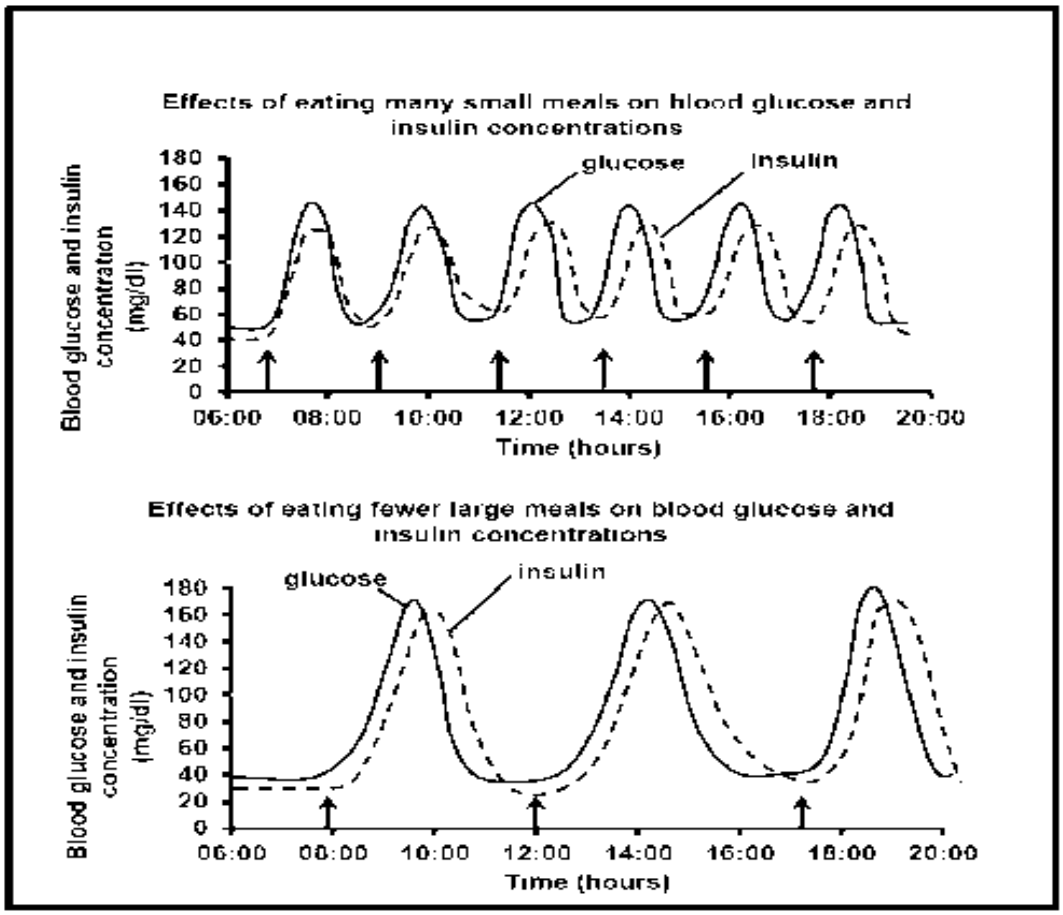
10.4 State TWO factors that were kept constant during this investigation. (2)

(9)

Question 11

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.



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

11.2 Use the information in the graphs.

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

11.3 Explain why eating many small meals per day is better for a diabetic person than eating fewer large meals a day. (4)

(10)

Question 12

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

12.2 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 13

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

13.2 State **THREE** effects that the hormone in **QUESTION 13.1** has on the body. (3)

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

(9)

Question 14

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

Question 15

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

PAPER 2
Topic: DNA Code of Life

Question 1

Various options are provided as possible answers to the following questions.
Choose the correct answer and write only the letter (A to D) next to the question number.

1.1 The scientists who won the Nobel Prize for the discovery of the structure of DNA were …

A Watson and Franklin
B Wilkins and Franklin
C Crick and Franklin
D Watson and Crick

1.2 The components of a DNA molecule that provide the code for protein synthesis are the …

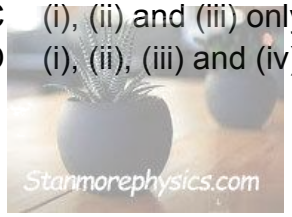
A Sugars
B Phosphates
C Hydrogen bonds
D Nitrogenous bases

1.3 The monomer units that link to form nucleic acids are:

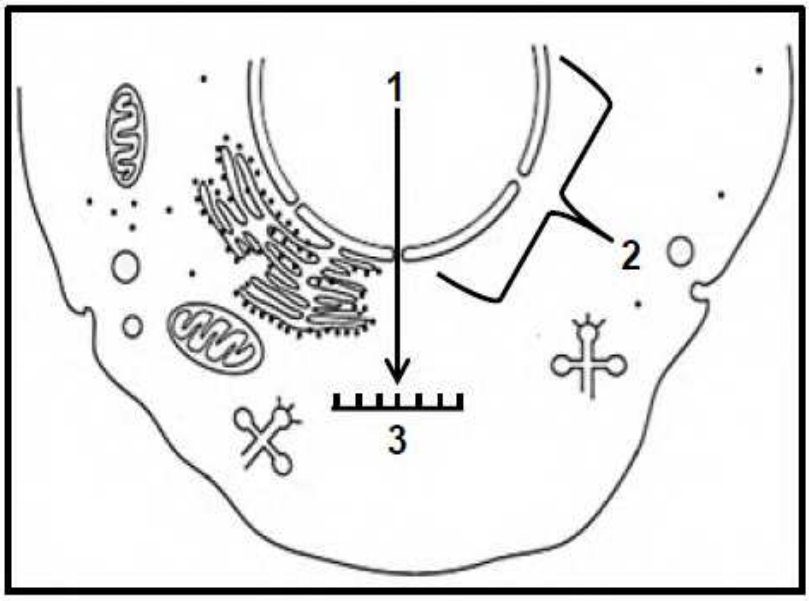
A Amino acids
B Nucleotides
C Glucose
D Fatty acids

1.4 Which of the following involves complementary base pairing?
(i) Transcription
(ii) Translation
(iii) Replication
(iv) Denaturation

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



1.5 The diagram below shows some of the processes, molecules and structures that are involved in protein synthesis in a cell.



Which ONE of the following is the CORRECT labels for 1, 2 and 3 in the diagram?

	PROCESS 1	STRUCTRE 2	MOLECULE 3
A	transcription	ribosome	tRNA
B	translation	ribosome	mRNA
C	transcription	nucleus	mRNA
D	translation	nucleus	tRNA

(5 x 2) **(10)**

Question 2

Biological Terms

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

	DESCRIPTION	TERM
2.1	A tangled network of DNA and protein located within the nucleus	
2.2	The bonds that hold the two strands of a DNA molecule together.	
2.3	The sugar found in DNA	
2.4	The analysis of DNA samples to identify individuals that may be related	
2.5	The process whereby DNA makes an exact copy of itself	
2.6	The monomers of nucleic acids	
2.7	The natural shape of a DNA molecule	
2.8	Sections of DNA that carry hereditary information	
2.9	The sugar that forms part of a nucleotide in RNA	
2.10	The process whereby mRNA is formed from DNA	
2.11	Base triplets found on mRNA	
2.12	The cell organelle to which mRNA attaches during protein synthesis	

2.13	The process of arranging amino acids according to the sequence of bases on mRNA	
2.14	The organelle in a cell where translation occurs	
2.15	The triplet of bases found on a tRNA molecule	
2.16	The type of RNA containing anticodons	
2.17	Bonds that join amino acids together	
	17 x 1	**(17)**

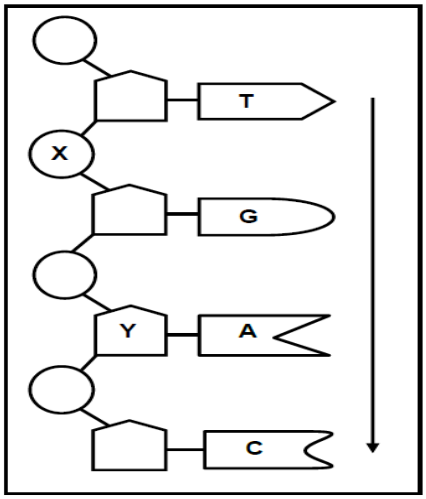
Question 3

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**
3.1	Produced the first X-ray image of the DNA molecule	A: Rosalind Franklin B: Watson & Crick
3.2	Found in the nucleus	A: DNA B: RNA
3.3	Unit of genetic code consisting of three mRNA bases	A: Codon B: Anticodon
3.4	The nitrogenous base found in messenger RNA but not in DNA	A: Uracil B: Adenine
3.5	Contains amino acids	A: RNA B: Protein
		(5 x 2) **(10)**

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:

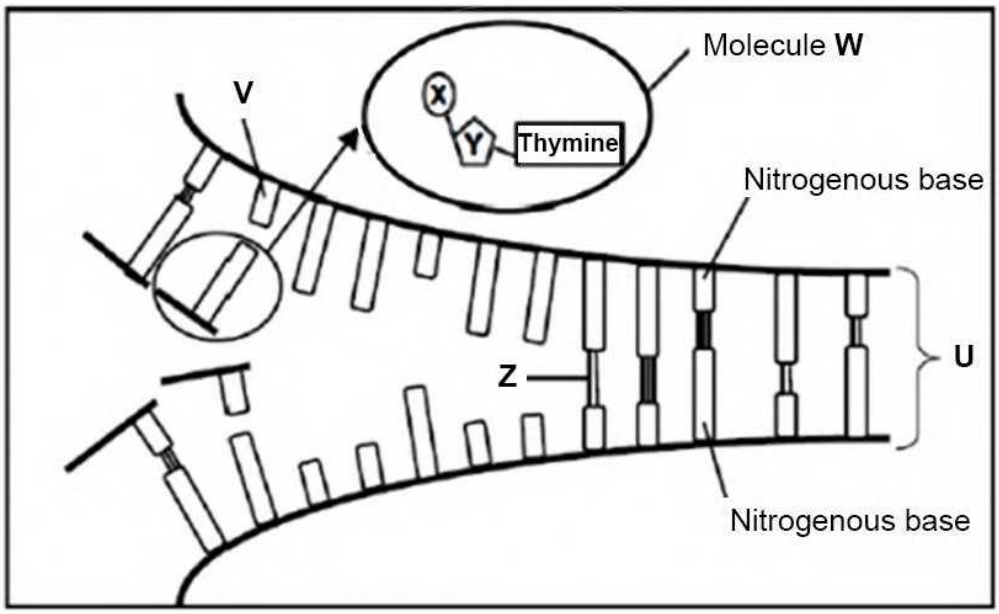
(a) Sugar molecule (1)

(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

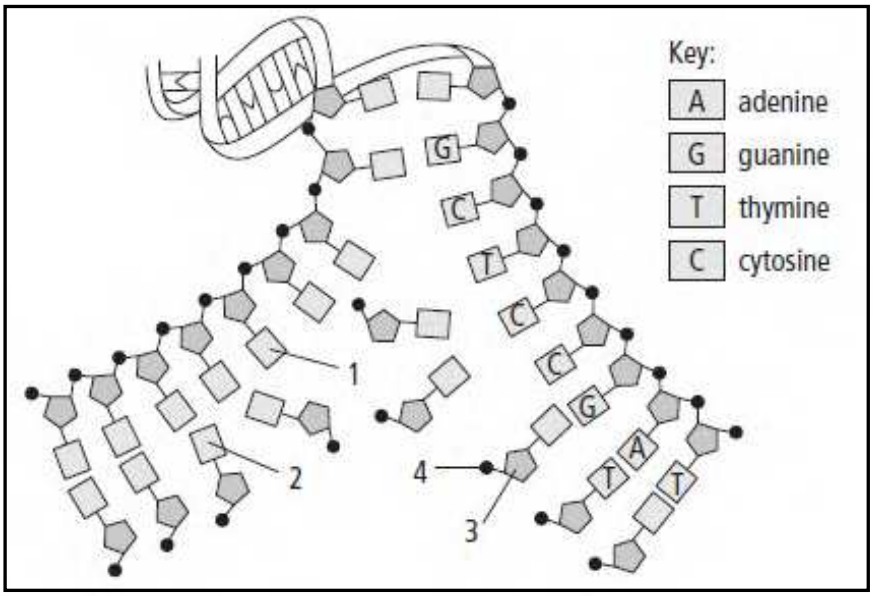
The diagram below represents DNA Replication.



5.1 Identify the following:
(a) Molecules **W** and **U**. (2)
(b) Parts of molecule **W** labelled **X** and **Y**. (2)
(c) Bond **Z**. (1)
(d) Nitrogenous base **V**. (1)
5.2 Where in the cell does this process take place? (1)
5.3 Name the phase of the cell cycle where replication takes place. (1)
(8)

Question 6

The diagram below shows part of a DNA molecule in a nucleus just before cell division.



6.1 Name the process taking place in the diagram. (1)

6.2 Identify the parts labelled:

(a) **3**. (1)

(b) **4**. (1)

6.3 Identify the nitrogenous bases labelled:

(a) **1**. (1)

(b) **2**. (1)

(5)

Question 7

Describe the following with respect to DNA:

7.1 Location (2)

7.2 Structure (7)

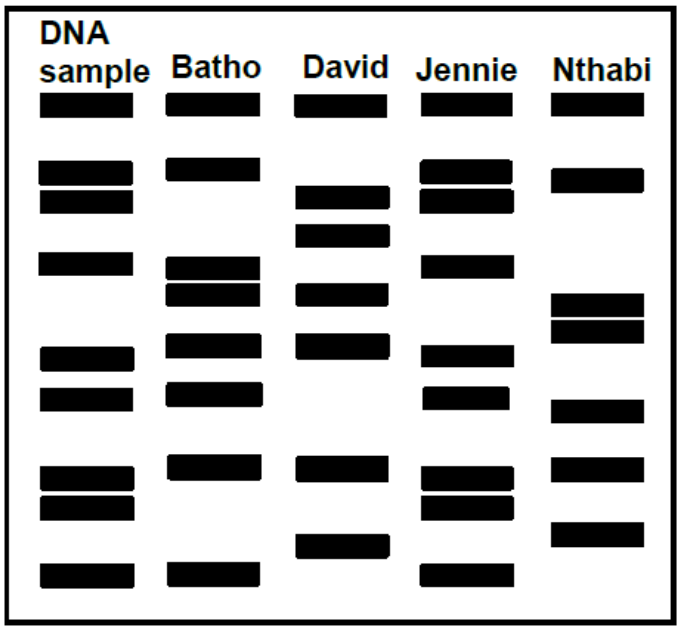
7.3 Replication (6)

(15)

Question 8

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:



8.1 Name the technique that was used to identify the criminal. (1)

8.2 Who is the possible criminal? (1)

8.3 Explain your answer to **QUESTION 8.2**. (2)

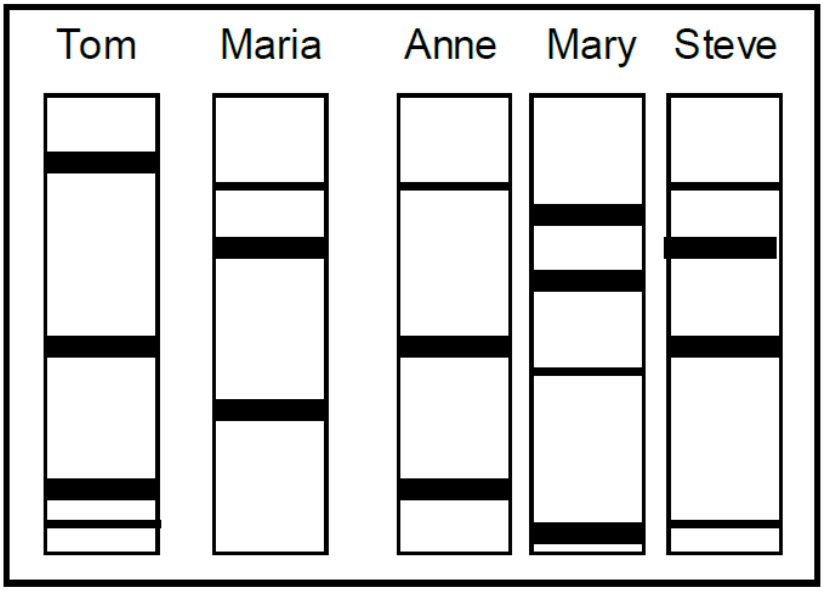
8.4 State ONE other use of the technique identified in **QUESTION 8.1**. (1)

8.5 Give TWO views against the use of the technique identified in **QUESTION 8.1**. (2)

(7)

Question 9

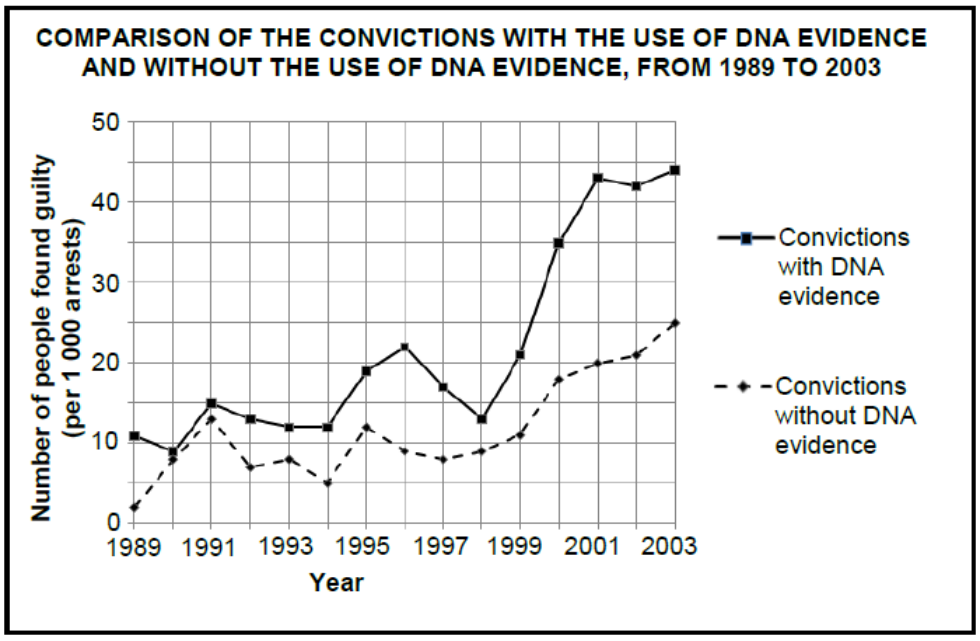
Tom and Maria have three children. One of the three children was adopted. A DNA profile for each member of the family was prepared to determine if Tom is the father of all three children (Anne, Mary and Steve).
The DNA profiles are given below.



9.1 Which ONE of the children has been adopted? (2)
9.2 Explain your answer to **QUESTION 9.1**. (2)
(4)

Question 10

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.



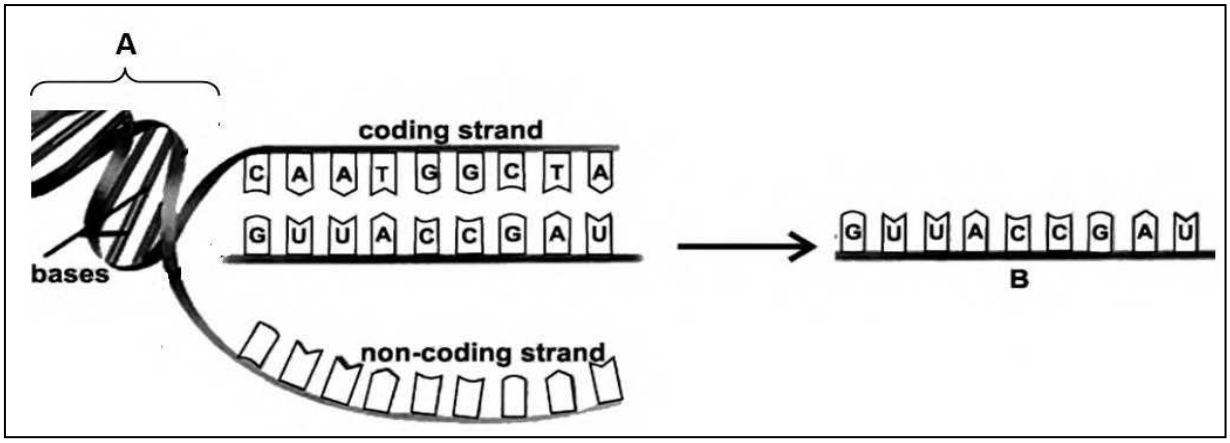
10.1 State the dependent variable in this investigation. (1)

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

10.3 A DNA database is a collection of the DNA profiles of all the citizens of a country.
Explain how you would use the information in the graph to convince the government to create a DNA database. (4)
(7)

Question 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

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

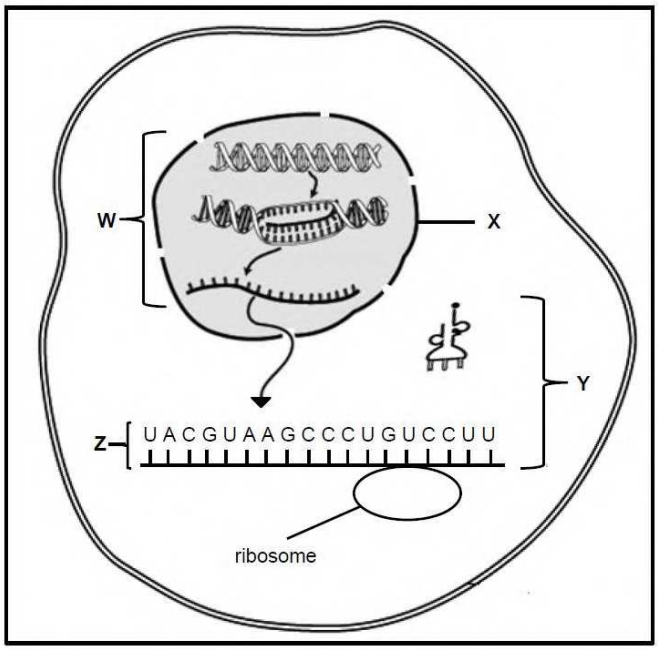
The table below shows the DNA base triplets coding for some amino acids.

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

12.1 Give the:
(a) DNA base triplet for amino acid **3**. (1)
(b) mRNA codon for amino acid **4**. (2)
12.2 What is a change in the sequence of DNA base triplets called? (1)
12.3 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)
12.4 Describe how a person with haemoglobin S would be affected. (2)
(10)

Question 13

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



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

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

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

13.4 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

13.5 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)

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

13.7 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 14

A section of a DNA molecule has the following base sequence:

C T T A C A

14.1 Name the nitrogenous base represented by **C** in the DNA molecule. (1)

14.2 The percentage of guanine in this DNA molecule is 30%. (2)
Give the percentage of thymine in the same amino acid.

14.3 Give the mRNA sequence, from left to right, for this segment of DNA. (2)

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

DNA TRIPLET	AMINO ACID
ACA	Cysteine
CTT	Glutamic acid
TGT	Threonine
TTA	Asparagine
GAA	Leucine
TAC	Methionine

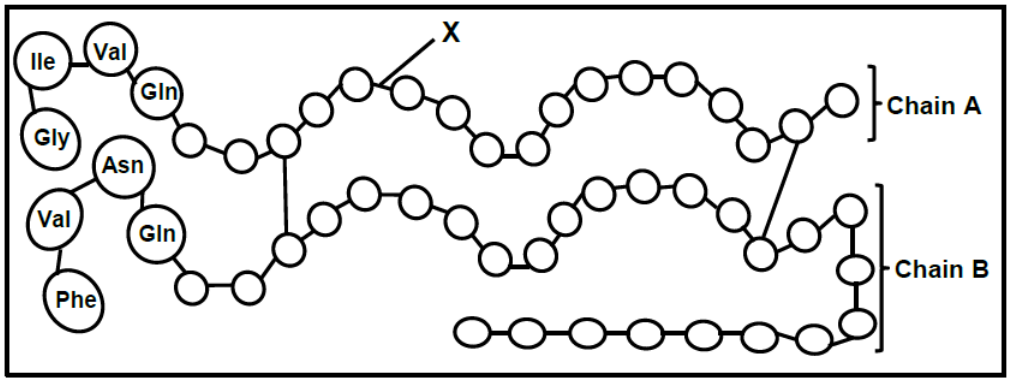
14.4 Give the sequence of amino acids that would be coded for by the section of DNA above. (2)

14.5 Give the anticodon for the amino acid methionine. (1)

(8)

Question 15

Insulin is one of the hormones responsible for the control of blood glucose levels in humans. It is made up of two long amino acid chains, **A** and **B**, which are joined. Chain **A** is made up of 21 amino acids and chain **B** of 30 amino acids.
The diagram below represents the amino acids present in each chain.



15.1 Name the process whereby insulin is produced in a normal human cell. (1)

15.2 Identify bond **X**. (1)

15.3 How many nitrogenous bases in DNA molecule code for the amino acids in chain **A**? (1)

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

mRNA CODON	AMINO ACID
UUC	Phenylalanine (Phe)
AUC	Isoleucine (Ile)
AAU	Asparagine (Asn)
GAA	Glutamic acid (Glu)
GUA	Valine (Val)
CAG	Glutamine (Gln)
CAU	Histidine (His)
GGA	Glycine (Gly)

15.4.1 Name the nitrogenous base represented by **G** in the mRNA codon CAG. (1)

15.4.2 Read the chains from left to right and give the:

(a) Codon for the fourth amino acid in chain **B**. (1)

(b) DNA base triplet that codes for the first amino acid in chain **A**. (1)

15.4.3 Give the anticodon for **valine**. (1)

(7)

Question 16

Describe the structure of RNA in a cell. **(6)**

Question 17

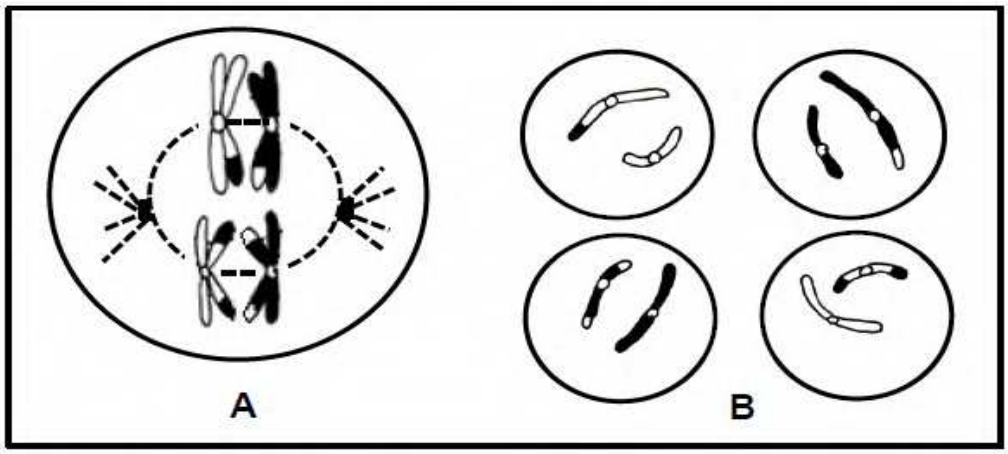
Describe the involvement of the different types of RNA in the process of Protein synthesis. **(8)**

TOPIC: Meiosis

Question 1

Various options are provided as possible answers to the following questions.
Choose the correct answer and write only the letter (A to D) next to the question number.

1.1 The diagram below represent two phases of meiosis



Which one of the following represent the correct sequence of the phase between phase A and Phase B

A Anaphase I, Metaphase I, prophase II, Telophase II
B Metaphase I, Telophase I, Prophase II, Metaphase II
C Anaphase I, Telophase I, Prophase II, Metaphase II and Anaphase II
D Prophase I, Telophase I, Prophase II, Metaphase II and Telophase II

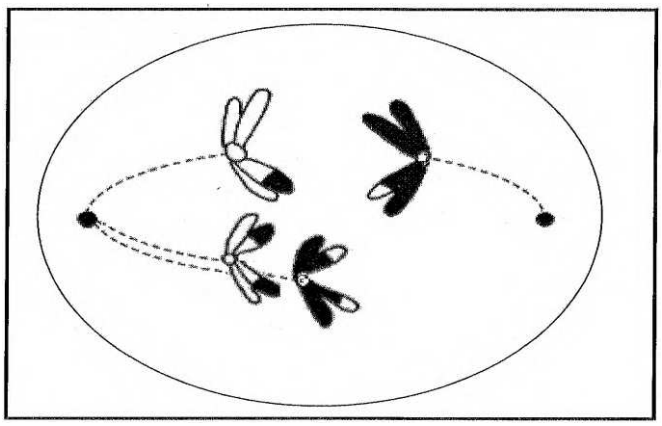
1.2 Normal human ova have…

A 22 autosomes and an X chromosome
B 23 autosomes and an X chromosome
C 22 autosomes and Y chromosome
D 23 autosomes and Y chromosome

1.3 Which one of the following occurs in mitosis and NOT in meiosis

A Two cells are formed at the end of division
B Crossing over takes place
C Homologous chromosomes arranged at the equator
D Centrioles formed at the poles of the cell

1.4 The diagram below shows a cell undergoing meiosis



The diagram above shows…

A non-disjunction in metaphase II
B a chromosomal aberration that results to haemophilia
C A chromosomal aberration involving chromosome pair number 23, leading to down syndrome
D Non-disjunction in anaphase I

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

Question 2

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

	Description	**Term**
2.1.	The point of crossing over between two adjacent chromosomes	
2.2.	The splitting of the cytoplasm during cell division	
2.3.	The failure of chromosome pairs to separate during meiosis	
2.4.	The structures in the cell that forms the spindle fibres.	
2.5.	The phase of meiosis when homologous chromosomes are aligned at the equator of the cell.	
2.6.	The point at which the two chromatids of a chromosome are joined together	
2.7.	The division of the nucleus	
2.8.	Exchange of genetic material between chromatids of homologous chromosomes	
2.9.	Site of meiosis in females	
2.10.	A genetic disorder caused by having an extra copy of chromosome number 21	
2.11.	The Structure formed by the centrioles during cell division	
2.12.	The non-sex chromosomes in humans	

2.13.	The condition in a cell where there is only one set of chromosomes	
2.14.	The structure that is responsible for the formation of spindle fibres during cell division in animal cells and is made up of two centrioles	
2.15	The phase in the cell cycle during which the cell growth occurs	
2.16	Chromosome that carry the same set of genes.	
	(16x1)	**(16)**

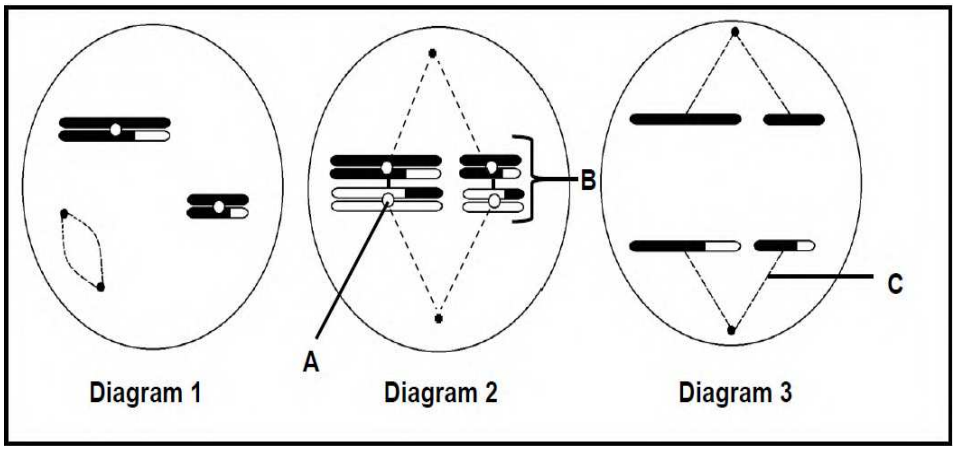
Question 3

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

	COLUMN I		**COLUMN II**
3.1	Chromosomes align at the equator.	A B	Prophase II Telophase I
3.2	Random arrangement of chromosomes	A B	Anaphase II Metaphase I
3.3	Site of meiosis in plants	A B	Anther Ovary
3.4	Process of meiosis produces	A B	4 diploid daughter cells 4 haploid daughter cells
3.5	Mechanism to introduce genetic variation in meiosis	A B	Crossing over Random arrangement of chromosomes
3.6	The point of attachment of two overlapping chromatids	A B	Locus Chiasma
	6X2		**(12)**

Question 4

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



4.1 Identify:
- (a) A (1)
- (b) B (1)
- (c) C (1)

4.2 Identify phase represented in **DIAGRAM 3**. (1)

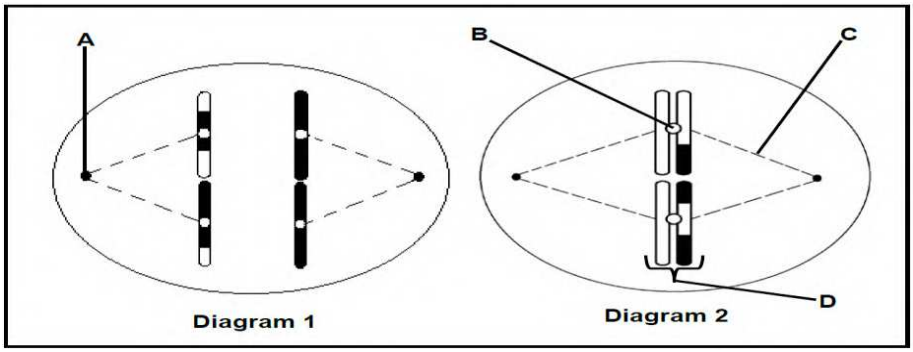
4.3 Write down the numbers of the diagrams to show the sequence in which the phases occurs. (2)

4.4. State ONE difference between metaphase II and metaphase II. (2)

(8)

Question 5

The diagram below represent two phases of meiosis in an organism.



5.1 Identify the phase of meiosis represented in Diagram 1 (1)

5.2 Identify part:
- (a) A (1)
- (b) B (1)
- (c) C (1)

5.3 State what happens to structure D in the next phase of meiosis. (1)

5.4 Name the process during which genetic material was exchanged as shown

in diagrams above. (1)

5.5 State the consequence if the process named in **Question 5.4** does not occur. (1)

5.6 Give the number of chromosomes present in:

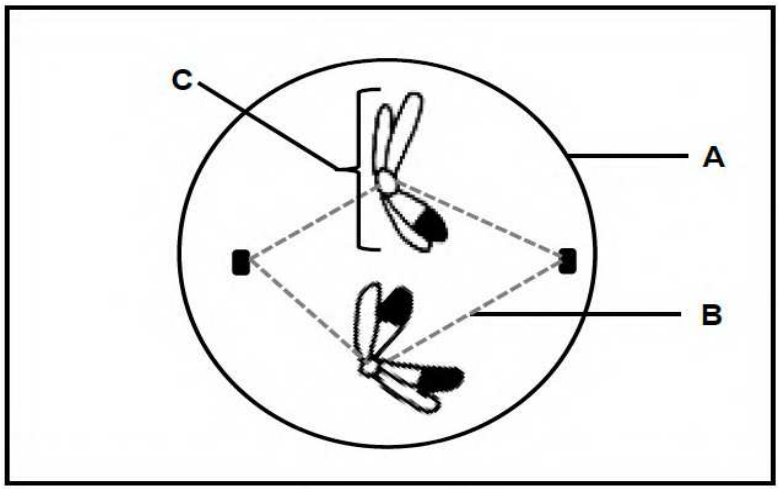
(a) The original parent cell in this organisms (1)

(b) A human cell in the same phase as that shown in Diagram 2 (1)

(9)

Question 6

The diagram below represent the one cell in a phase of meiosis.



6.1 Identify the phase of meiosis shown in the diagram. (1)

6.2 Give ONE observable reason for your answer to **QUESTION 6.1.** (2)

6.3 Identify structure:

(a) A (1)

(b) B (1)

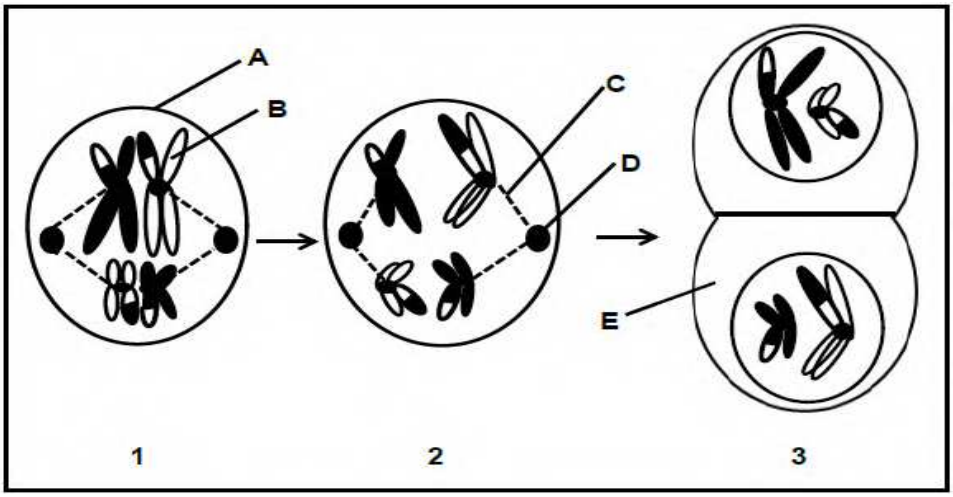
6.4 Describe the role of part **B** in the movement of chromosome during meiosis. (2)

6.5 Draw a labelled diagram of structure **C** as it would appear in the final phase of this meiotic division. Show the correct shading. (4)

(11)

Question 7

Diagrams 1 to 3 below show some of the phases of meiosis in the correct order.



7.1 Identify the phase represented by the diagram:
- (a) 1 (1)
- (b) 3 (1)

7.2 Give the LETTER only of the part that:
- (a) contains DNA (1)
- (b) attaches to the centromeres of chromosomes (1)
- (c) forms spindle fibres (1)

7.3 Name the organ in a human male where meiosis occurs. (1)

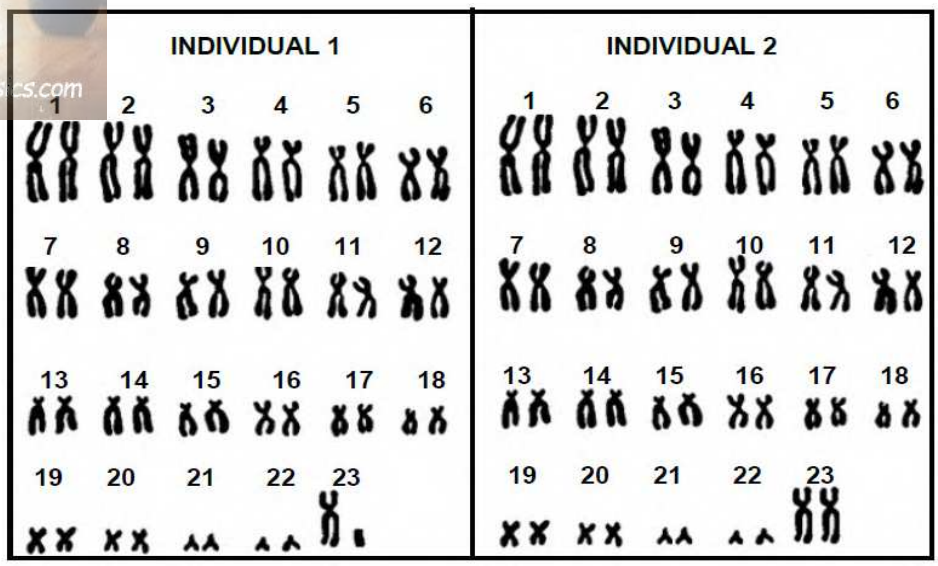
(6)

Question 8

Describe how meiosis lead to generic variation. **(5)**

Question 9

Diagram below represent chromosome from the human somatic cell of two individuals who are twins.



9.1 Identify the type of chromosomes numbered **1** to **22**. (1)

9.2 Each of the pairs shown is a homologous pair of chromosomes.

(a) State the origin of each chromosome in a homologous pair during zygote formation. (2)

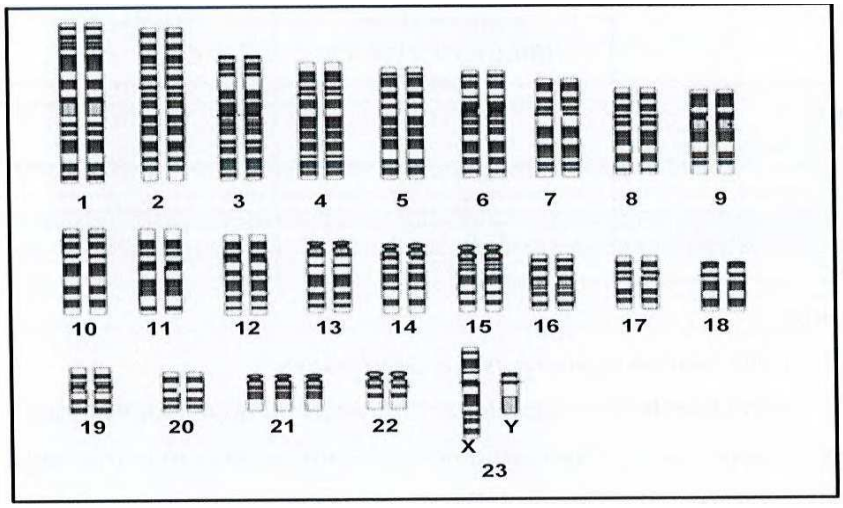
(b) List THREE characteristics that chromosomes in a homologous pair have in common. (3)

9.3 Explain ONE observable reason why the two individuals are not identical twins (3)

(9)

Question 10

The diagram below shows the karyotype of an individual with a disorder caused by non-disjunction.



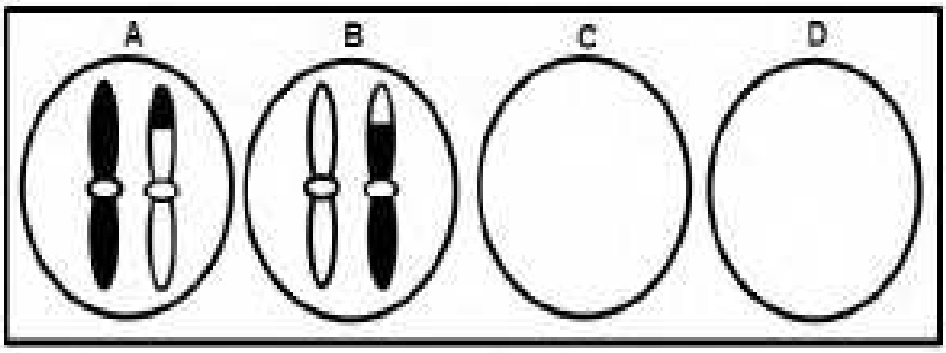
10.1 Name:

(a) This disorder (1)

(b) The phase in meiosis when non-disjunction occurs (1)
(c) The type of mutation that is a result of non-disjunction (1)
(3)

Question 11

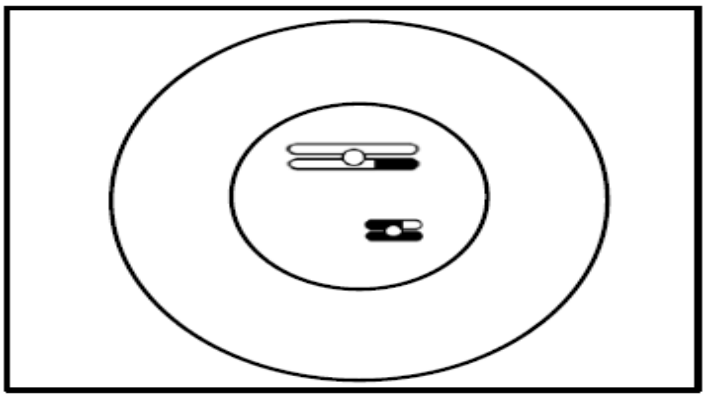
The diagram below represent the distribution of chromosome pair 21 as it appears in each gamete at the end of meiosis II in human male.



11.1 Explain why the gamete represented by diagram C and D do not have any chromosomes. (3)
11.2 If gamete A is involved in fertilisation, describe how this may result in Down syndrome. (3)
11.3 Due to the process of crossing over, the chromosomes in diagram **A** and **B** appear different to each other.
(a) Identify the phase of meiosis during which crossing over occurs. (1)
(b)Describe the events during crossing over. (3)
(10)

Question 12

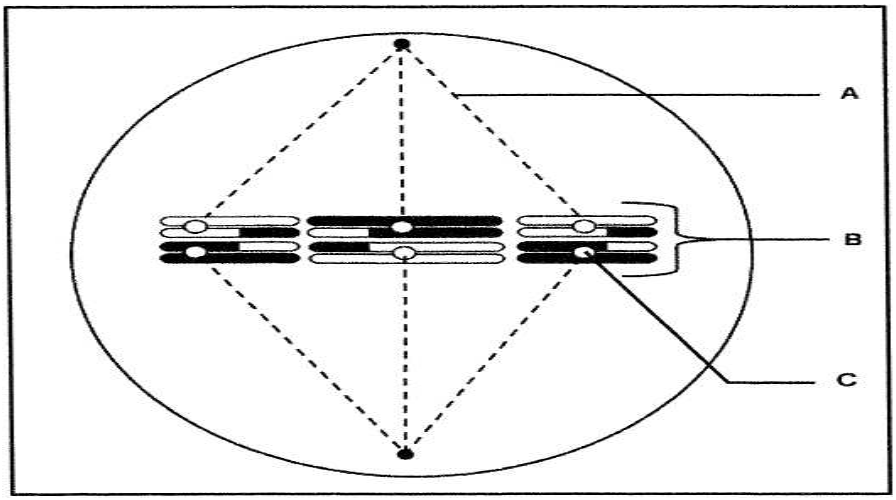
The diagram below represents one of the two cells that formed during Telophase I of meiosis in an organism.



Draw a labelled diagram to show the cell during Anaphase II of meosis. **(5)**

Question 13

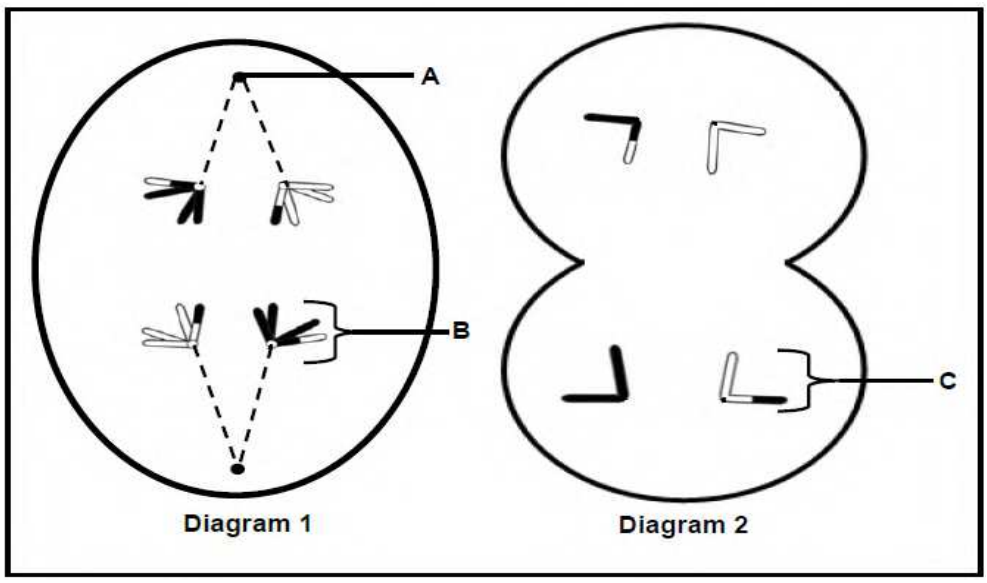
The diagram below shows a phase during meiosis in an animal cell.



13.1	Identify part labelled C.	(1)
13.2	Name the phase represented in the diagram above.	(1)
13.3	B represents the homologous chromosomes. What are homologous chromosomes?	(2)
13.4	Explain the appearance of chromosome in the diagram.	(3)
13.5	State the function of part A in the phase following the one represented in the diagram.	(1)
13.6	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)
		(10)

Question 14

The diagram below represents two phases of meiosis



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

14.2 Identify the phase represented by diagram 1. (1)

14.3 Describe the events that took place in the phase before the one represented in diagram 2. (2)

14.4 Name the process that causes the chromosomes to have the combination of genes as shown in diagrams. (1)

14.5 Give ONE reason why the process named in **Question 14.4** is important. (1)

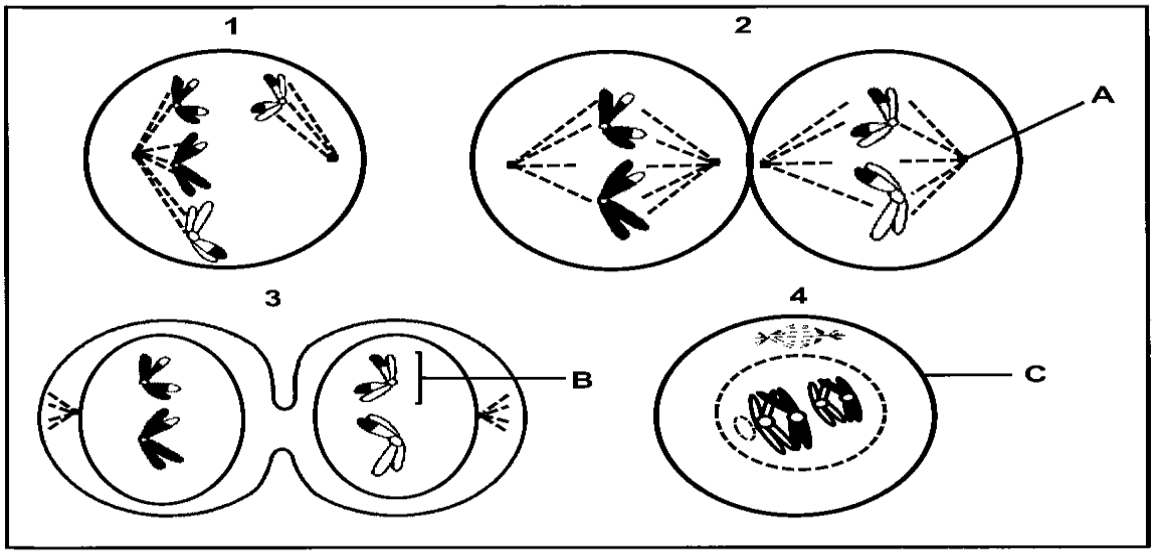
14.6 If this was a human cell, how many chromosome will be present in the cell during the phase represented in diagram 1. (1)

14.7 Structure **B** and structure **C** are both chromosomes. Explain why they are structurally different. (3)

(10)

Question 15

Diagram below represents different phases of meiosis.



15.1 Identify part:

(a) A (1)

(b) B (1)

(c) C (1)

15.2 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)

15.3 How many chromosome will be found in:

(a) The cell at the end of meiosis shown in the diagrams. (1)

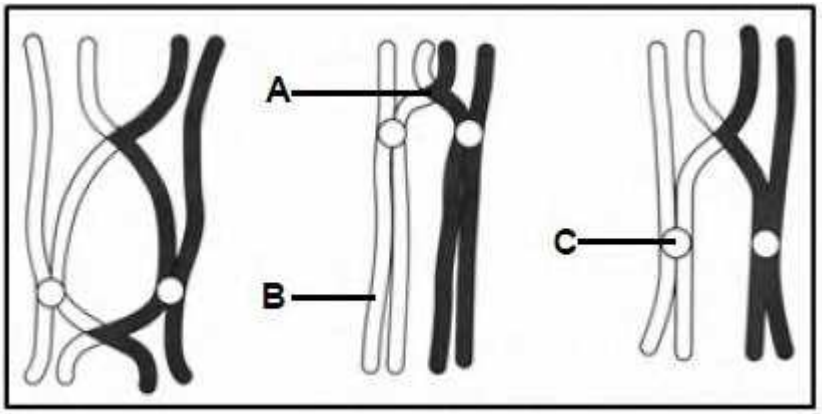
(b) A normal, human sperm. (1)

(c) The somatic cell of the normal mother who has a son with Down syndrome. (1)

(11)

Question 16

The diagram below represents ALL the chromosomes in a cell that is undergoing normal cell division.



16.1 Name the:

(a) Type of cell division that is occurring in the cell in the diagram (1)

(b) Phase of cell division during which chromosomes behaves as shown in the diagram (1)

16.2 Where in human female body would the type of cell division named in **QUESTION 16.1 (b)** take place? (1)

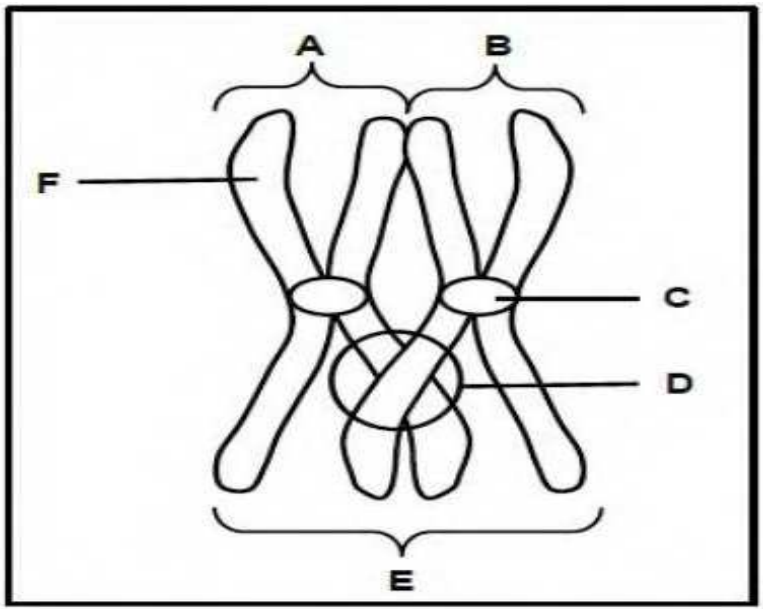
16.3 Give the LETTER and NAME of the structure that attaches to the spindle fibres (2)

16.4 How many chromosomes will be found in each daughter cell at the end of this cell division? (1)

(6)

Question 17

Study the diagram below.



17.1 Identify part:

(a) C (1)

(b) D (1)

(c) E (1)

(d) F (1)

17.2 Name TWO ways in which structure A and B are similar to one another. (2)

17.3 Describe the process that occurs at D. (5)

17.4 A certain species has 42 chromosomes in its muscle cells. Give the number of chromosomes in each:

(a) of its sperm cell (1)

(b) of its skin cells (1)

(c) ova of its female counterpart (1)

(14)

Question 18

Describe how non-disjunction may lead to Down syndrome. **(5)**

TOPIC: Genetics

Question 1

Various options are provided as possible answers to the following questions.
Choose the correct answer and write only the letter (A to D) next to the question number.

1.1 An individual is heterozygous for a harmful recessive allele but is unaffected by it.

Which ONE of the following best represents the genetic composition of this individual?

A Two dominant normal alleles
B One harmful recessive allele and one harmful dominant allele
C One harmful recessive allele and one normal dominant allele
D One harmful dominant allele and one normal recessive allele

1.2 What is the percentage chance of a woman having a female child?

A 25%
B 100%
C 50%
D 75%

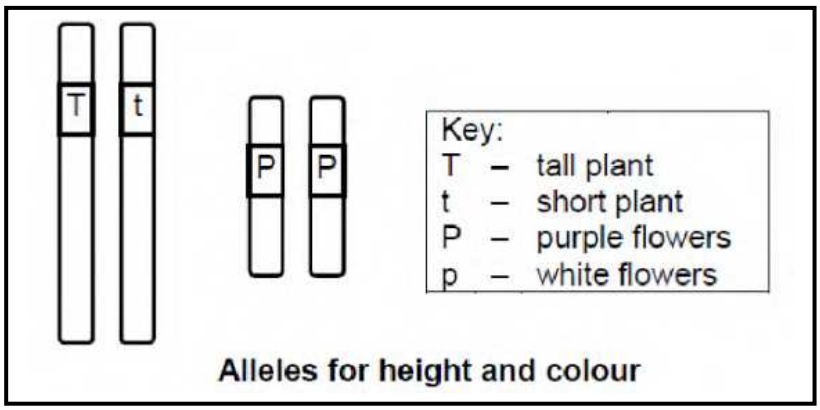
1.3 Refer to a list of Mendel's laws below:

(i) Law of dominance
(ii) Principle of independent assortment
(iii) Principle of segregation

A scientist crossed a red-eyed fruit fly with a white-eyed fruit fly and all the F1 offspring were red-eyed.
Which ONE of the following correctly represents the laws that apply to this cross?

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

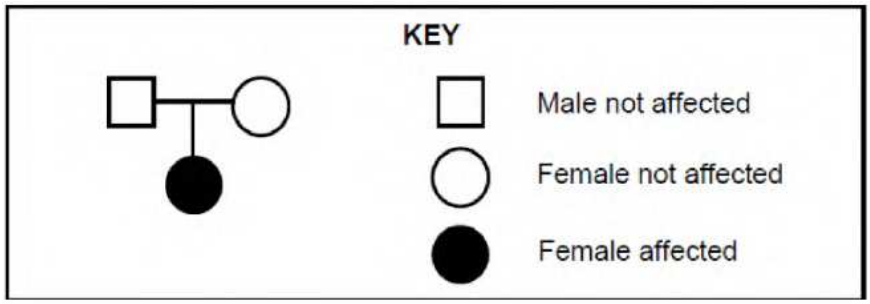
1.4 The diagram below shows the alleles for height and flower colour in a flowering plant.



The plant is ...

A A homozygous dominant for height and heterozygous for flower colour.
B B heterozygous for height and homozygous dominant for flower colour.
C C homozygous recessive for height and homozygous dominant for flower colour.
D D heterozygous for height and heterozygous for flower colour.

1.5 The diagram below shows the pattern of inheritance of a disorder.



One can conclude that the disorder is caused by a …

A recessive allele, with both parents heterozygous.
B dominant allele, with both parents heterozygous.
C recessive allele, with one parent homozygous recessive while the other is heterozygous.
D dominant allele, with one parent heterozygous while the other is homozygous recessive.

(5 x 2) **(10)**

Question 2

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

	DESCRIPTION	TERM
2.1	The study of heredity and variation in organisms	
2.2	All the genes that make up an organism	
2.3	Two or more alternative forms of a gene at the same locus	
2.4	The position of a gene on a chromosome	
2.5	The no-sex chromosomes in humans	
2.6	An inherited disorder where blood fails to clot properly	
2.7	The number, shape and arrangement of all chromosomes in the nucleus of a somatic cell	
2.8	A genetic cross involving one gene and its alleles	
2.9	A genetic disorder where blood does not clot	
2.10	The use of living organisms and their biological processes to improve the quality of human life	
2.11	The type of inheritance involving two alleles that are not dominant over one another	
2.12	Characteristics controlled by genes which are located on the sex chromosomes	
2.13	The type of inheritance involving alleles that equally determine the phenotype of heterozygous offspring	
2.14	An allele that is expressed phenotypically only in the homozygous condition	
2.15	The physical and functional expression of a gene	
2.16	The production of a genetically identical copy of an organism using biotechnology	
2.17	The manipulation of the genetic material of an organism to get desired changes	
2.18	A diagram showing the inheritance of genetic disorders over many generations	
2.19	An allele that does not influence the phenotype when found in the heterozygous condition	
2.20	Organisms having two identical alleles at a given locus	
2.21	An allele that is always expressed in the phenotype	
2.22	An individual having two non-identical alleles for a characteristic	
2.23	A segment of a chromosome that codes for a particular characteristic	
		23 x1 **(23)**

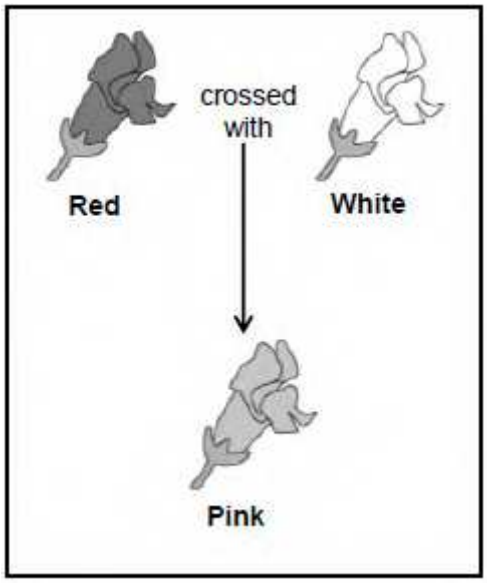
Question 3

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**
3.1	An advantage of genetic modification	A: Increases shelf life of food B: Increases resistance to disease
3.2	The genotype for an individual with blood group AB	A: I^A B: I^B
3.3	Inheritance of haemophilia	A: Sex-linked inheritance B: Complete dominance
3.4	Caused by a chromosomal mutation	A: Colour-blindness B: Down syndrome
3.5.	Unspecialised cells that have the potential to develop into any other type of cell in the body	A: Stem cells B: Somatic cells
		4x2 **(8)**

Question 4

The diagram below shows the inheritance of flower colour in snapdragon plants.
The two alleles controlling flower colour are red (R) and white (W).



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

4.2 Give a reason for your answer to **QUESTION 4.1.** (2)

4.3 A gardener crossed two pink-flowered snapdragon plants.
Use a genetic cross to show the ratio of the expected phenotypes in the offspring. (6)

(9)

Question 5

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

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

(11)

Question 6

A farmer mated a black bull with a white cow and obtained calves with a mixture of black and white coat colour (i.e. they were black with patches of white on them).

6.1 Name the type of dominance shown by these animals. (1)

6.2 Use a diagram to show how the above results were obtained. (6)

(7)

Question 7

Flower colour (purple or white) in a particular plant species is controlled by two alleles, **D** and **d**.

Four crosses were carried out to determine which allele is dominant. Forty (40) offspring were produced in each cross. The phenotypes of the parents and offspring in each cross were recorded.

The results are shown in the table below.

CROSS	PHENOTYPE		
	PARENT 1	PARENT 2	OFFSPRING
1	purple	white	40 purple
2	purple	purple	31 purple, 9 white
3	white	white	40 white
4	purple	white	21 purple, 19 white

7.1 State the dominant flower colour. (1)

7.2 Use cross 1 to explain your answer to **QUESTION 7.1.** (2)

7.3 State Mendel's Law of Segregation. (3)

7.4 Use a genetic cross to show how the crossing of two purple flowering plants can produce white offspring, as in cross **2**. (6)

(12)

Question 8

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

The table below shows the possible genotypes of the offspring.

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

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

8.2 Give the:

(a) genotype of the parents (2)

(b) number of genotypes that could result in offspring with short fingers and a continuous hairline (1)

(c) allele for a continuous hairline (1)

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

(7)

Question 9

In tomato plants, tall stems (**T**) are dominant over short stems (**t**) and red fruit (**R**) is dominant over yellow fruit (**r**).
A farmer crossed a homozygous tall, yellow tomato plant with a plant that is heterozygous for both characteristics.

9.1 Name this type of genetic cross. (1)

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

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

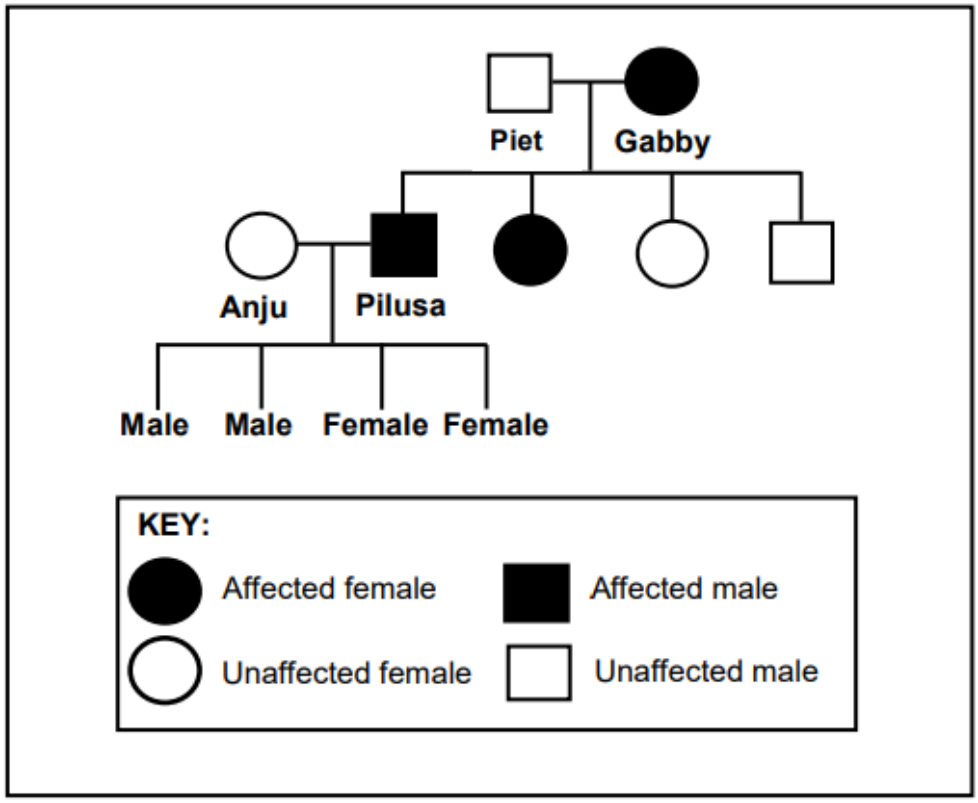
(7)

Question 10

Haemophilia is a genetic disorder caused by a recessive allele on the **X** chromosome.
A haemophiliac female marries a normal male. Explain why all their sons will be haemophiliacs **(4)**

Question 11

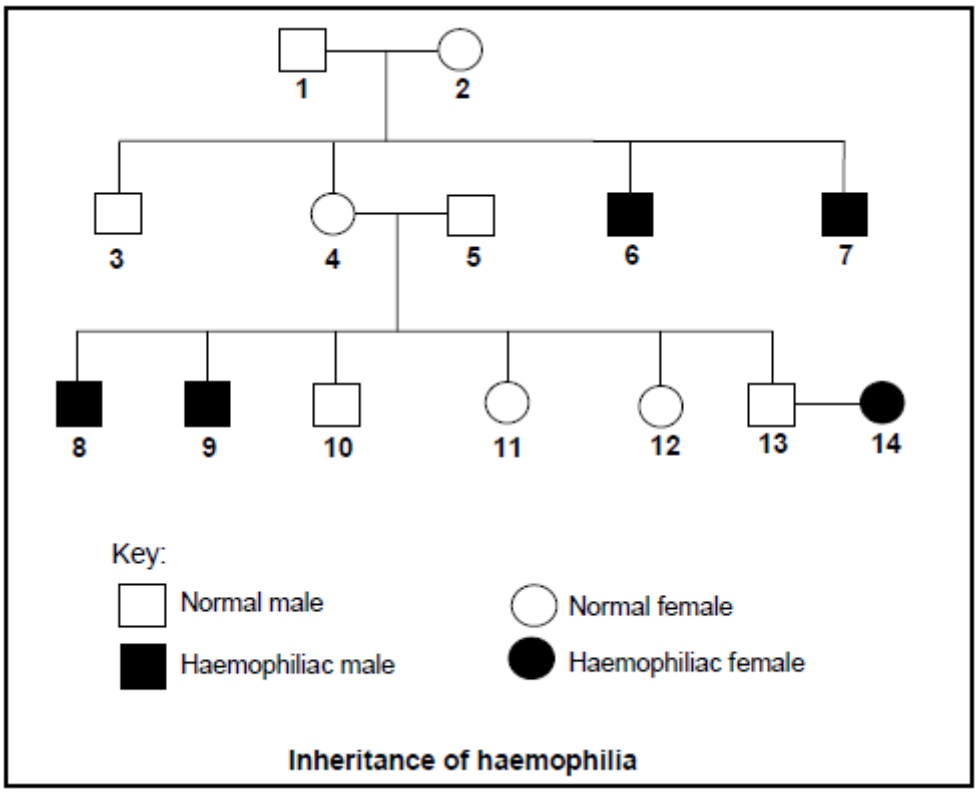
Goltz syndrome is a sex-linked genetic disorder. It is caused by a dominant allele X^G.
The diagram below shows the inheritance of Goltz syndrome in a family.



11.1 Name the type of diagram shown above. (1)
11.2 How many:
(a) females are in this family? (1)
(b) males in the F1-generation have Goltz syndrome? (1)
11.3 Give Gabby's genotype. (2)
11.4 Anju and Pilusa have four children. Give the phenotype of their sons. (2)
11.5 Explain your answer to **QUESTION 11.4**. (4)
(11)

Question 12

The pedigree diagram below shows the inheritance of haemophilia in a family. The allele causing haemophilia is represented by $\mathbf{X^h}$ and the normal allele is represented by $\mathbf{X^H}$



Inheritance of haemophilia

12.1 Determine the:

(a) phenotype of individual **4.** (1)

(b) genotype of individual **2.** (2)

12.2 Explain why females have a smaller chance of suffering from haemophilia. (3)

12.3 Represent a genetic cross to show the percentage chance of individuals **13** and **14** having a haemophiliac son. (7)

(13)

Question 13

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**

13.1 What is a gene mutation? (2)

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

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

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

(a) Suffers from sickle cell disease (1)

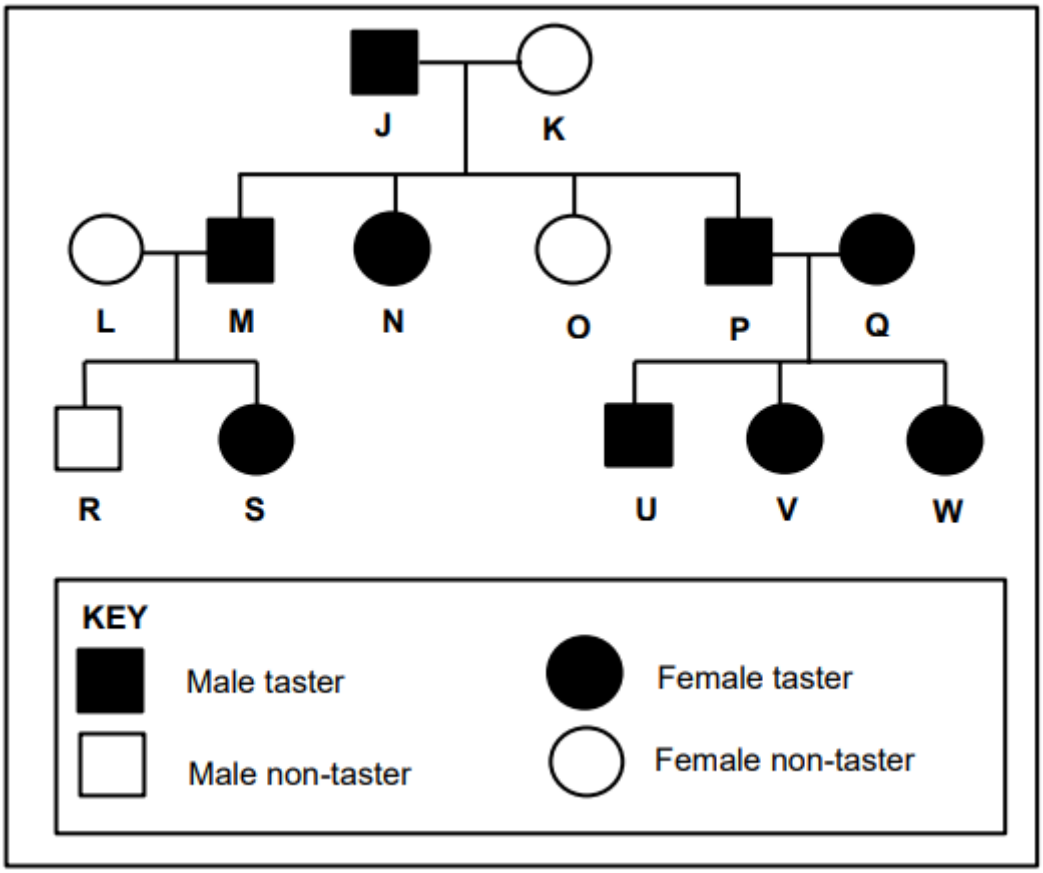
(b) Carries the allele but does not suffer from the disease (1)

(8)

Question 14

In humans, the ability to taste a certain substance is inherited and is controlled by the dominant allele **T**. People who are able to taste this substance are called tasters, while those who cannot, are called non-tasters.

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



14.1 What does the term dominant allele mean? (2)

14.2 Give the:

(a) LETTER of a female in the F1-generation who is a taster. (1)

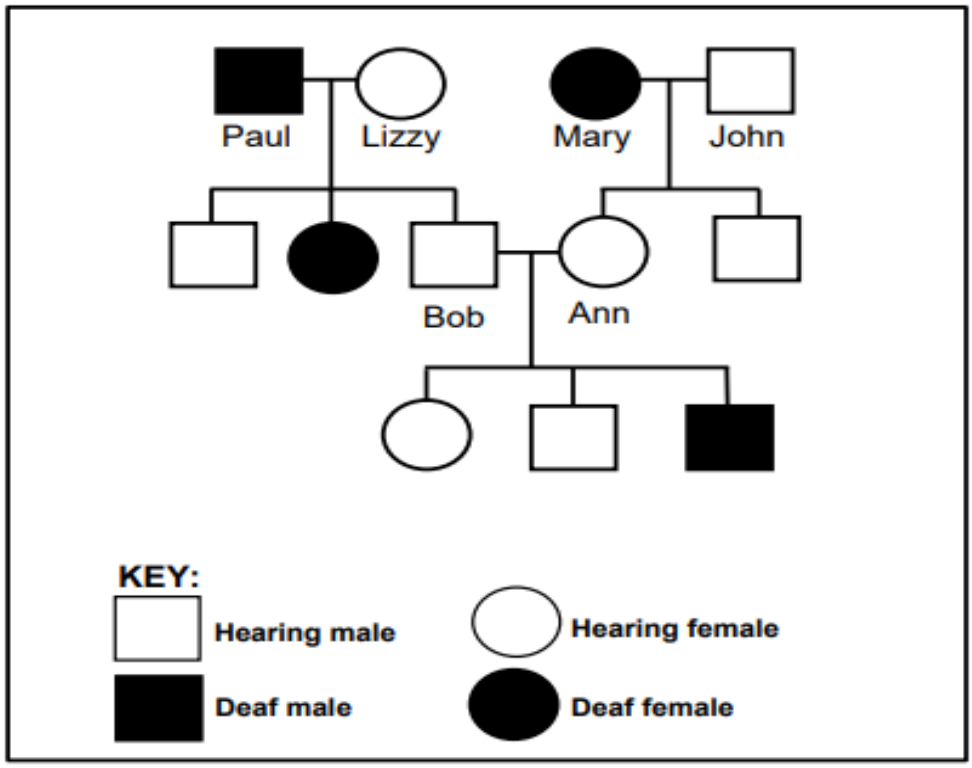
(b) genotype of individual **J.** (1)

14.3 Use evidence from the diagram to support your answer to **QUESTION 14.2 (b).** (4)

(8)

Question 15

One type of deafness in humans is carried on a single allele. The diagram below shows the inheritance of deafness in a family.



15.1 How many:

(a) generations are represented in this pedigree diagram? (1)

(b) children of Paul and Lizzy are able to hear? (1)

15.2 Which phenotype is dominant? (1)

15.3 Use the offspring of Bob and Ann to explain your answer to **QUESTION 15.2.** (4)

15.4 Use the letter **'A'** to represent the dominant allele and the letter **'a'** for the recessive allele to give ALL the possible genotypes for a hearing individual. (2)

(9)

Question 16

Read the extract below.

> Researchers have discovered that members of a particular family have high bone density that may be caused by a gene mutation. High bone density reduces the risk of bone fractures.
>
> Twenty members of the family had their bone density measured and DNA samples taken. Seven had high bone density. The high bone density occurred throughout their bodies but especially in the spine and hips.

16.1 From the extract, identify TWO areas in the body where bone density can mainly be measured. (2)

16.2 Describe what a gene mutation is. (2)

16.3 Explain why it was necessary for the researchers to collect DNA samples. (2)

16.4 State the effect of this mutation. (1)

16.5 Calculate the percentage of the family members who had normal bone density. Show ALL your workings. (3)

(10)

Question 17

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

17.1 How many:

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

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

17.2 Give the genotype of the father. (2)

17.3 Which member of the family:

(a) has the genotype ii? (1)

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

(c) is adopted? (1)

(7)

Question 18

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**).

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

18.2 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)

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

18.4 State TWO benefits of cloning. (2)
(8)

Question 19

Human blood groups are controlled by multiple alleles.

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

19.2 How many of the alleles named in **QUESTION 19.1** can any individual inherit? (1)

19.3 Give a reason for your answer to **QUESTION 19.2.** (2)

19.4 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 20

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**.

20.1 Give the possible genotypes of:
(a) Mrs. Phonela (2)
(b) the baby girl (1)

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

20.3 Explain why the use of blood type for paternity testing is not conclusive. (2)
(8)

Question 21

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

21.1 How many alleles control the inheritance of blood groups? (1)
21.2 Describe the type of dominance that occurs in the inheritance of blood group **B** in the woman. (3)
21.3 Use a genetic cross to show all the possible genotypes and phenotypes of their children. (6)
(10)

Question 22

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

TOPIC: Evolution

Question 1

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number.

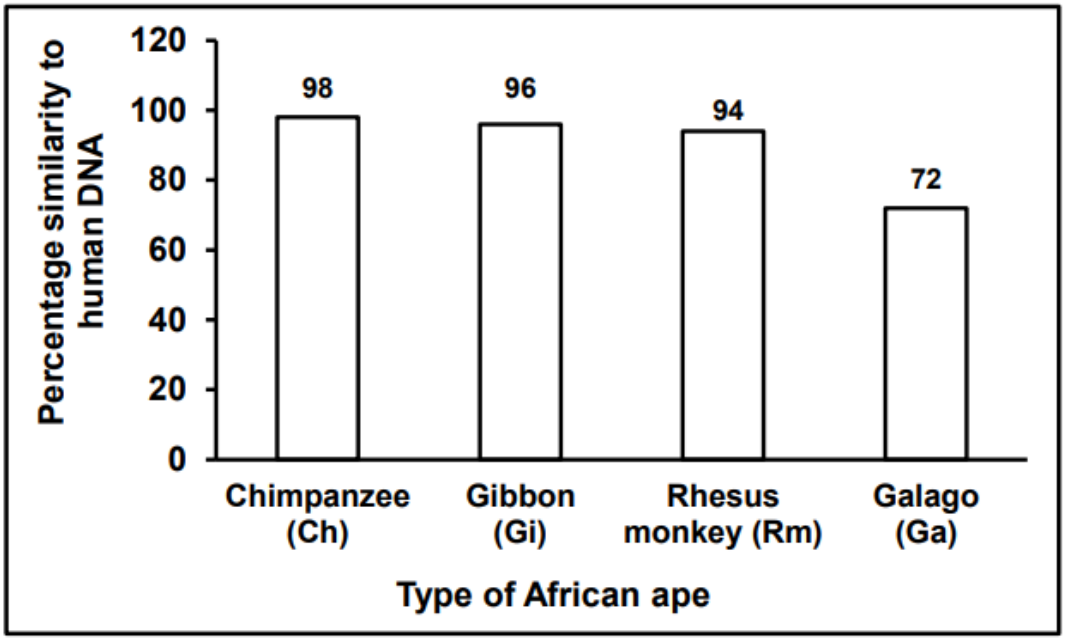
1.1 African apes and humans are similar. Both have….

A Small jaws and well-developed brow ridges
B Opposable thumbs and bare fingertips
C Gaps between their teeth and eyes in front
D An upright posture and a cranial ridge

1.2 Variation within a species is introduced through…

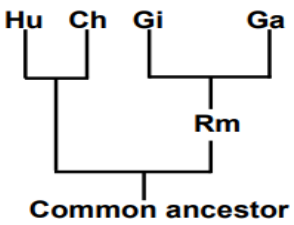
A Random mating and asexual reproduction
B Mitosis and random fertilisation
C Random mating and random fertilisation
D Mitosis and meiosis

1.3 The graph below shows the percentage similarity between human (Hu) DNA and the DNA of some species of African apes.

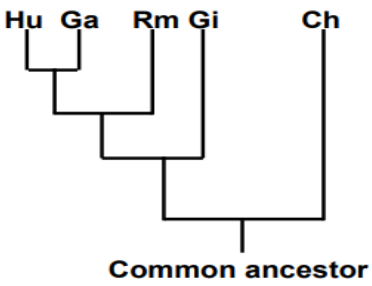


Which ONE of the following phylogenetic trees best represents the information in the graph?

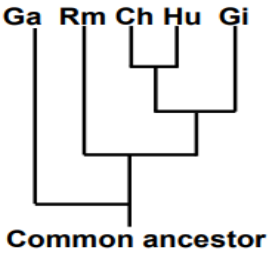
A



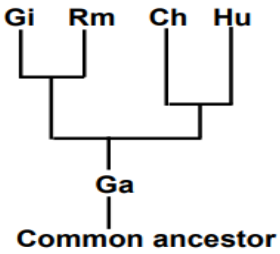
B



C



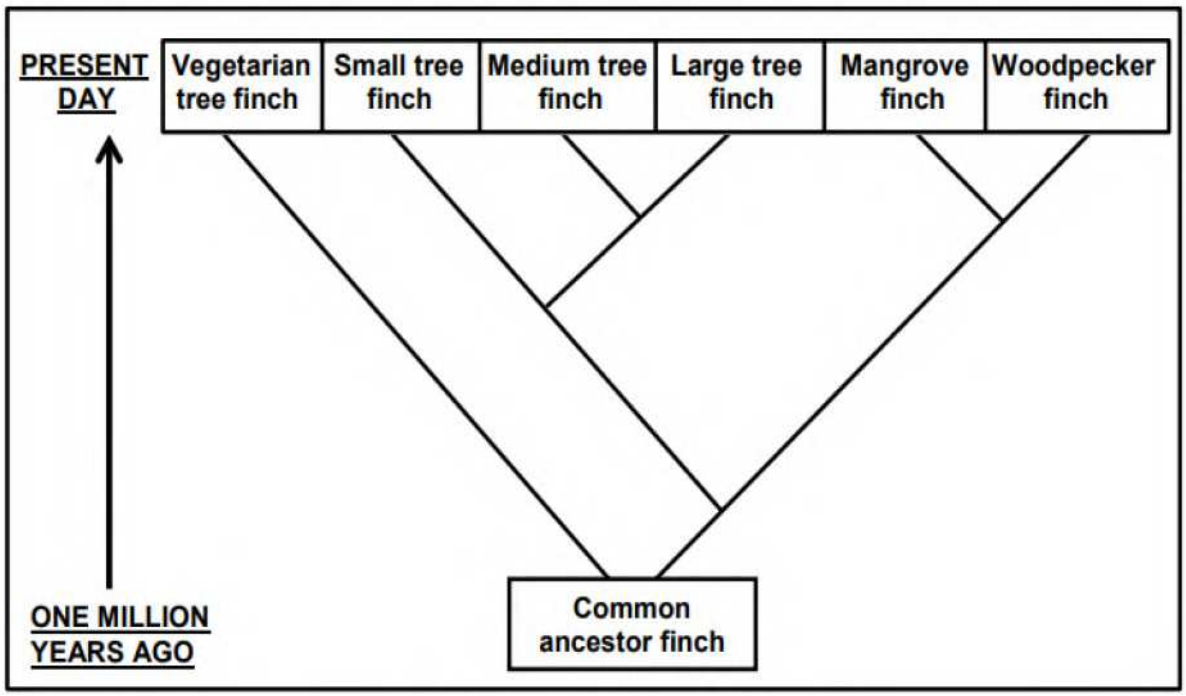
D



1.4 Who formulated the law of use and disuse?

A Lee Berger
B Rosalind Franklin
C Gregor Mendel
D Jean Baptiste de Lamarck

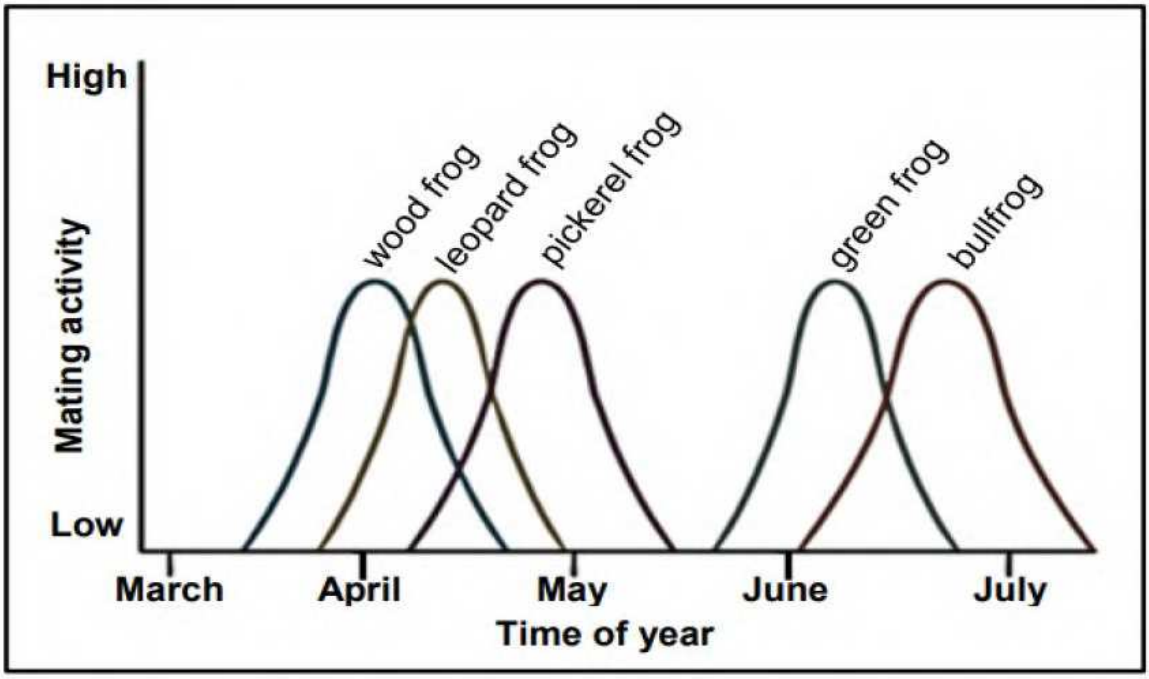
1.5 Study the diagram below



Which present day finch is LEAST related to all others?

A Woodpecker finch
B Large tree finch
C Mangrove finch
D Vegeterian tree finch

1.6 Different frogs, which all belong to the genus *Lithobates*, are found in the same forest. The graph below shows their mating activity



Based on the information, what kind of isolation mechanism is most likely keeping the bullfrog and wood frog as separate species?

A Geographic isolation through the presence of geographic barriers
B Reproductive isolation through species-specific courtship behaviour
C Reproductive isolation through breeding at different times of the year
D Reproductive isolation through the production of infertile offspring

(6 x 2) **(12)**

Question 2

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

	DESCRIPTION	**TERM**
2.1	A type of variation where there is a range of phenotype for the same characteristics	
2.2	Present day distribution of living organisms	
2.3	The selection of desirable characteristics by humans	
2.4	The process whereby new species are formed	

2.5	The type of variation in a population with no intermediate phenotype	
2.6	An explanation describing evolution as consisting of long phases of little change alternating with short phases of rapid change	
2.7	The permanent disappearance of species from earth	
2.8	An explanation for something that has been observed in nature and which can be supported by facts, laws and tested hypothesis	
2.9	Organisms with similar characteristics, able to interbreed randomly and produce fertile offspring	
2.10	Structured in different organism that have similar basic plan which suggest that they share common ancestor	
2.11	The process that enable organisms with desirable characteristics to survive and reproduce in that particular environment	
2.13	Remains of life forms preserved in rocks, ice and dried sap trees	
2.14	Change in the characteristics of species over time	
2.15	Large, pointed teeth in African apes that are used for tearing food	
2.16	The part of the skull that houses the brain	
2.17	Having a protruding jaw	
2.18	A diagrammatic representation showing possible evolutionary relationships between different species	
2.19	The opening in the base of the skull through which the spinal cord passes	
2.20	Family to which humans belong	
2.21	An upright posture and walking only on two legs	
2.22	The type of vision shared by apes and humans that allows for depth perception	
2.23	The act of walking on all four limbs	
	(23 x 1)	**(23)**

Question 3

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**
3.1	A group of similar organisms that occurs in a particular place at a particular time with the ability to interbreed	A: Population B: Species
3.2	The manipulation of biological processes to satisfy human needs	A: Biogeography B: Biotechnology
3.3	Fossils found in South Africa	A: Little Foot B: Taung Child
3.4	Long and narrow pelvis	A: African apes B: Humans
3.5	Mechanisms of reproductive isolation	A: Species-specific courtship behaviour B: Breeding at different times of the year
3.6	Fossil evidence found in Ethiopia	A: *Ardipithecus ramidus* B: *Australopithecus africanus*

(6 x 2) **(12)**

Question 4

Scientists compare the number of differences in the amino acid sequence to see how closely related species are. Fewer differences in the amino acid sequence mean the species are more closely related.

Cytochrome C is a protein that occurs in many species. The amino acid sequence of this protein differs between species.

The table below shows the number of differences in the amino acid sequences of three species, **A**, **B** and **C**.

	SPECIES B	**SPECIES C**
SPECIES A	**11**	**3**
SPECIES B		**10**

4.1 What type of evidence for evolution is being used in this table? (1)

4.2 Give the LETTER of the species, **A**, **B** and **C**, that should appear at positions 1, 2 and 3 in the diagram below. (3)

(4)

Question 5

The fat content of cow's milk may vary between 2,6% and 5%. A farmer has found that there is a high demand for low-fat milk (milk with a content of 3% or less). He determined the fat content in the milk produced by the cows on his farm.

The results of his survey are given in the table below.

FAT CONTENT (%)	**NUMBER OF COWS**
2,6 – 3,0	11
3,1 – 3,5	66
3,6 – 4,0	93
4,1 – 4,5	61
4,6 – 5,0	15

5.1 Draw a histogram to represent the results of the survey. (6)

5.2 Calculate the percentage of the farmer's cows that produce low-fat milk. Show All your working. (3)

5.3 State the type of variation that occurs in the cows, based on the evidence in the table. (1)

5.4 Give an explanation, for your answer to **QUESTION 5.3.** (1)

(11)

Question 6

Read the extract below:

MUTATION IN GENE ALLOWS TIBETANS TO SURVIVE AT HIGH ALTITUDE

It is possible to cope with the low oxygen content at high altitudes

One way is for the body to produce more red blood cells in response to an increase in altitude.

Another way of coping has developed in Tibetans as a result of a gene mutation that they inherited from their ancestors. The mutant gene helps them to use the low amount of oxygen present more efficiently. The mutant gene was found in 87% if the Tibetan population but only in 9% of the Han population that live at a lower altitude the Tibetans.

A gene mutation caused variation between the Tibetan population and the Han population.

6.1 Name THEE other sources of variation in a human population. (3)

6.2 Give evidence in the extract which suggests that the survival of people living at high altitudes could be:

(a) due to a genetically inherited trait. (1)

(b) caused by an environment factor. (1)

6.3 Explain the advantages of producing more red blood cells. (2)

6.4 Describe how Lamark would have explained the survival of Tibetans at high altitudes (5)

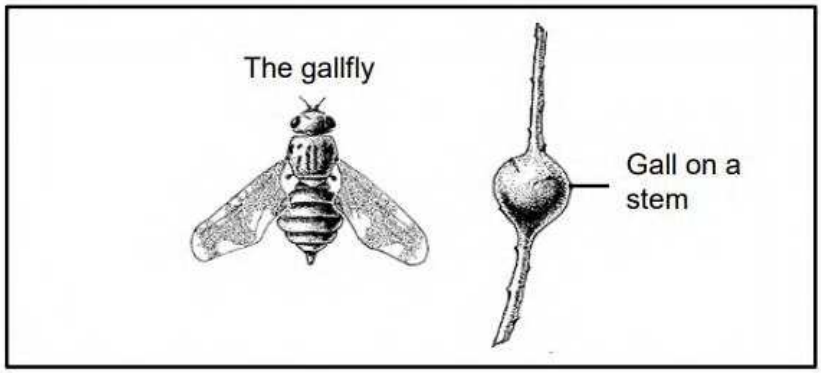
(12)

Question 7

Female gallflies lay eggs on the stems of plants. The eggs hatch to form larvae that secrete a substance into the plant tissue. The secretions cause the plant cells to grow and form ball-like structures, called galls, which are high in nutrients. Predatory birds feed on the larvae called galls.

The size of the galls produced actually depends on genetic variation in the gallfly.

The diagram bellow shows the gallfly and a gall on a plant stem.



Scientists wanted to investigate whether the size of the galls had an effect on the percentage of the gallfly killed by predatory birds.

The table below shows the results of their investigation.

Gall size (mm)	Gallfly larvae killed by predatory birds (%)
10	1
15	0
20	1
25	2
30	10

7.1 State the:
(a) independent variable (1)
(b) dependent variable (1)
7.2 Give ONE advantage of the gall to the gallfly larvae. (1)
7.3 State why the size of the galls produced is an example of continuous variation (1)
7.4 Explain how the percentage of gallfly larvae killed by predatory birds is influenced by the size of the gall. (3)
7.5 Draw a line graph to represent the information in the table. (6)
(13)

Question 8

Describe the process of natural selection **(7)**

Question 9

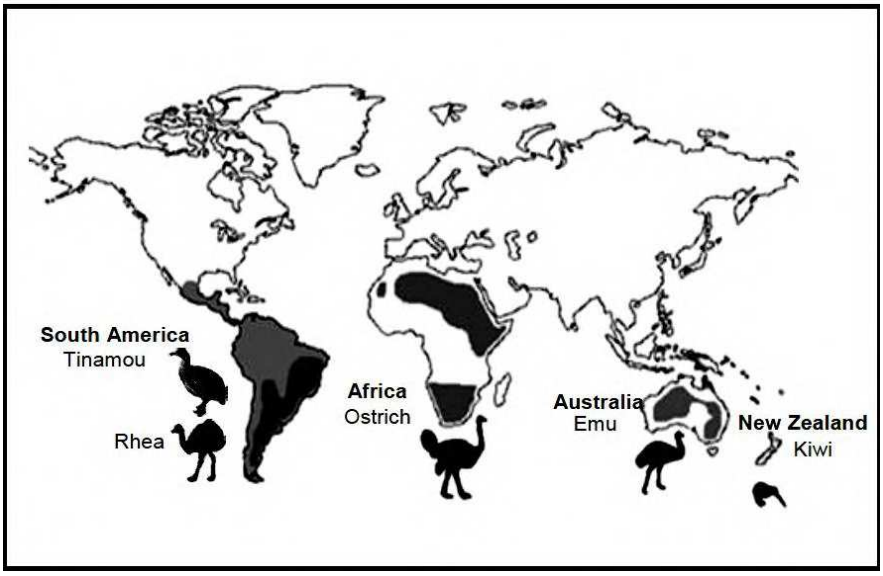
Explain why modern day Spider monkeys all have long tails whereas ancestors of Spider monkeys had much shorter tails using:
9.1 Lamarck's theory (6)
9.2 Darwin's theory (8)
(14)

Question 10

Tabulate Three differences between Lamarckism and Darwinism **(7)**

Question 11

Flightless bird species that are currently distributed across different continents are shown in the picture below



Scientists hypothesize that these species of flightless birds arose from a single common ancestor that was able to fly.

11.1 Describe how Lamarck would have explained the evolution of flightless birds (4)

11.2 Name THREE reproductive isolation mechanisms that keep species separate (3)

(7)

Question 12

Male long-tailed widowbirds have extremely long tail feathers that they use in mating to attract females.

Scientist conducted, an investigation to determine the relationship between the length of the male long-tailed widowbird's tail and its mating success.

The procedure was as follows:

- A total of 27 male long-tailed widowbirds was sampled and divided into 3 groups
- The tail feathers of the birds in each group were treated in the following way:
  - Group 1 – Cut short
  - Group 2 – Made longer by adding artificial feathers
  - Group 3 – Left unchanged

- The 3 groups of male long-tailed widowbirds, along with female long-tailed widowbirds, were released into an environment suitable for mating.
- Each time a pair mated successfully they produced a nest, and all the nests were counted.
- The average number of nests produced by each group was calculated and used as an indication of mating success.

The results are shown in the table below.

GROUP	AVERAGE NUMBER OF NESTS PRODUCED
1	0,5
2	2,5
3	1

12.1 Name the:

(a) reproductive isolating mechanism that occurs in long-tailed widowbirds. (1)

(b) independent variable in this investigation. (1)

12.2 Explain why 27 long-tailed widowbirds were used in the investigation instead of only 3. (2)

12.3 Explain why Group 3 was included in the investigation (2)

12.4 Draw a bar graph to represent the results of this investigation (6)

12.5 State a conclusion for this investigation (2)

(14)

Question 13

A group of students observed that the mating calls of a population of frogs at the local dam has recently become much louder. The dam is close to a highway where traffic noise has increased over the years

They wanted to investigate if the increase in the increase in traffic noise from the highway had an evolutionary effect on the loudness of the frogs mating calls in the mating season.

They recorded the following:

- Average level of traffic noise over a period of 6 years.
- Average loudness of the frogs mating calls during the same period

The results are shown in the table below

YEAR	AVERAGE LOUDENESS OF TRAFFIC NOISE (bD)	AVERAGE LOUDNESS OF MATING CALLS (dB)
2006	30	36
2007	32	38
2008	36	40
2009	40	48
2010	55	68
2011	62	74

13.1 Explain the advantages of a louder mating calls. (2)
13.2 State why these results may be considered to be reliable. (1)
13.3 State a conclusion for this investigation. (2)
13.4 Give TWO variables that should be kept constant in this investigation (2)
13.5 Draw line graphs on the same set of axes to show the change in average loudness of traffic noise and mating calls for the period 2006 to 2009 (7)
(14)

Question 14

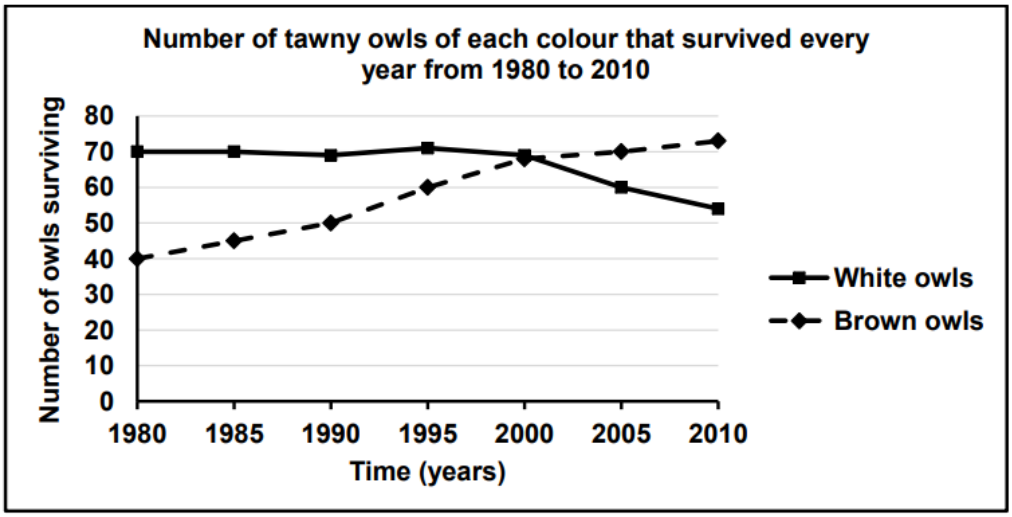
There is variation in tawny owls. Some are white and others are brown in colour.

Scientists studied these owls over a period of 30 years, from 1980 to 2010, to determine the effect of climate change caused increasing global temperatures with less snow each year.

The scientists:

- Conducted the investigation over the same four months of winter each year
- Observed the same population of tawny owls each year.
- Determine the number of tawny owls of each colour that survived every year

The results are shown in the graph below:



14.1 Identify the dependent variable in this investigation. (1)
14.2 What conclusion can be made about the suitability of each colour owl to

survive in more snow? (2)

14.3 Explain the results obtained from 2000 to 2010 for the white owls (3)

14.4 Describe how the scientists determined the number of owls that survived each year (3)

14.5 Name ONE variable that was kept the same. (1)

(10)

Question 15

A population of lizard on an island, Island **A**, were well suited to feed mainly on insects. Scientists moved five adult pairs of this pairs of this lizard species to a neighbouring island, Island **B**. Here they reproduced and a new population formed. Island **B** has a large supply of plants with tough fibrous leaves and fewer insects. Exposure to this new environment may have caused the lizards to undergo evolution.

Thirty-six years later, scientists returned to Island **B** to conduct further investigations on the lizard population there. They observed that the jaw size of the lizards had increased. Scientists also analysed the stomach content of the lizards and found that it was mainly plant-based. They also confirmed that the two populations still belong to the same species.

15.1 Describe how the scientists could confirm that there was a change in jaw size between the lizards of Island **A** and the lizards of Island **B**. (3)

15.2 Explain how the larger jaws of lizards on Island **B** would be structurally suited to eat tough fibrous leaves. (3)

15.3 How did the scientists determine that the two populations of lizards on both islands still belong to the same species? (2)

15.4 Explain the possible effect that the evolution of the lizards has on biodiversity. (2)

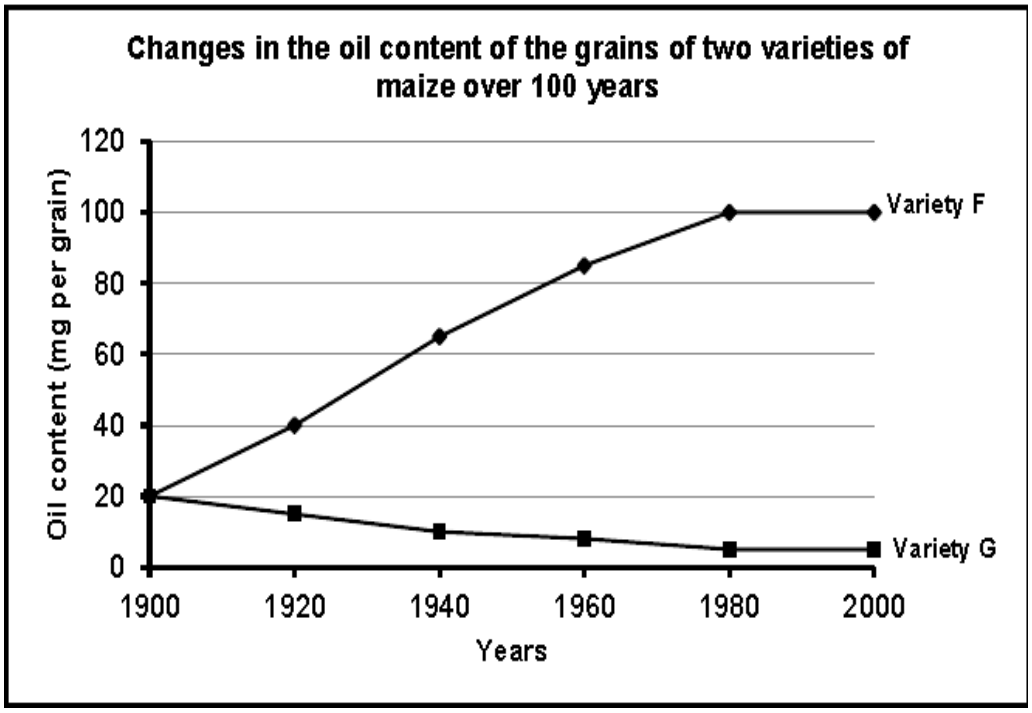
15.5 Use Darwin's theory of natural selection to explain the evolution of lizards with larger jaws. (7)

(17)

Question 16

Artificial selection programme have produced two varieties of maize. One has grains with a high oil content (Variety F) and the other has grains with a low oil content (variety G)

The graph below shows the changes in the oil content of the grains of the two varieties over 100 years of artificial selection.



16.1 In which year did the two maize varieties have the same oil content? (1)

16.2 Calculate the percentage increase in the oil content of Variety F over the 100-year period. Show ALL working. (3)

16.3 Tabulate TWO differences between natural selection and artificial selection. (5)

(9)

Question 17

Read the extract below.

> The red-bellied black snake (*Pseudechis porphyriachus*) and the green tree snake (*Denderelaphis punctualatus*) are predators that sometimes feed on can toads (*Bufo mannus*) that contain a toxin that may kill them.
>
> The snakes consume the loads by swallowing them whole. A decrease in the average jaw size has been observed over a period of 70 years. Some scientists believe that this may be an example of punctuated equilibrium. With this change it was also noted that the snakes could no longer swallow the large cane toads. This has resulted in an increase in the survival of the snakes

17.1 Define *punctuated equilibrium*. (3)
17.2 What characteristic of the toad species protects it from predation? (1)
17.3 Explain how the change in jaw size helped the snakes to survive. (3)
17.4 How would the Lamarck have explained the development of small jaw size in the snakes? (4)
(11)

Question 18

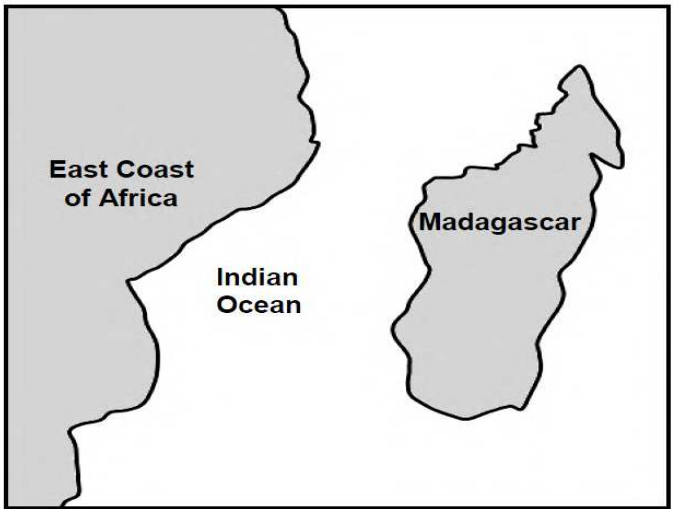
Describe speciation through geographical isolation **(6)**

Question 19

Pottos and lemurs are small mammals.

Scientists believe that pottos and lemurs share a common ancestor that existed in Africa. Presently pottos only occur in Africa while lemurs are only found in Madagascar.

Madagascar is an island off the East of Africa as shown in the diagram below.



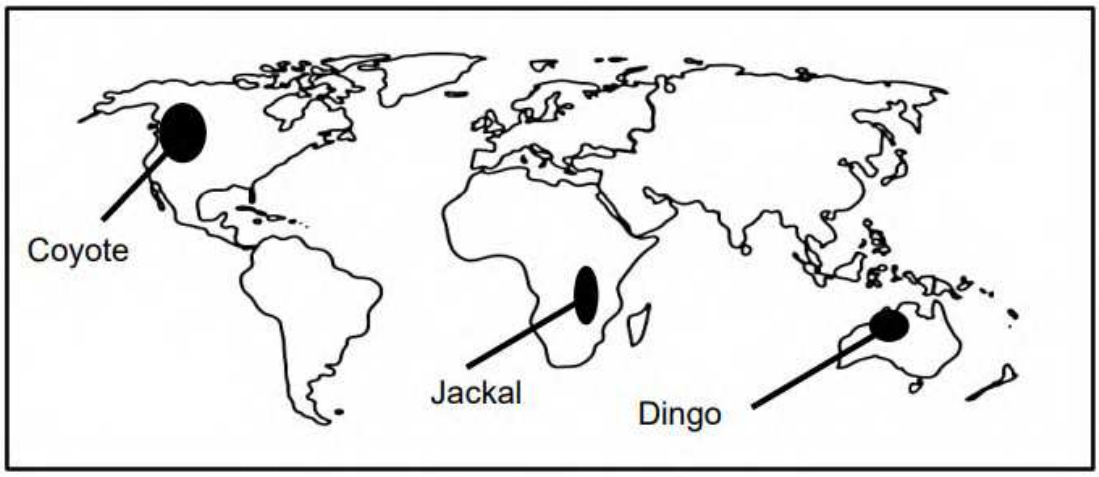
19.1 Explain how continental drift could have affected the distribution of the common ancestor (4)

19.2 Describe the speciation of the pottos and lemurs to become different (6)

(10)

Question 20

The present –day distribution of three closely related species of the dog family, the coyote , jackal and dingo , is shown on the world map below.



20.1 What type of evidence for evolution is represented here? (1)

20.2 What is a biological species? (3)

20.3 Describe how these three species could have evolved from a common ancestor (7)

(11)

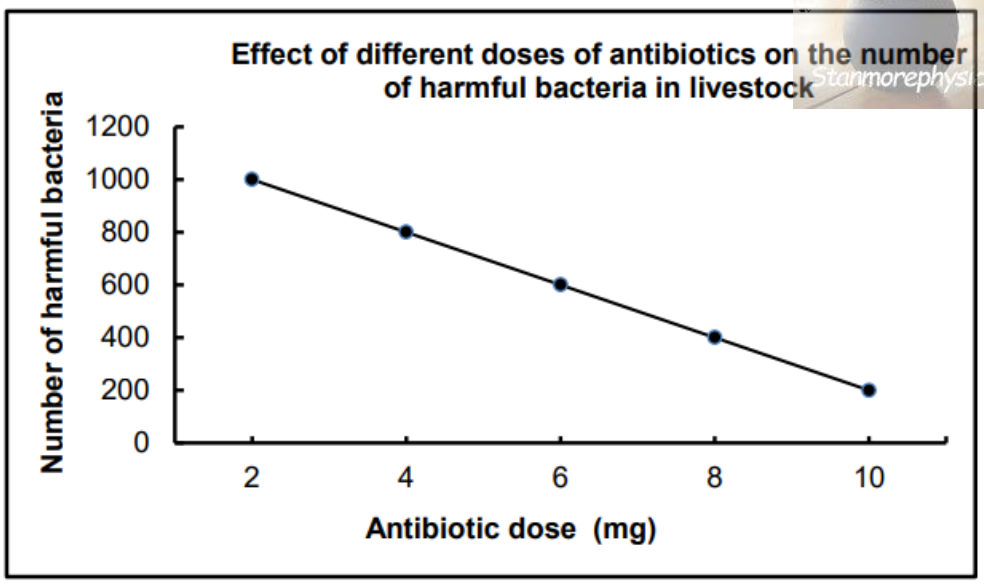
Question 21

Use ONE example to describe the role of mutations in evolution in present times. **(8)**

Question 22

Some farmers add low doses of antibiotics to the feed for cattle. The use of antibiotics in cattle feed could result in the evolution of antibiotics-resistant bacteria.

The graph below shows the effect of different doses of antibiotics on the number of harmful bacteria in the cattle.



22.1 Use evidence from the graph to explain why higher doses of antibiotics will benefit the farmer economically. (4)

22.2 Explain how the use of antibiotics in animal feed may result in the evolution of antibiotic resistant bacteria. (6)

(10)

Question 23

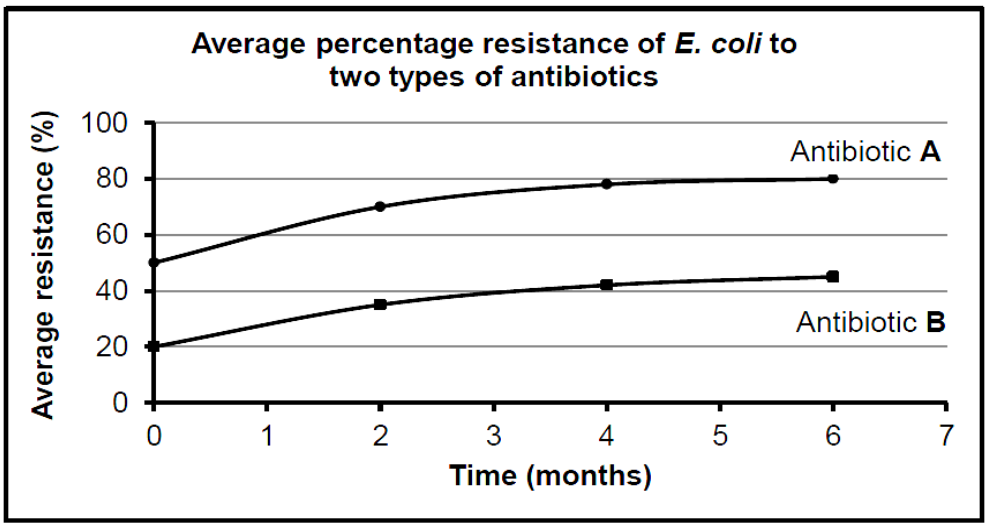
The E. coli bacterium lives in the intestines of pigs where they reproduce rapidly. Certain strains of E coli cause diarrhoea in young pigs (piglets)

Scientists carried out an investigation using 100 piglets to determine the resistance of E. coli to two antibiotics, **A** and **B**.

The scientists

- Injected the piglets with antibiotic **A** and antibiotic **B**
- Took a sample of E.coli from the intestines of each piglet a week later and placed them in a separate petri dishes.
- Allowed the bacteria to grow for 24 hours
- Added antibiotic **A** to one petri dish and antibiotic **B** to the other petri dish
- Measured the growth of the bacteria in each petri dish after 24 hours.
- Used growth measurement as an indication of the resistance of the bacteria to each antibiotic
- Repeated the process over a period of six months
- Calculated the average percentage resistance to both antibiotics

The results are shown in the graph below



23.1 Identify the independent variable in this investigation. (1)

23.2 Identify TWO factors that should be kept constant during the investigation. (2)

23.3 State TWO ways in which the scientist ensured the reliability of the investigation. (2)

23.4 Which antibiotic will you recommend for controlling E. coli in piglets? (1)

23.5 Support your answer to **QUESTION 23.4** using the evidence in the graph. (2)

23.6 Explain the results that are shown in the graph for antibiotic A in terms of natural selection. (5)
(13)

Question 24

Weeds are problematic to farmers because they invade farm fields and outcompete crop plants for space. This reduces the crop yield.

Farmers spray their fields with chemicals known as herbicides to kill the weeds. Some weeds however have evolved to be resistant to herbicides.

Scientists investigated the time it took for a species of weed to develop resistance to five types of herbicides. The results are shown in the table below

TYPES OF HERBICIDE	TIME TAKEN FOR WEEDS TO DEVELOP RESISTANCE (YEARS)
2,4-D	9
Dalapon	9
Picloran	25
Dicloflop	7
Trifluralin	26

24.1 Refer to the passage above and state how weeds act to reduce crop yield. (1)

24.2 Identify the:
(a) Independent variable (1)
(b) Dependent variable (1)

24.3 Name the herbicide:
(a) To which the weeds developed resistance the fastest (1)
(b) That remained effective for the longest period of time (1)

24.4 The scientists used the same weed species when investigating resistance to the different herbicides.

(a) Describe how the scientists would have determined the resistance of the weeds to the herbicides. (2)
(b) Explain how the use of the same weed species improved the validity of the investigation. (2)

24.5 Draw a bar graph to show the time taken for the evolution of resistance to the herbicides. (6)

(15)

Question 25

There are anatomical differences between African apes and humans. There are also characteristics that they share.

25.1 Name ONE characteristics of the hand that African apes share with humans. (1)

25.2 Tabulate THREE differences between the skulls of African apes and humans. (7)

25.3 Give TWO characteristics of the pelvis of a bipedal organism. (2)

(10)

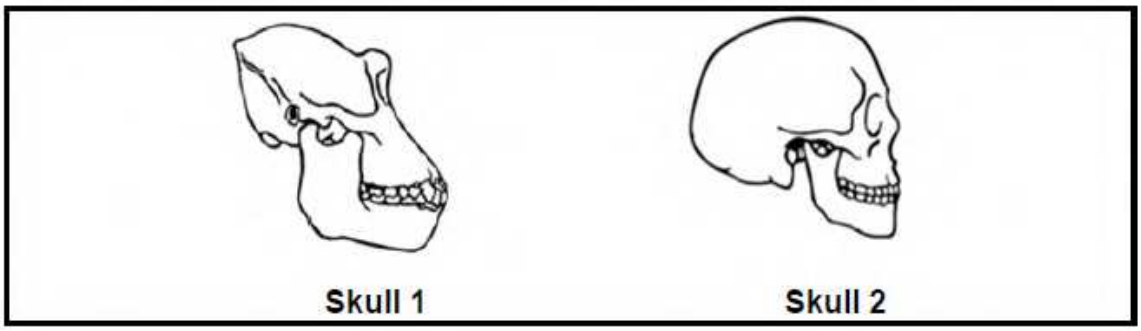
Question 26

Humans are bipedal organisms.

26.1 What is meant by bipedalism? (2)
26.2 Explain how each of the following skeletal structures have contributed to bipedalism in humans:
(a) Foramen magnum (2)
(b) Pelvic girdle (2)
(c) spine (2)
(8)

Question 27

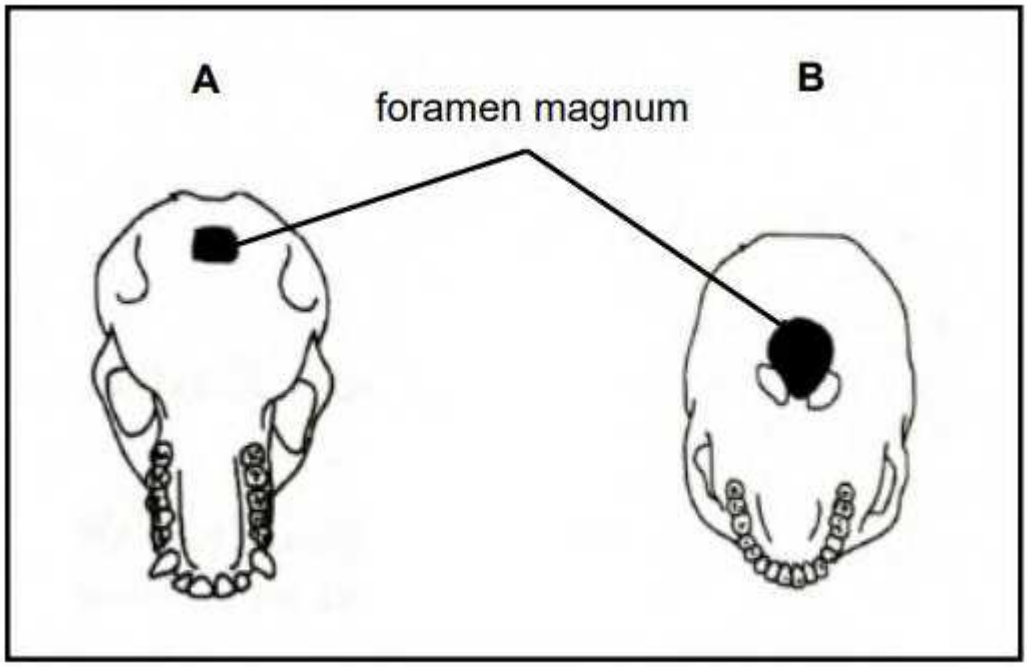
The diagrams below show the skulls of two species of primates



27.1 Tabulate THREE observable differences between skull **1** and skull **2** that show trends in human evolution. (7)
27.2 Give FOUR characteristics of the upper limbs that humans share with other primates (4)
27.3 Explain how an increase in cranial volume is related to intelligence (3
(14)

Question 28

Diagram A and B show the ventral (bottom)view of the skulls of two organisms. The diagrams are NOT drawn to scale.



28.1 Which diagram represents the skull of a bipedal organism? (1)

28.2 Give ONE visible reason for your answer to **QUESTION 6.1.** (2)

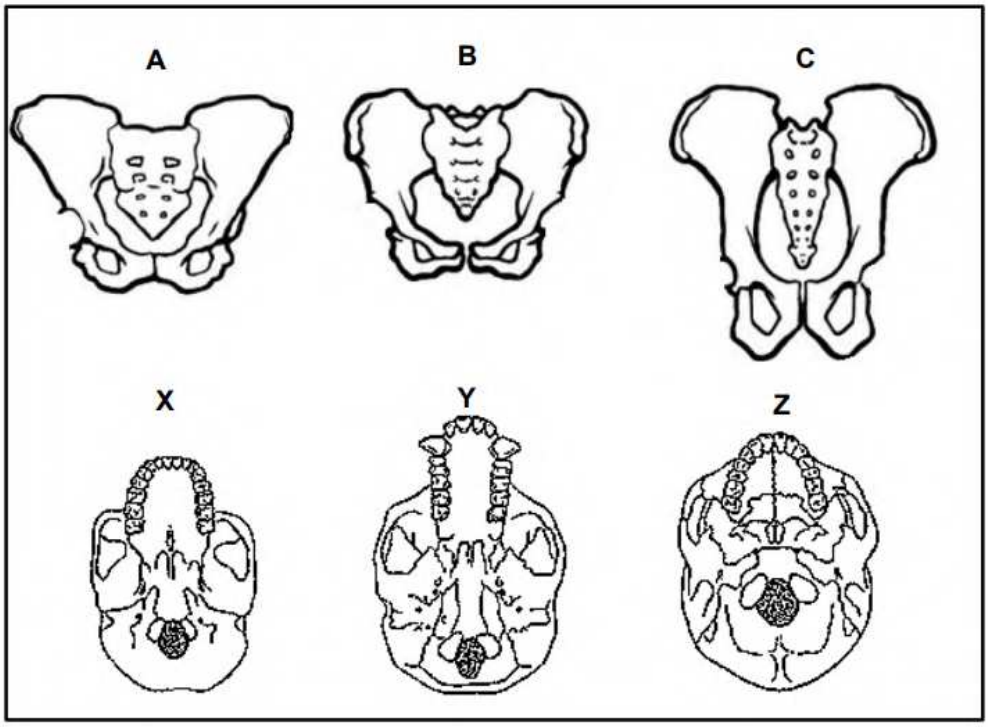
28.3 Tabulate TWO visible differences between the upper jaws in the diagrams **A** and **B** that represents trends in human evolution. (5)

28.4 Explain the significance of the shape of the spine that is associated with the skull in diagram **B.** (2)

(10)

Question 29

The diagram below represents the pelvic structure and the ventral view of the skulls of three organisms. The diagrams are drawn to scale.



29.1 Write down the LETTER(S) if the diagram(s) that represent the:
(a) Skulls of bipedal organisms (2)
(b) Pelvic structure of a quadrupedal organism. (1)

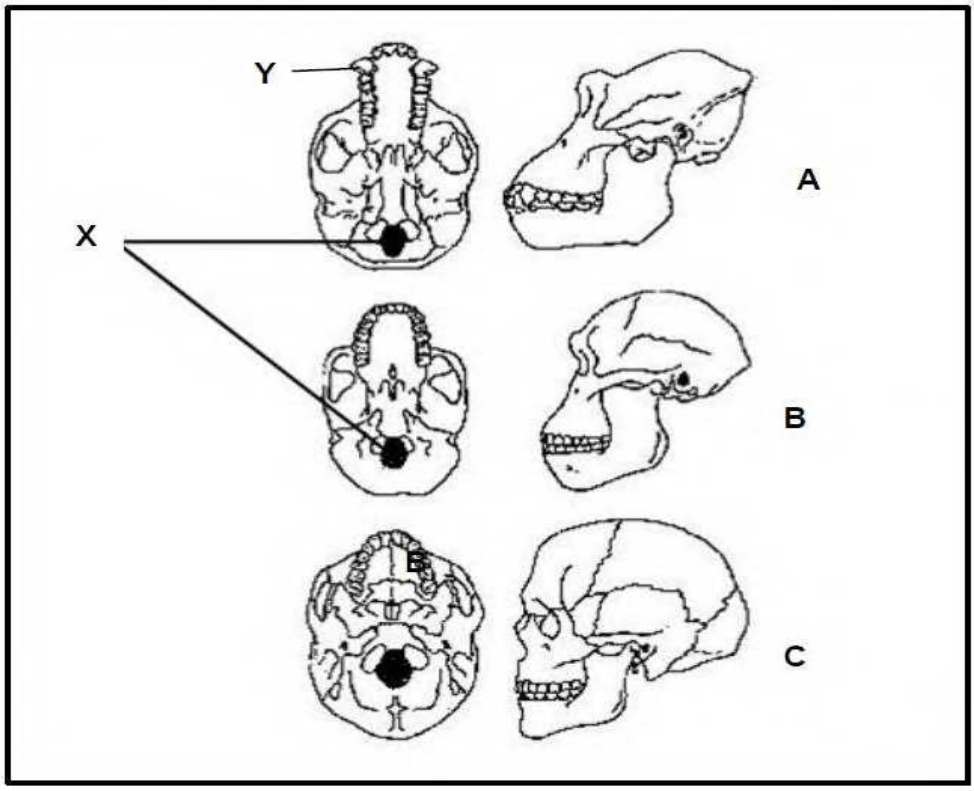
29.2 Give a reason for your answer to **QUESTION 29.1(b).** (2)

29.3 Describe ONE other structural differences between a bipedal and a quadrupedal organism. (3)

(8)

Question 30

The diagram below represents the fossilised skulls of three different species of primates. They were either bipedal or quadrupedal (organisms that habitually walk on all four limbs)



30.1 Label part **X** and the type of teeth at **Y.** (2)

30.2 Explain the significance of the location of structure **X** in organism **C.** (3)

30.3 Which of the skulls (**A,B** or **C**)belong to:

(a) An *Australopithecine* (1)

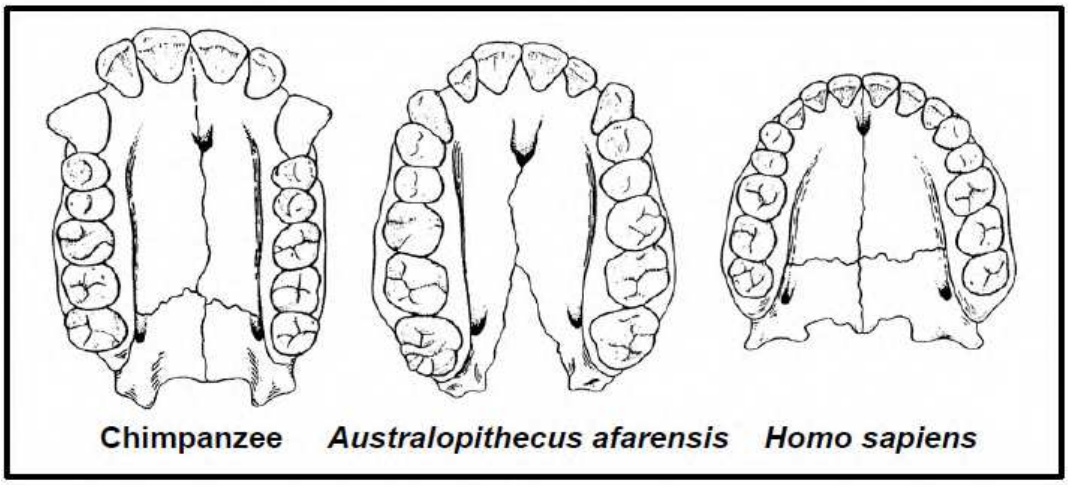
(b) A quadrupedal primate (1)

30.4 Explain how the change in the skull from B to C could indicate a change in intelligence. (3)

(10)

Question 31

The diagrams below show the upper jaws of some fossils. These diagrams are draw to scale



31.1 Describe ONE visible difference between the jaw of a chimpanzee and that of *Homo sapiens* which show trends in human evolution. (2)

31.2 Based on the differences in dentition, what conclusion can be made about the change in diet from *Australopithecus afarensis* to *Homo sapiens*? (2)

31.3 *Australopithecus* may be described as a transitional species between the chimpanzee *and Homo sapiens.*

(a) Define a transitional species. (1)

(b) Use ONE visible feature of the jaw to explain why *A. afarensis* may be described as a transitional species. (2)

(7)

Question 32

32.1 Describe the structural changes that characterize the evolution of modern humans from their ape-like ancestors in the following parts:

(a) Foramen magnum (2)

(b) Cranium (2)

32.2 Explain the significance of the structural changes to the parts mentioned in **QUESTION 32.1** above. (4)

(8)

Question 33

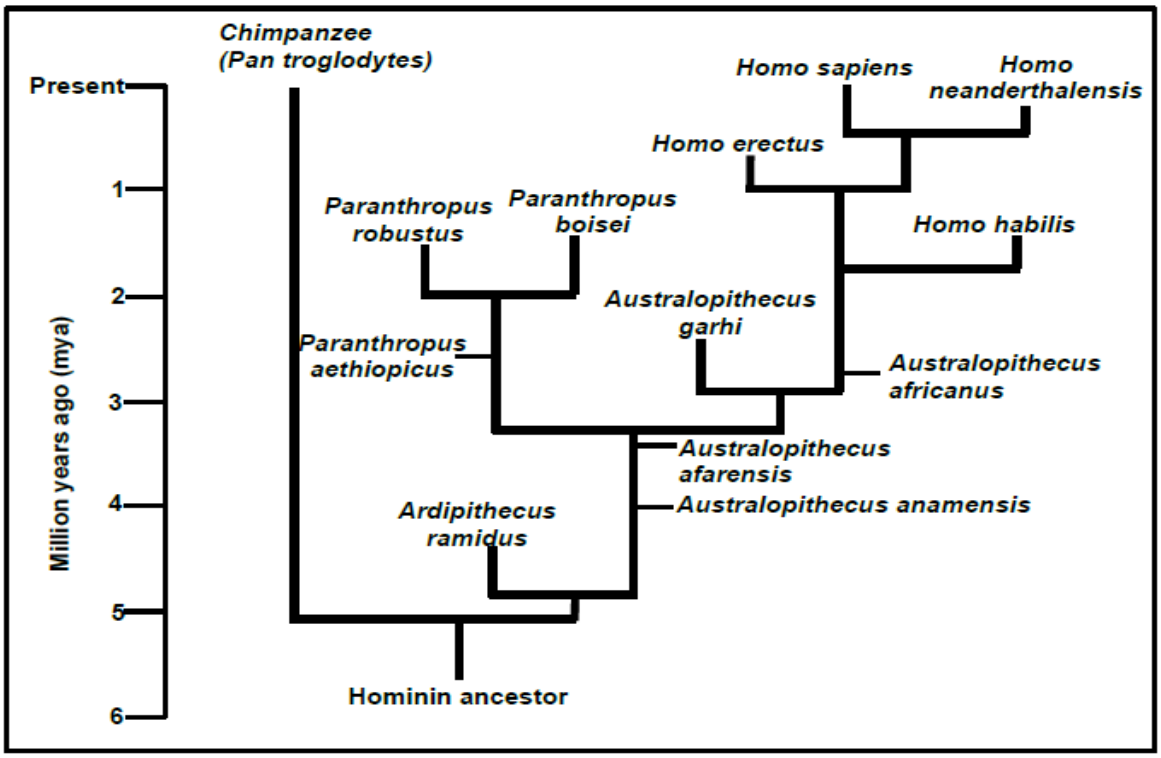
The table shows the evolution of cranial capacity in some species.

SPECIES	PERIOD OF EXISTENCE (MILLION YEARS AGO)	AVERAGE CRANIAL CAPACITY (CM^3)
Sahelanthropus	7,0-6,0	450
Australpoithecus afrecanus	3,0-2.0	480
Homo habilis erectus	2.2-1,6	650
Homo erectus	2.0-0.4	900
Homo neanderthalensis	0.4-0.04	1500
Homo sapies	0.2-0	1450

33.1 Name:
(a) Two hominid genera in the table above (2)
(b) Two fossils of *A. africanus* that were found in South Africa (2)
(c) The genus that appeared first on Earth as shown in the table (1)
33.2 Which hominid had a cranial capacity closest to that of *Homo sapiens?* (1)
33.3 Give the smallest cranial capacity (in cm3) of a Homo species (1)
33.4 When did *Australopithecus africanus* become extinct? (1)
33.5 Fossils are used as evidence of hominid evolution.
Name TWO other lines of evidence (2)
(10)

Question 34

The diagram below shows possible evolutionary relationships among some hominids.



34.1 What is this type of diagram called? (1)

34.2 How many of EACH of the following are represented in the diagram:

(a) Genera (1)

(b) Homo species (1)

34.3 Name the species that have *Paranthropus aethiopicus* as a common ancestor. (2)

34.4 When did:

(a) *Ardipithecus ramidus* become extinct (1)

(b) *Homo erectus* first appear (1)

34.5 Name the:

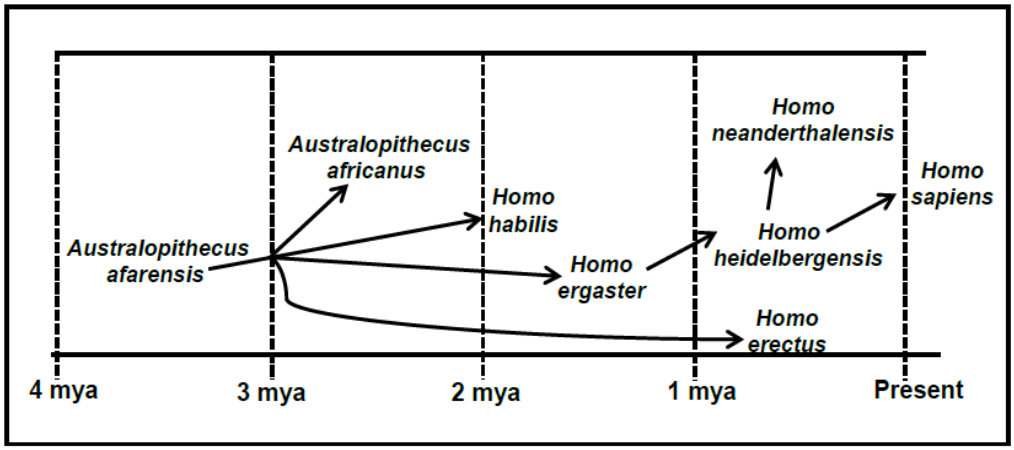
(a) Hominid species that existed at the same time as Homo sapiens. (1)

(b) First Homo species to use tools (1)

(9)

Question 35

Fossil evidence for humans may be interpreted in different ways. One possible model of human evolution is shown below



35.1 Name the family to which all of the represented organism belong. (1)

35.2 Describe how cultural evidence is used to support the theory of human evolution. (2)

35.3 How long ago did the most recent common ancestor of H. erectus and *H.heidelbergensis* exist on earth? (1)

35.4 Explain a possible reason why *H. ergaster* was placed between A. afarensis and *H.heidelbergensis* on the model. (2)

(6)

Question 36

36.1 State the 'Out of Africa' hypothesis (2)

36.2 Name the family to which modern humans belong. (1)

36.3 What genetic evidence is used to support the 'Out of Africa' hypothesis? (1)

36.4 Describe how fossil evidence is used to support the 'Out of Africa' hypothesis. (4)

(8)

PROVINCE OF KWAZULU-NATAL
DEPARTMENT OF EDUCATION

GRADE 12

LIFE SCIENCES

REVISION DOCUMENT

Solutions

August 2022

&

CONTENT & METHODOLOGY WORKSHOP

Teachers Resource

August 2022

INTRODUCTION

This document has been prepared as revision material for the Final Examinations for Grade 12 Life Sciences.

The materials have been arranged in such a way that studying can be undertaken topic-wise. Within each topic, questions on the different sub-topics are arranged in the same sequence as that in the 2021 Examination Guideline Document.

Questions were selected such that all the core concepts and core skills are assessed.

CONTENTS

GRADE 12

PAPER 1

REVISION SOLUTIONS DOCUMENT

TOPIC: REPRODUCTIVE STRATEGIES AND HUMAN REPRODUCTION

Question 1

1.1 C ✓✓
1.2 D ✓✓
1.3 D ✓✓
1.4 C ✓✓
1.5 B✓✓
1.6 D ✓✓
1.7 D ✓✓

(14)

Question 2

BIOLOGICAL TERMS:

	DESCRIPTION	TERM
2.1	The fusion of the sperm and egg outside the body	**External fertilization✓**
2.2	The development of the embryo inside an incubated egg that is laid.	**Internal fertilization✓**
2.3	The development of the embryo in the uterus and the young are born alive.	**Vivipary✓**
2.4	The complete development of the embryo inside an egg in the female body.	**Ovovivipary✓**
2.5	The development of the embryo in which very little energy is used and parental care is required.	**Altricial✓**
2.6	The development of the embryo in which a lot of energy is used and the young are able to move directly after hatching.	**Precocial✓**
2.7	Structure that provides nutrition to the embryo in the amniotic egg	**Yolk Sac✓**
2.8	Fluid filled bag around embryo	**Amnion✓**
2.9	Structure in the sperm cell that contains enzymes used to penetrate the ovum	**Acrosome✓**
2.10	The liquid that surrounds the human embryo	**Amniotic fluid✓**
2.11	A hollow ball of cells into which the fertilised ovum develops	**Blastula/blastocyst✓**
2.12	The lining of the uterus which is richly supplied	

	with blood vessels	**Endometrium✓**

2.13	Coiled tubular structure outside the testis that stores sperms	**Epididymis✓**
2.14	The part of the female reproductive system in which fertilisation takes place	**Fallopian tube/Oviduct✓**
2.15	The name given to the embryo after it reaches 12 weeks	**Foetus✓**
2.16	The hormone produced by the pituitary which controls growth of the Graafian follicle	**Follicle Stimulating Hormone✓**
2.17	Layer within the ovary that is responsible for formation of ova through meiosis	**Germinal Epithelium✓**
2.18	Another name for the period of pregnancy	**Gestation✓**
2.19	The process by which the embryo becomes attached to the uterine wall	**Implantation✓**
2.20	The hormone which converts the ruptured follicle into a corpus luteum	**Luteinizing Hormone✓**
2.21	Type of cell division by which sperms are produced	**Meiosis✓**
2.22	The 28-day reproductive cycle in females involving changes in the ovary and uterus	**Menstrual cycle✓**
2.23	Tearing away of the endometrium lining of the uterine wall, accompanied by the loss of blood	**Menstruation✓**
2.24	The cell division by which the zygote becomes multicellular	**Mitosis✓**
2.25	Production of ova by meiosis	**Oogenesis✓**
2.26	The hormone which starts the preparation of the lining of the uterus for attachment of the fertilised ovum	**Oestrogen✓**
2.27	Process by which an ovum is released from the ovary in humans	**Ovulation✓**
2.28	Gland in the brain that produces FSH and LH	**Pituitary/hypophysis✓**
2.29	Combination of foetal and maternal tissue responsible for gas exchange, nutrition and excretion	**Placenta✓**
2.30	Hormone that maintains pregnancy	**Progesterone✓**
2.31	The stage when sexual maturity is reached in males and females	**Puberty✓**
2.32	Production of spermatozoa by meiosis	**Spermatogenesis✓**
2.33	Hormone responsible for secondary sexual characteristics in males	**Testosterone✓**
2.34	A hollow, rope-like tube which attaches the embryo to the placenta	**Umbilical cord✓**
2.35	The blood vessel that carries nitrogenous waste from the foetus to the placenta	**Umbilical artery✓**
2.36	The blood vessel that carries oxygenated blood from	

	the placenta to the foetus	**Umbilical vein**✓
2.37	The structure where testosterone is produced	**Testes**✓
2.38	Sac-like structure that contains testes	**Scrotum**✓
2.39	A gland that lubricates end of penis	**Cowper's gland**✓
2.40	Common tube for sperm and urine	**Urethra**✓
2.41	A gland that produces alkaline medium of semen	**Prostate gland**✓
2.42	A gland that provides nutrients for the sperms	**Seminal vesicle**✓
2.43	A tube that transfers sperms to the urethra	**Vas deferens**✓
	(43 x 1)	**(43)**

Question 3

3.1 Both A and B ✓✓
3.2 B only ✓✓
3.3 A only✓✓
3.4 None ✓✓
3.5 A only ✓✓
3.6 B only ✓✓
3.7 A only ✓✓
3.8 A only ✓✓
3.9 B only ✓✓
3.10 B only ✓✓
3.11 Both A and B ✓✓
3.12 None ✓✓
3.13 None ✓✓
3.14 Both A and B ✓✓
3.15 B only ✓✓
3.16 None ✓✓
3.17 B only ✓✓
3.18 None✓✓

(18 x 2) **(36)**

Question 4

4.1 Internal ✓ fertilisation (1)

4.2 -Sperm are deposited inside the female body ✓
thereby increasing the chances of fertilisation ✓
- Gametes/zygotes are inside the body✓
therefore protected from the predators✓/ environmental dangers
(Mark first TWO only)

(2 x 2) (4)

4.3 - The eggs hatch inside the female's body ✓
- and the young are born live ✓ (2)

(7)

Question 5

- The (amniotic) egg is retained inside the mother's body✓*
- to protect the embryo from predators✓
- The allantois✓protects the embryo
- by removing waste products✓
- The embryo is protected from shocks✓/sudden changes in temperature/dehydration by the:
  - Chorion✓
  - Amnion✓
  - Amniotic fluid✓ inside the amniotic membrane
  - Shell✓/outer covering
  - Air pocket✓

Compulsory 1* + Any 4

Nourishment (N)

- The embryo receives nutrients✓
- from the egg yolk✓ in the yolk sac

and from the albumen✓

(7)

Question 6

6.1 Internal fertilisation ✓ (1)

6.2 Internal fertilisation ✓
increases the chances of fertilisation ✓
Ovovivipary ✓/ eggs retained inside the female's body where they are protected ✓
(Mark first TWO only) (2 x 2) (4)

To increase the chances of fertilisation✓/ the survival of the eggs/ number of offspring
- As eggs may be lost to predators✓/environmental factors etc.
- Since there is external fertilisation✓ Any (2)

(7)

Question 7

7.1 Cervix ✓ (1)

7.2 - The site of fertilisation ✓
- The site of zygote division✓
- The transfer of the ovum/embryo to the uterus ✓

(1)

Any
(Mark first ONE only)

7.3 -Diploid cells in the ovary undergo mitosis✓
- to form numerous follicles✓
- Under the influence of FSH ✓
- one cell undergoes meiosis✓
- to form a (haploid) ovum ✓ (4)

Any

7.4 -It is a hollow organ ✓
- It has a muscular wall✓
- It has a blood-rich lining✓/endometrium (1)

Any
(Mark first ONE only)

7.5 - No follicle will develop ✓
- No oestrogen produced ✓
- and no progesterone produced✓
- Therefore, the endometrium will not develop✓* to be shed during menstruation

Compulsory mark✓*1 + Any 2 (3)

(10)

Question 8

8.1 (a) Vas deferens✓/sperm duct (1)
(b) Scrotum✓ (1)
(c) Penis✓ (1)

8.2 D✓ Epididymis✓ (2)
G✓Urethra✓ (2)
E✓ Testis✓ (2)

8.3 A✓
B✓
E✓ Any (2)
(Mark first TWO only)

(11)

Question 9

9.1 Vas deferens ✓ (1)

9.2 - Sperm storage✓
- Sperm maturation ✓ (1)

Any

(Mark first ONE only)

9.3 - The semen will not contain sperm ✓ because
- they are not transported✓
- but will contain all other secretions of the accessory glands✓
- / examples thereof
- the vasectomy occurred before✓ the accessory glands

Any Two (2)

9.4 - The temperature of the testes inside the body will be too high✓
- No/abnormal sperm will be produced✓
- The man will be infertile✓/not able to reproduce (3)

9.5 - Under the influence of testosterone✓
- diploid cells✓/germinal epithelial cells
- in the seminiferous tubules✓/testes
- undergo meiosis✓
- to form haploid sperm cells ✓ (4)

(7)

Question 10

10.1 - Must have regular menstrual cycles✓
- They must not become pregnant✓
- Diet ✓ Any (2)

(Mark first TWO only)

10.2 - 250 females per group were used✓/1000 females participated
- Measurement was done for 5 cycles✓

(Mark first TWO only) (2)

10.3 Older groups of women have a higher (average) FSH level than the younger groups✓✓ **OR**
Younger groups of women have a lower (average) FSH level than the older groups✓✓
Any (2)

(Mark first ONE only)

10.4 - The Graafian/developing follicles secretes oestrogen✓but since the number of follicles are low✓/depleted
- less/no oestrogen will be secreted✓ (3)

10.5 - A high concentration of progesterone✓
- inhibits the pituitary gland✓/results in reduced FSH secretion
- This will decrease the validity of the investigation✓ (3)

(12)

Question 11

11.1 Male fertility✓ (1)

11.2 Measuring the sperm count✓ (1)

11.3 Age✓
- Diet✓
- Exercise✓
- Activity level✓
- Lifestyle✓
- Occupation✓ etc.

(Accept factors that are NOT related to health; race) Any
(Mark first TWO only) (2)

11.4 - TU inhibits the secretion of testosterone✓
- spermatogenesis cannot take place✓/no sperm will be produced (2)

11.5 - The higher temperature/pressure on the testes✓ due to the tight underwear
- could decrease the sperm count✓/sperm production/lead to the production of abnormal sperm. (2)

11.6 - To determine if TU is still effective after 12 months✓
- To see if the sperm count returns to normal✓ when the treatment stops Any
(Mark first ONE only) (1)

11.7 - No sperm will be transported✓
- from the epididymis to the urethra✓
- Semen without sperm will be released✓ (2)

Any

(11)

Question 12

12.1 Acrosome✓ (1)
12.2 mitochondrion✓ (1)

12.3 (a) 3✓ (1)
(b) 1✓ (1)
(c) 1✓ (1)

12.4 B✓- Nucleus✓ (2)
12.5 Mitosis✓ (1)

12.6 - After implantation the chorion✓
- develops many finger-like outgrowths✓
- called chorionic villi✓
- The endometrium✓
- together with the chorionic villi forms the placenta✓
- The umbilical artery✓
- and the umbilical vein✓develops
- inside a hollow tube✓to form the umbilical cord between the foetus

and the placenta✓ Any (6)

(14)

Question 13

13.1 (a) Pituitary✓ gland/hypophysis (1)
(b) Graafian follicle✓ (1)
(c) Ovulation✓ (1)
(d) Corpus luteum✓ (1)

13.2 Remains low✓/decreases (1)

13.3 - stimulates ovulation✓
- stimulates the development of the corpus luteum✓
(Mark first ONE only) (1)

(6)

Question 14

14.1 -A✓
-B✓
-E✓
Mark first TWO only (2)

14.2 -The scar tissue✓
-may partially block the Fallopian tube✓
- preventing the embryo from reaching the uterus✓/resulting in implantation in the Fallopian tube (3)

14.3 - The other Fallopian tube is still present✓/not blocked
- Fertilisation may still take place in this Fallopian tube✓/the developing embryo can move along this Fallopian tube
OR
- During invitro fertilisation✓ (IVF)
- the resulting embryo is inserted into the uterus✓
OR
- The ovum can be placed after the blockage✓
- allowing fertilisation✓ (2)

14.4 - Insufficient space✓
- Poor/no placental development✓
- Decreased blood supply✓
- Insufficient nutrients✓/oxygen
(Mark first TWO only) Any (2)

(9)

Question 15

15.1 Progesterone maintains/thickens the endometrium✓ and therefore, maintains the pregnancy✓ (2)

15.2 (a) Progesterone treatment ✓ (1)

(b) Development of gestational diabetes✓ (1)

15.3
- Glucose levels were taken daily✓
- When the glucose level of a pregnant woman remains high continuously it indicates the development of gestational diabetes. ✓ (2)

15.4 (Same) dosage/250 mg of progesterone✓
(Same) period of time for injection injections given between weeks 16 and 20 ✓
(Same) frequency of injections/weekly injections✓. (2)
Any 2
(Mark first TWO only)

15.5 Group B did not receive progesterone✓
If gestational diabetes develops in group A it would be due to the progesterone treatment✓ (2)

(10)

Question 16

16.1 Chorion✓ (1)

16.2 - Acts as a shock absorber✓
- It prevents desiccation✓/dehydration
- It helps to keep the temperature within a narrow range✓
- It facilitates free movement✓ of the foetus (2)
Any
(Mark first TWO only)

- The zygote divides by mitosis✓
- to form a (solid) ball of cells✓
- called the morula✓
- which develops into a hollow ball of cells✓
- called the blastula✓/blastocyst (4)

16.3 - Acts as a micro-filter✓/protect against pathogens
- Removal of harmful metabolic waste✓
- Produces antibodies✓
- Maintains the endometrium✓ (2)
Any
(Mark first TWO only)

16.5 Umbilical vein✓ (1)

16.6 -In humans the developing foetus receives nutrients from the mother's✓ blood
- via the placenta✓/umbilical vein
- In oviparous organisms the developing embryo receives nutrients

from the yolk.//albumen (3)

(13)

Question 17

17.1 (a) Oestrogen✓ (1)
(b) Progesterone✓ (1)

17.2 - It increases✓
- the thickness✓ of the endometrium/the blood vessels in the endometrium/the amount of glandular tissue in the endometrium (2)

17.3 (a) Release of an ovum✓ from the ovary✓/Graafian follicle (2)
(b) Day 14 ✓ (1)
(c) LH/ Luteinising Hormone ✓ (1)

17.4 - High levels of hormone B/progesterone will inhibit✓
- the secretion of FSH✓
OR
- No new ova/mature follicles✓
- are required during pregnancy✓ (2)

17.5 The progesterone✓
- levels decreased✓
- because the corpus luteum degenerated✓ (3)

17.6 - High levels of progesterone ✓
- stimulate the Pituitary gland/ Hypophysis✓ to secrete a less FSH ✓
To prevent the growth of a new follicle ✓/ ovulation during the pregnancy
OR
- Low levels of progesterone ✓ (4)
- stimulate the Pituitary gland/ Hypophysis✓ to secrete a more FSH ✓
-which stimulate the development of new follicles ✓

(17)

Question 18

18.1 Accept day 14✓ or day 15 (1)

18.2 Days 0 - 7✓ (1)

18.3 - Causes the follicle to burst open✓/stimulates ovulation
- Stimulates the formation of corpus luteum✓
(Mark first ONE only) (1)

18.4 - LH levels remain low up to day 12/13✓
- Then it increases sharply up to day 14✓

- After which it decreases and remains low✓ (3)

18.5 As the oestrogen level increases✓
the thickness of the endometrium also increases✓ (2)

18.6 Maintain the increase in the thickness of the endometrium✓
for greater chance of implantation✓ (2)

18.7 No✓ (1)

18.8 The progesterone levels✓ has dropped✓/not maintained/corpus luteum has started to degenerate (2)
(13)

TOPIC: Human response to environment (Brain, neurons and spinal cord)

Question1

1.1 B ✓✓
1.2 C ✓✓
1.3 A ✓✓
1.4 A ✓✓
1.5 B ✓✓

(2x5) **(10)**

Question 2

	DESCRIPTION	TERM
2.1	The part of the nervous system made up of cranial and spinal nerves	**Peripheral nervous system**
2.2	The part of the brain that receives impulses from the maculae	**Cerebellum**
2.3	The structure that connects the left and right hemispheres of the brain	**Corpus callosum**
2.4	The part of the brain that controls body temperature	**Hypothalamus**
2.5	The part of the brain that regulates breathing	**Medulla oblongata**
2.6	The branch of the autonomic nervous system that restores an increased heart rate back to normal	**Parasympathetic**
2.8	A part of the nervous system that consist of sympathetic and parasympathetic section	**Autonomic**
2.9	A functional gap between two consecutive neuron	**Synapse**
2.10	Collective name for the membranes that the brain and spinal cord	**Meninges**
2.11	Neurons that carry impulses from receptors	**Sensory**
2.12	A diseases characterized by the degeneration of brain cells and memory loss	**Alzheimer**
	(10x1)	**(10)**

Question 3

3.1 B Only ✓✓
3.2 A Only ✓✓
3.3 Both A and B ✓✓
3.4 B Only ✓✓

(4x2) **(8)**

Question 4

4.1

(a) B✓ - Cerebrum✓ (2)

(b) D✓ - Cerebellum✓ (2)

(c) A✓ - Pituitary gland✓/Hypophysis (2)

(d) C✓ - Corpus callosum✓ (2)

(e) E✓ - Spinal cord✓ (2)
(10)

Question 5

5.1 Cerebellum ✓ (1)

5.2 - High thought processes ✓ / (intelligence/ memory/ reasoning)
- Interpretation of all senses ✓
- Controls all voluntary actions ✓ (2)
(Mark the first TWO only)

5.3 Meninges ✓
Cranium ✓ (1)
(Mark the first ONE only)

5.4 Heart muscles ✓ (2)
Breathing muscles ✓ (intercostal and diaphragm)

(6)

Question 6

6.1 (a) Myelin sheath✓ (2)
(b) Axon✓

6.2 (a) A✓ (2)
(b) C✓

6.3 D✓ Synapse✓ (2)

Question 7

7.1 Motor✓ /efferent neuron (1)

7.2 C → B → A ✓✓ (Must be in the correct sequence) (2)

7.3 - Impulse will be transmitted faster in neuron 1✓✓ / slower in neuron 2 (3)
- because of the presence of myelin sheath in neuron 1✓ / absence of myelin sheath in neuron 2

7.4 - Impulses from the receptor✓/ sensory neuron
- will be transmitted to the central nervous system ✓ but
- the impulse will not reach the effector ✓ (3)

(9)

Question 8

8.1 1✓ and 4✓ (2)
(Mark first TWO only)

8.2 1✓ and 3✓ (2)
(Mark first TWO only)

8.3 2✓ and 3✓ (2)
(Mark first TWO only)

(6)

Question 9

9.1 Reflex arc✓ (1)

9.2 (a) B - Motor✓ neuron/multipolar neuron/efferent neuron (1)

(b) C - Interneuron✓/connector neuron (1)

(c) E - Sensory✓ neuron/unipolar neuron/afferent neuron (1)

9.3 (a) F✓ (1)

(b) A✓ (1)

9.4 (a) D✓ - Synapse✓ (2)

(b) G✓ - Myelin sheath✓ (2)
(10)

Question 10

10.1 A✓ (1)

10.2 The impulse does not travel to the brain✓/goes directly from receptor to effector via the spinal cord (1)

10.3
- Allows the person to respond rapidly✓
- and without thinking✓/involuntarily
- to a stimulus✓
- to prevent damage to the body✓*

1* compulsory + any other 2 (3)

10.4 Nerve✓/spinal cord (1)

10.5
- It acts as an insulator✓
- and therefore, speeds up the nerve impulse✓/prevents a short circuit (2)

10.6
- The person would be able to feel the stimulus✓
- but would be unable to react✓
- because the impulse would not be transmitted to the effector✓

Any (2)

10.7
- The receptor receives the stimulus✓
- and converts it into an impulse✓
- which is transported by a sensory neuron✓ via the spinal cord
- to the brain✓*/cerebrum
- The brain/cerebrum interprets the impulse✓*
- The brain/cerebrum sends an impulse to a motor neuron✓
- which conducts the impulse to the effector✓
- to bring about a response✓ 2* compulsory + any other 4 (6)

(16)

Question 11

11.1
- From the dendrite✓
- to the axon✓ (2)

11.2 0 to 1✓✓ µm/ 0 to 0,9 µm (2)

11.3 As the axon diameter increases the speed of the impulse increases✓✓
OR
As the axon diameter decreases the speed of the impulse decreases✓✓ (2)

11.4
- The speed of the impulse will decrease✓
- resulting in it taking longer for impulses to reach the effectors✓
- and the person will react more slowly✓ (3)

(9)

EYE

Question1

1.1 B✓✓
1.2 B✓✓
1.3 D✓✓
1.4 D✓✓
1.5 A✓✓

5X2 **(10)**

Question 2

		DESCRIPTION	**TERM**
	2.1	A type of vision in which both eyes are used together to focus on an object	**Binocular vision**
	2.2	The watery fluid that supports the cornea and the front chamber of the eye	**Choroid**
	2.3	A structure in the eye that absorbs light to prevent internal reflection.	**Aqueous humor**
	2.4	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	**Accomodation**
	2.5	A defect condition of the eye where a person can see nearby objects clearly while distant objects are blurred.	**Myopia**
		1x5	**(5)**

Question 3

MATCHING COLUMNS

3.1 A only✓✓
3.2 Both A and B✓✓
3.3 Both A and B✓✓
3.4 Both A and B✓✓
3.5 B only✓✓

2x 5= **10**

Question 4

4.1

(a) A✓ – Iris✓ (2)

(b) E ✓– Optic nerve✓ (2)

(c) C✓ –Choroid✓ (2)

(d) D ✓–Fovea / yellow spot✓ (2)

(e) B✓- Cornea (2)

(10)

Question 5

5.1

(a) Sclera✓ (1)

(b) Lens✓ (1)

(c) Iris✓ (1)

5.2 Pupillary mechanism✓

-In the bright light the circular muscles constrict✓

-The radial muscles relax✓ and the pupil becomes small✓

--Less light enters the eye✓ (4)

5.3 Iris✓ (1)

5.4 Accommodation near vision

- Ciliary muscle contract✓
- Suspensory ligament becomes slackens✓
- Tension on the lens decreases✓
- Refractive power increased✓
- Image is formed on the retina✓ (5)

(13)

Question 6

6.1

(a) Accommodation✓ (1)

(b) Pupillary mechanism✓/ pupillary reflex (1)

6.2 (a) B✓ and D ✓ *(mark the first TWO only)* (2)

(b) A✓ and B✓ *(mark the first TWO only)* (2)

6.3 (a) C✓ and D ✓ *(mark the first TWO only)* (2)

(b) A ✓and C ✓ *(mark the first TWO only)* (2)

(10)

Question 7

7.1 Long-sightedness✓ (1)

7.2 (a) The lens becomes cloudy/opaque/milky✓ and there it does not allows the light to pass through✓ (2)

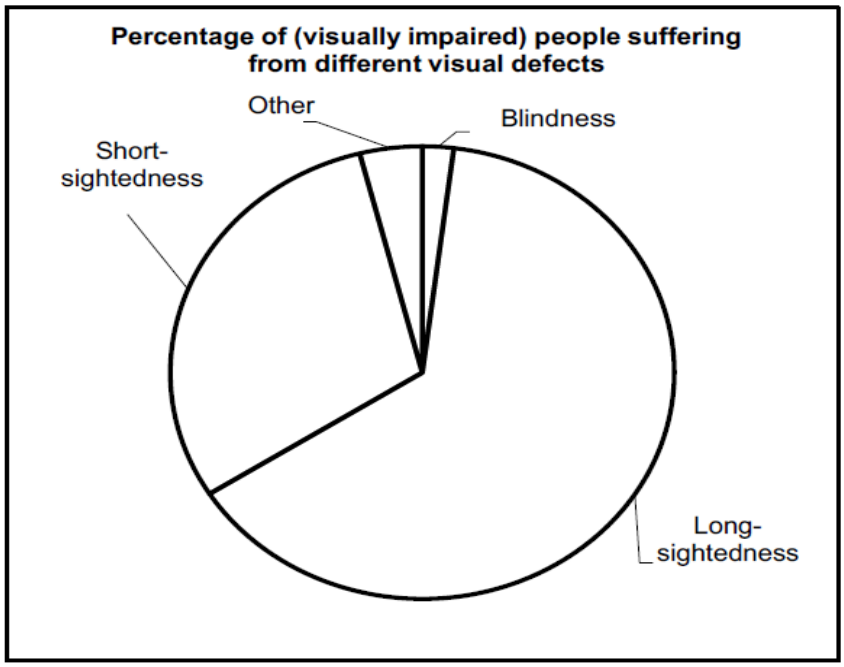
(b) Surgery ✓ *(mark first ONE only)* (1)

7.3 The lens is less convex✓ / the eye ball is too short / Cornea is flat.
This causes the light rays to fall behind the retina✓
Therefore light rays are focused on the retina to form a clear image✓ (2)

7.4 Astigmatism✓ (1)

7.5

The percentage of (visually impaired) people suffering from different visual defects



Rubric for assessing the graph

Title of the graph shows the relation between the two variables (**H**)	**1**
Correct calculation to determine the proportion (**C**)	**2**:All 4 correct **1**:1-3 correct
Correct proportions for the labelled sectors (**P**)	**2**:All 4 sectors correct **1**:1-3 sectors correct (6)

(13)

Question 8

8.1

(a) Curvature✓ of the lens (1)

(b) Distance✓ of the pencil (1)

8.2 Same light intensity✓
Same person doing experiement✓
Same person taking measurent✓
Using the same optic instrument✓
Time to focus on the pencil✓
Same eye✓

(Mark first TWO only) (2)

8.3 To improve the validity✓ of the procedure

To get results for the factors✓ that is being tested so the above factors do not interfere with the factors being tested✓
(*Mark any first TWO)* (2)

8.4 As the distance increases✓ curvature of the lenses decreases✓ (2)

8.5 Ciiary muscle ✓ (2)

suspensory ligament✓

(10)

EAR

Question1

1.1 A ✓✓
1.2 B ✓✓
1.3 C ✓✓
1.4 C ✓✓
1.5 B ✓✓

5X2 **(10)**

Question 2

	2.1	Receptors that provide information about the gravitational position of the head	**Macullae**
	2.2	A small device that is inserted in the ear to drain fluids caused by a middle-ear infection	**Grommet**
	2.3	A structure in the ear that contains receptors that converts pressure waves into nerve impulse in the ear	**Cochlea**
	2.4	A structure in the ear that absorbs excess pressure waves from the inner ear	**Round window**
	2.5	A structure in the ear that transmits the nerve impulse to the cerebellum for the balance of the body	**Auditary nerve**
		1x6	**(10)**

3. MATCHING

3.1 A only ✓✓
3.2 A only ✓✓
3.3 B only ✓✓

6

Question 4

4.1 (a) Semi-circular canal ✓ (1)

(b) Auditory canal ✓ (1)

4.2 (a) E✓ - Oval window✓ (2)

(b) D✓ - Round window✓ (2)

4.3 (a) Cerebellum✓ (1)

(b) Hair cells/Organ of Corti✓ (1)

(8)

Question 5

5.1 (a) F✓ – Auditary nerve✓ (2)

(b) G✓ –Eustachian tube✓ (2)

5.2 (a) B✓ and C✓ (2)

(b) E✓ and F✓ (2)

5.3 -Grommet will be inserted in the tympanic membrane✓
-Antibiotics✓ (1)

5.4 Auditary canal✓ (1)

5.5 -The ear wax can be removed from the auditory canal✓ (2)
-to allow sound to reach the tympanic membrane/which allow the tympanic membrane to vibrate freely. ✓

(12)

Question 6

6.1 (a) A - Cerebrum✓ (1)

(b) B - Medulla oblongata✓ (1)

(c) H - Eustachian✓ (1)

6.2 G✓ – Round window✓ (2)

6.3 Hair cells/Organ of Corti✓ (1)

6.4 -Part B controls vital processes✓, /heartbeat/breathing
- These processes will stop✓ leading to death (2)

6.5 The impulses will be interpreted✓ and sent to the skeletal muscles✓ to maintain balance✓ (3)

6.6 -The oval window /Part F will not vibrate✓ freely
- Fewer / no vibrations will be carried to the cochlea✓ / inner ear
- Fewer / no pressure waves will form✓ in the cochlea
- There will be less / no stimulation of the organ of corti/hair cells✓ (4)

(15)

Question 7

7.1 (a) Auditary canal✓ (1)

(b) Ossicles✓ (1)

7.2
- Collects the sound waves✓
- Directs the sound waves towards the auditory canal✓

(Mark first ONE only) (1)

7.3
-Part D / the ossicles do not vibrate freely✓
- Fewer / no vibrations will be sent to oval window✓ / inner ear
- Fewer / no pressure waves will be set up in the cochlea✓
-The receptors/organ of Corti will be stimulated less✓/ not stimulated
- The cerebrum is stimulated differently/ not stimulated
-which leads to hearing loss✓ Any (4) (4)

7.4
-Equalises pressure✓
-on the either side of the tympanic membrane✓

(2)

7.5
Grommet✓

(1)

7.6
C✓

(1)

7.7
- The cristae are stimulated✓
- To convert the stimuli to impulse✓
- The impulses are sent to the cerebellum ✓ where they are interpreted✓
- The cerebellum sends impulses to the skeletal muscles✓ to maintain balance Any (4)

(4)
(15)

Question 8

8.1 (a) Transmits sound waves to the tympanic membrane✓/Secretes ear wax (1)
(Mark first ONE only)

(b) Equalises pressure on either side of the tympanic membrane✓ (1)
(Mark first ONE only)

(c) Releases pressure from the inner ear✓ (1)
(Mark first ONE only)

8.2 (a) C✓ (1)

(b) D✓ (1)

8.3
- The receptors cannot convert the stimuli into impulses✓
- No impulses/fewer impulses are transmitted to the cerebrum✓
- and the person does not hear anything✓/hearing is impaired (3)

8.4
- The sound vibrations are transmitted from the large tympanic membrane✓
- to the smaller oval window✓
- through the ossicles✓
- which are arranged from largest to smallest✓
- This concentrates the vibrations✓, amplifying them Any (3)

8.5
- A change in speed/direction of movement✓
- stimulates the cristae✓
- The stimulus is converted to an impulse✓
- The impulse is transmitted to the cerebellum✓
- via the auditory nerve✓
- The cerebellum sends impulses to the muscles✓ to restore balance Any (4)

(15)

Question 9

9.1 (a) Auditory nerve✓ (1)

(b) Round window✓/Fenestra rotunda (1)

9.2 Cerebrum✓ (1)

9.3
- The cristae✓in the semi-circular canals
- are stimulated by changes in speed and direction✓
- when the endolymph moves✓
- The cristae convert the stimuli to nerve impulses✓
- The nerve impulses are transported along the auditory nerve✓
- to the cerebellum✓to be interpreted
- Impulses sent to muscles✓ to restore balance (Any 5) (5)

9.4
- The mucus will block the opening of the Eustachian tube✓
- Air cannot enter or leave✓the middle ear
- to equalise pressure✓/causing imbalance in pressure

OR

- Mucus may move through the Eustachian tube✓
- causing pressure in the middle ear✓
- pushing on the tympanic membrane✓/part E (3)

9.5
- The ossicles/structures at A will not be able to vibrate✓
- and hence no vibrations will be passed to the inner ear✓/cochlea will not be stimulated/no amplification (2)

(13)

Question 10

10.1 (a) Round window✓ (1)

(b) Cochlea✓ (1)

10.2 Cristae✓ (1)

10.3 (a)
- Impulses from the cochlea cannot be transmitted to the brain✓
- and therefore hearing will not occur✓ (2)

(b)
- Part A will not be able to vibrate✓
- The round window will not absorb the sound waves✓ from the cochlea
- and hearing will be affected✓ (Any 2) (2)

(7)

Question 11

11.1 -The pinna of the ear traps sound waves✓
-The auditory canal directs the sound waves to the tympanic membrane✓
-causing the tympanic membrane to vibrate✓
-which causes the ossicles to vibrate✓and
-pass the vibrations to the oval window✓/ amplify the vibrations
-(Pressure) waves are set up in the inner ear✓ / perilymph/endolymph
-The organ of Corti is stimulated✓
-and converts the stimuli into impulses✓
-which are transmitted by the auditory nerve✓
-to the cerebrum✓ for interpretation Any (7)

Topic Plant Growth Hormones
Solution
Question 1

1.1 B ✓✓ (2)
1.2 A ✓✓ (2)
1.3 B ✓✓ (2)
(6)

Question 2

	Description	Term
2.1	Growth or bending reaction by plants in response to light stimuli.	**Phototropism**
2.2	The plant hormone that promote apical dominance	**Auxin**
2.3	The plant hormone that causes leaves to fall off trees in Autum	**Abscisic acid**
2.4	A chemical that is used by farmers to kill weeds	**Herbicides**
2.5	Promote sprouting of buds	**Gibberellins**
2.6	Inhibition of the growth of lateral buds by auxins present in apical buds	**Apical dominance**
2.7	A movement of part of a plant in response to gravity	**Geotropism**
2.8	Plant growth responses to external stimuli	**Tropism**
2.9	A substance containing plant hormones used to kill unwanted plants	**Weed killer/herbicide**
2.10	Sharp structures found in plants for protection from herbivores	**Thorns**
	(10X1)	**(10)**

Question 3

3.1 A only ✓✓ (2)
3.2 Both A and B ✓✓ (2)
3.3 B only ✓✓ (2)
(6)

Question 4

4.1 Rate of seed germination ✓
Percentage of seed germination ✓ (2)

4.2 -Same amount of water ✓
-Same species!/type of seed ✓
-Same light intensity✓/darkness ✓
- Same temperature ✓
- Same time period (24 hours) for all 3 groups ✓
- Seed mixtures were treated in the same way ✓/filtered and rinsed with cold, distilled water for 2 minutes (Any 3)
(Mark first THREE only). (3)

4.3 Same volume ✓/amount of gibberellins that the seeds were soaked in (1)

4.4 - So that the average percentage and rate of seed germination could be calculated ✓
- in order to improve the reliability✓ of the results (2)

4.5 - Seeds usually germinate under the soil ✓ (2)
- in the absence of light✓

(10)

Question 5

51 Gibberellins stimulates cell elongation✓/cell enlargement/ growth in stems/elongation of internodes
(Mark first ONE only) Any (1)

5.2 (120 – 80) ✓mm = 40 ✓mm✓ (3)

5.3 Increase the number of plants used in each treatment✓
Repeat the investigation✓
Increase the period of the investigation✓
(Mark first TWO only) Any (2)

5.4 Auxins diffused from the paste into the plants✓
inhibiting growth of the lateral branches✓
Once all the auxins were used up✓ from the paste
the growth of the lateral branches increased ✓ (4)

(10)

Question 6

6.1 To ensure unilateral light ✓ / the plant receives light from one direction only (1)

6.2 Auxins ✓ AA/ Indole acetic acid (1)

6.3 Differences between plants A and plants B after two weeks
T✓

Plant A	Plant B
The stem of the plant will bend towards the light✓	The stem of the plant will remain straight✓/will not bend towards the light
Does not have lateral branches✓/only lower lateral branches will start to grow	All the lateral branches will grow✓along the whole stem
The plant will be taller✓	The plant will be shorter✓

(**Mark first TWO ONLY**)
1 table (T) + (2 X 2) (5)

(7)

Question 7

7.1 (a) Amount of abscisic acid ✓
(b) Seed germination✓ (2)

7.2 Promotes seed dormancy✓/inhibits growth (1)

7.3 As the days increase the hormone concentration decreases✓✓ (2)

7.4 - Decrease in abscisic concentration✓
- which allows seed germination✓/growth. (2)

7.5 - Same type of seeds✓.
- Same age of seeds ✓
- Same measuring instrument✓.
- Same person taking measurements✓
(Mark the FIRST TWO only) (2)

7.6 - As the setup was placed in the dark cupboard✓
- there was no effect of light✓
- Force of gravity✓acts on the seedlings
- the stem is negatively geotropic ✓
- hence it grows straight upwards✓ (Any 4) (4)

(13)

Question 8

8,1 Geotropism✓/gravitropism (1)

8.2 - Auxins✓
- accumulate at the lower✓part of the stem
- because of gravity✓
- The higher concentration of auxins at the lower part of the stem stimulates cell elongation✓/growth on the lower side of the stem
- The lower concentration of auxins at the upper part of the stem inhibits cell elongation✓/growth on the upper side of the stem

(Any 4) (4)

8.3 - The leaves and stem will be carried in such a way that they receive maximum sunlight✓
- for photosynthesis✓
OR
- Exposes the flowers more favourably✓
- for pollination✓/seed dispersal (2)

8.4 The roots will grow downwards✓/towards gravity (1)
(8)

TOPIC: ENDOCRINE AND HOMEOSTASIS

QUESTION1

1.1 B ✓✓
1.2 A ✓✓
1.3 D ✓✓
1.4 B ✓✓
1.5 C ✓✓

(5x2) **(10)**

QUESTION 2: BIOLOGICAL TERMS

	DESCRIPTION	TERM
2.1	A gland whose secretion are transported through blood streams.	**Endocrine gland**✓
2.2	A system that is responsible for chemical coordination in the body.	**Endocrine system**✓
2.3	A hormone that stimulates ovulation in humans	**LH**✓
2.4	The process of maintaining a constant internal environment in the human body	**Homeostasis**✓
2.5	A gland whose secretions are transported through ducts.	**Exocrine Gland**✓
2.6	A hormone that stimulates mammary gland to produce milk.	**Prolactin**✓
2.7	A hormone that is responsible for osmoregulation in the body.	**ADH**✓
2.8	Specialized cells in the pancreas that secretes insulin and glucagon	**Islets of Langerhans**✓
2.9	A hormone responsible for secondary sexual characteristics in males	**Testosterone**✓
2.10	A hormone that is responsible for maintaining salt balance in the blood.	**Aldosterone**✓
2.11	A gland that secretes FSH and LH in females.	**Pituitary**✓
2.12	Chemical messengers produced by endocrine glands.	**Hormone**✓
2.13	A gland located in the neck that secretes thyroxin hormone.	**Thyroid gland** ✓
2.14	A hormone that controls the metabolic rate in the body.	**Thyroxin**✓
2.15	A hormone that increases the blood glucose level in the body.	**Glucagon**✓
2.16	A hormone that lowers the blood glucose level in the body.	**Insulin**✓
2.17	Promotes the secretions of hormones produced by thyroid glands.	**TSH**✓

2.18	A mechanism that detects imbalances and restores balance in the internal environment	**Negative feedback**✓
2.19	A hormone responsible for growth and development in the body.	**Growth Hormone**✓
		(19x1) **(19)**

QUESTION 3

3.1 None✓✓
3.2 A only✓✓
3.3 A only✓✓
3.4 A only✓✓
3.5 B only✓✓

(5 x 2) **(10)**

QUESTION 4

4.1 **A** – Pituitary gland✓ (2)
D- Adrenal gland✓

4.2 a) C✓ Pancreas✓
b) A✓ Pituitary gland✓
c) B✓ Thyroid gland✓
d) D✓ Adrenal gland✓ (8)

4.3 They respond to internal/external stimulus✓
They protect organisms ✓ (2)
(**Mark first TWO only)**

(12)

Question 5

5.1 Sweat gland✓ (1)

5.2
- Structure A will constrict✓/vasoconstriction occurs
- Less blood flows towards the surface✓of the skin
- Less heat is lost✓ through the surface of the skin
- Temperature increases✓ / returns to normal (3)

5.3
- Enzymes function optimally✓ at normal body temperature✓/37° C
- Enzymes/proteins will denature✓ at high temperatures✓
- Enzymes will become inactive✓ at low temperatures✓

(Mark first ONE only) (2)

(6)

Question 6

6.1 (a) Growth hormone ✓ (1)

(b) Prolactin ✓ (1)

6.2 (a) Adrenalin✓ (1)

(b)
- More air/oxygen will be inhaled✓
- Blood will be pumped faster✓
- therefore, transporting more oxygen and glucose✓ to the skeletal muscles
- which will increase the rate of cellular respiration✓/metabolism (4)

6.3
- Part B/the medulla oblongata is stimulated✓
- and sends impulses to the heart✓and to
- the breathing muscles✓/ intercostal muscles and diaphragm
- More blood is transported to the lungs✓
- and the carbon dioxide is exhaled faster✓
- and the carbon dioxide levels return to normal✓ Any (4)

(11)

Question 7

7.1 5✓µg/dl (1)

7.2 $\left[\frac{(25 - 5)}{5}\right]$ ✓ x 100 ✓

= 400✓%

OR

$\left[\frac{(24 - 5)}{5}\right]$ ✓ x 100 ✓

= 380✓%

Accept a range between:
- 24 and 25 for the first value and
- 380% and 400% for the answer (3)

7.3
- Thyrotoxicosis increases the metabolic rate✓/rate of cellular respiration
- More glucose is used✓
- less glucose is stored✓
- fat is broken down✓ causing weight loss

Any (3)

7.4
- The high levels of thyroxin✓ in the blood
- causes the pituitary gland✓/hypophysis
- to secrete less TSH✓ into blood
- causing the level of TSH to decrease✓

(4)

(11)

Question 8

8.1 50✓°C (1)

8.2 As the temperature increases the average rate of blood-flow to the skin increases✓✓ (2)

8.3 $\left.\frac{11-4}{4}\right\}$ ✓ x 100✓ = 175✓% **OR** $\left.\frac{7}{4}\right\}$ ✓ x 100✓ = 175✓% (3)

8.4
- As the temperature increases✓ from 20 °C to 45 °C
- vasodilation occurs✓/blood vessels dilate
- to increase the rate of blood flow✓ /more blood flows to the skin
- so that more heat✓/ sweat can be lost

(4)

8.5
- Less blood flows to the skin✓ at low temperatures
- Less oxygen✓/nutrients reach the cells of the tissue and the cells may die

OR

- Less blood flows to the skin✓ at low temperatures
- More carbon dioxide✓/waste products accumulate in the cells of the tissue and the cells may die

(2)

(12)

Question 9

9.1 (a) Volume of urine✓ (1)

(b)
- Decide on a time✓ /date/place to conduct the investigation
- Decide on the apparatus✓ /materials that need to be used
- Decide how to record the data✓
- Decide on the number of participants to include✓
- Decide what factors to keep constant✓ /example of factor to be kept constant
- Decide on the composition of the sample✓
- Develop an indemnity form for the participants to sign✓
- Recruit✓ /get permission from volunteers to participate

(Mark first TWO only) Any (2)

c)
- The same room✓ /environment/temperature
- The same apparatus✓
- The same investigator✓
- No other liquid intake by both groups✓
- Same type of beer✓

(Mark first TWO only) Any (2)

d)
- They used a large sample✓ /12 men/6 men in each group
- The average volume of urine produced was calculated✓

(Mark first TWO only) (2)

9.2
- Alcohol inhibits/reduces the secretion of ADH✓
- causing the renal tubules✓ /distal convoluted tubules and collecting ducts
- to become less permeable to water✓
- Less water is reabsorbed✓ back into the blood
- A larger volume of urine is produced✓

Any (4)

(11)

Question 10

10.1
- Body temperature increases✓
- Pulse rate increases✓

OR

Both increase✓✓ (2)

10.2 30✓ minutes (1)

10.3 **Vasoconstriction**
- Less blood reaches the surface of the skin✓
- and less heat is lost✓

OR
- Less blood reaches the sweat glands✓
- and less heat is lost✓

Any 1 x 2

Increase in metabolism
- An increase in metabolism results in an increase in respiration✓
- which generates more heat✓

(4)

10.4
- Amount of energy drink✓
- Length of time when measurements were taken✓
- Amount of caffeine in the energy drink✓
- Type of energy drink✓
- The level of activity of all participants✓
- Gender✓/only men

(Mark first TWO only) Any (2)

(9)

Question 11

11.1 The level increases✓ (1)

T✓

11.2

Fewer larger meals	More smaller meals
1. Maximum blood insulin concentration is higher✓/between 160-180 mg/dl	1. Maximum blood insulin concentration is lower✓/between 120-140 mg/dl
2. Minimum blood insulin concentration is lower✓/between 20-30 mg/dl	2. Minimum blood insulin concentration is higher✓/40 mg/dl
3. Blood insulin concentration rises and falls three times a day✓/less often	3. Blood insulin concentration rises and falls six times a day✓/more often
4. Large changes in insulin concentration✓/between 140-160 mg/dl	4. Small changes in insulin concentration✓/between 80-100 mg/dl
5. Insulin concentration drops below minimum glucose concentration✓	5. Insulin concentration varies above and below minimum glucose concentration✓

(Mark first TWO only) 1 for table + Any 2 x 2 (5)

11.3
- A diabetic may not produce sufficient insulin✓
- When eating many smaller meals, less glucose✓ enters the blood
- less insulin✓ is needed
- to return blood glucose to normal✓

OR

- A diabetic may not produce sufficient insulin✓
- When eating fewer larger meals, more glucose✓ enters the blood
- more insulin✓ is needed
- to return blood glucose to normal✓

(4)
(10)

Question 12

12.1
- The pituitary gland✓ is stimulated
- to secrete less TSH✓
- Low TSH levels causes the thyroid gland✓
- to secrete less thyroxin✓
- Thyroxin levels return to normal✓

(5)

12.2
- The rate of metabolism/respiration in the body decreases✓
- Less glucose will be broken down✓
- and more glucose will be converted and stored as fat✓/glycogen

(3)

(8)

Question 13

13.1 Adrenalin✓ (1)

13.2
- Increases the heart rate✓
- Increases blood pressure✓
- Stimulates the conversion of glycogen into glucose✓
- Increases the blood supply to the heart✓/skeletal muscles
- Decreases blood flow to the digestive system✓
- Decreases blood flow to the skin✓
- Increases muscle tone✓
- Increases the rate/depth of breathing✓
- Increases the rate of respiration✓/metabolism
- Dilates/increases the diameter of the pupils✓

(Mark first THREE only) (3)

13.3
- Blood glucose levels rise✓ above normal
- The pancreas✓/islets of Langerhans
- secretes insulin✓ into the blood
- which travels to the liver✓/muscle cells
- and stimulates them to absorb glucose✓ from the blood
- and to convert the excess glucose into glycogen✓
- which decreases the blood glucose levels✓ to normal

Any 5 (5)

(9)

Question 14

When the carbon dioxide levels rise above normal (C):

- Receptor cells in the (carotid) artery in the neck/aorta are stimulated✓
- to send impulses to the medulla oblongata✓
- The medulla oblongata sends an impulse to the breathing muscles✓
- to contract more actively✓
- and increase the rate/depth of breathing✓
- An impulse is also sent to the heart✓
- to beat faster✓
- More carbon dioxide is taken to the lungs✓/exhaled
- The carbon dioxide levels return to normal✓

Any (7) **(7)**

Question 15

Role of the endocrine system in providing energy (E)

- More adrenalin✓ is secreted
- by the adrenal glands✓
- increases blood glucose✓/increase heart rate/ increase breathing rate/dilate blood vessels to essential organs

- More glucagon✓ is secreted
- by the pancreas✓/islets of Langerhans
- increases blood glucose✓

- More TSH✓ is secreted
- by the pituitary gland✓
- to increase thyroxin production✓

- More thyroxin✓ is secreted
- by the thyroid gland✓
- to increase the body's metabolic rate✓/rate of respiration

Any (9) **(9)**

PAPER 2
Topic: DNA Code of Life

Question1

1.1 D✓✓
1.2 D✓✓
1.3 B✓✓
1.4 C✓✓
1.5 C✓✓

(10)

Question 2

	DESCRIPTION	**TERM**
2.1	A tangled network of DNA and protein located within the nucleus	**Chromatin network**✓
2.2	The bonds that hold the two strands of a DNA molecule together.	**Hydrogen bonds**✓
2.3	The sugar found in DNA	**Deoxyribose sugar**✓
2.4	The analysis of DNA samples to identify individuals that may be related	**DNA Profiling**✓
2.5	The process whereby DNA makes an exact copy of itself	**DNA replication**✓
2.6	The monomers of nucleic acids	**Nucleotides**✓
2.7	The natural shape of a DNA molecule	**Double helix**✓
2.8	Sections of DNA that carry hereditary information	**Gene**✓
2.9	The sugar that forms part of a nucleotide in RNA	**Ribose**✓
2.10	The process whereby mRNA is formed from DNA	**Transcription**✓
2.11	Base triplets found on mRNA	**Codons**✓
2.12	The cell organelle to which mRNA attaches during protein synthesis	**Ribosome**✓
2.13	The process of arranging amino acids according to the sequence of bases on mRNA	**Translation**✓
2.14	The organelle in a cell where translation occurs	**Ribosome**✓
2.15	The triplet of bases found on a tRNA molecule	**Anticodon**✓
2.16	The type of RNA containing anticodons	**tRNA**✓
2.17	Bonds that join amino acids together	**Peptide bond**✓

(17 X 1) **(17)**

Question 3

3.1 A only✓✓
3.2 Both A and B✓✓
3.3 A only✓✓
3.4 A only✓✓
3.5 B only✓✓

(10)

Question4

4.1 (a) Y✓ (1)
(b) X✓ (1)
4.2 4✓ (1)
4.3 A C T G (Must be in the correct order) ✓ (1)
4.4 (DNA) replication✓
Transcription (Protein synthesis) ✓ (2)
(6)

Question 5

5.1 (a) W – Nucleotide ✓
U – DNA✓ (2)

(b) X - Phosphate✓/ phosphate ion
Y - Deoxyribose✓ sugar (2)

(c) Hydrogen✓ bond (1)
(d) V – Adenine (1)

5.2 Nucleus✓ (1)
5.3 Interphase✓ (1)
(8)

Question 6

6.1 DNA replication✓ (1)

6.2 (a) Sugar✓ (1)
(b) Phosphate✓ (1)

6.3 (a) Guanine✓ (1)
(b) Guanine✓ (1)
(5)

Question 7

7.1 - The DNA is located in the nucleus✓
- and mitochondria✓ and
chloroplasts✓ any 2 (2)

7.2 - DNA is a double-stranded✓molecule that
- forms a double helix✓
- It is made up of nucleotides✓
- Each nucleotide has a deoxyribose sugar✓molecule
- a phosphate group✓ and
- a nitrogenous base✓
- The bases are A, T, C and G✓
- which join to form complementary pairs✓/ (A to T & C to G)
- held by hydrogen bonds✓ any 7 (7)

7.3 - The DNA (double helix) unwinds✓ and
- unzips✓/hydrogen bonds break
- to form two separate strands✓
- Both DNA strands serve as templates✓
- to build a complementary DNA✓/(A to T and C to G)
- using free (DNA) nucleotides✓ from the nucleoplasm
- This results in two identical (DNA) molecules✓
- Each consists of 1 original and 1 new strand✓ any 6 (6)

(15)

Question 8

8.1 DNA Profiling✓ (1)

8.2 Jennie✓ (1)

8.3 -Jennie's DNA profile✓ /bands
matches DNA profile/ bands of the sample✓ from the crime scene (2)

8.4 -Proof of paternity✓
- Tracing missing person✓
- identification of genetic disorders✓
-Establishing family relationships✓
- Matching tissues for organ transplants✓
- identifying dead persons✓/ animals. (1)

8.5 - Samples containing DNA can be planted✓/person was framed
- Human error✓ during DNA profiling process
- Costly procedure✓
- Invasion of privacy✓ any 2 (2)

(7)

Question 9

9.1 Mary✓✓ (2)

9.2 There are no matching bands✓/ bars/ patter/ DNA profile with both parents✓ and Mary (2)

(4)

Question 10

10.1 Number of people✓ found guilty/ convicted (1)

10.2 44 – 25✓ = 19✓ (2)

10.3
- More criminals are found guilty when DNA evidence is included✓ in the investigation
- DNA found at crime scene✓
- can be compared to the DNA database✓
- making it easier✓/ Faster
- to identify suspects in the crime✓ any 4 (4)

(7)

Question 11

11.1 Transcription✓ (1)

11.2 mRNA✓ (1)

11.3 -makes up the genes which carry hereditary information
-contains coded information for protein synthesis (2)

11.4 ✓

A (DNA)	B (RNA)
Double strand✓ / Paired bases✓	Single strand✓ Unpaired bases✓
Double helix/ helical✓	Non- helical✓
Thymine ✓	Uracil✓

(5)

11.5
- The double helix DNA unwinds✓and
- unzips✓/weak hydrogen bonds break
- to form two separate strands✓
- One strand is used as a template✓
- to form mRNA✓
- using free RNA nucleotides from the nucleoplasm✓
- The mRNA is complementary to the DNA✓
- The coded message for protein synthesis is thus copied onto mRNA✓ Any 6 (6)

11.6 - This will result in different tRNA molecules ✓
- bringing different amino acids ✓
- leading to the formation of a different protein. ✓ (3)

(18)

Question 12

12.1 (a) GAC✓ (1)
(b) ACU✓✓ (2)

12.2 (Gene) mutation✓ (1)

12.3
- CTC on the DNA changed to CAC✓
- Codons (on the mRNA) changed✓/GAG changed to GUG
- Anticodons (on tRNA) changed✓/CUC replaced by CAC
- which resulted in a different amino acid✓/ Val (4)

12.4
- The cells will not receive enough oxygen✓
- resulting in reduced cellular respiration✓/ a person lacking energy/becoming tired/ anaemia (2)

(10)

Question 13

13.1 (a) Transcription✓ (1)
(b) Translation✓ (1)
13.2 (a) Nucleus✓ (1)
(b) mRNA✓ (1)
13.3 Chloroplasts✓
Mitochondria✓ (2)
13.4 (a)
- The double helix DNA unwinds✓ and
- (the double-stranded DNA) unzips✓/weak hydrogen bonds break
- to form two separate strands✓
- One strand is used as a template✓
- to form mRNA✓
- using free (RNA) nucleotides✓ from the nucleoplasm
- The mRNA is complementary to the DNA✓/ (A-U, G-C) (7)
- mRNA now has the coded message for protein synthesis✓

(b)
- Each tRNA carries an amino acid✓
- When the anticodon on the tRNA✓
- matches the codon on the mRNA✓
- the tRNA brings the (required) amino acid to the ribosome✓ (6)
- Amino acids become attached by peptide bonds✓
- to form the (required) protein✓

13.5 (a) TCG✓ (1)
(b) Tyrosine✓
Valine✓ (2)
13.6 Gene mutation✓ (1)
13.7 - The anticodon will be GGA✓/not GAA
- The last amino acid would be proline instead of leucine✓
- resulting in a different protein✓/ no protein at all (3)
(20)

Question 14

14.1 Cytosine✓ (1)
14.2 20✓✓% (2)
14.3 G A A✓ U G U✓ (2)
14.4 Glutamic acid✓ - Cysteine✓ (in that order) (2)
14.5 U A C✓ (1)
(8)

Question 15

15.1 Protein synthesis✓ (1)
15.2 Peptide✓ bond (1)
15.3 63✓ (1)
15.4 15.4.1 Guanine✓ (1)
15.4.2 (a) CAG✓ (1)
(b) CCT✓ (1)
15.4.3 CAU✓ (1)
(7)

Question 16

-RNA is single stranded✓
-and is made up of nucleotides✓ which comprise:
-ribose✓ sugar
-phosphate✓ group
-nitrogenous bases✓ which are
-adenine, uracil, guanine and cytosine✓/ (A, U, G and C)
-The phosphate group is attached to the ribose sugar✓
- and the nitrogenous base is attached to the ribose sugar✓
-Bases on RNA are arranged in triplets✓
-as codons on mRNA ✓
-and anticodons on tRNA✓
-tRNA has a clover-leaf✓/hairpin structure
-tRNA has a place of attachment for an amino acid✓ any (6) **(6)**

Question 17

- mRNA✓ forms
- during transcription✓/by copying the coded message from DNA
- and moves out of the nucleus✓
- and attaches to the ribosome✓
- During translation✓
- the anticodon matches the codon✓
- tRNA✓
- brings the required amino acid✓ to the ribosome
- Amino acids become attached by peptide bonds✓
- to form the required protein✓ any (8) **(8)**

TOPIC: MEIOSIS

Question1

1.1 C ✓✓
1.2 A ✓✓
1.3 A ✓✓
1.4 D ✓✓

(8)

Question 2
BIOLOGICAL TERMS:

	DESCRIPTION	TERM
2.1	The point of crossing over between two adjacent chromosomes	**Chiasma**
2.2	The splitting of the cytoplasm during cell division	**Cytokinesis**
2.3	The failure of chromosome pairs to separate during meiosis	**Non-disjunction**
2.4	The structures in the cell that forms the spindle fibres.	**Centrioles**
2.5	The phase of meiosis when homologous chromosomes are aligned at the equator of the cell.	**Metaphase I**
2.6	The division of the nucleus	**Karyokinesis**
2.7	Exchange of genetic material between chromatids of homologous chromosomes	**Crossing over**
2.8	The point at which the two chromatids of a chromosome are joined together	**Centromere**
2.9	Site of meiosis in females	**Ovary**
2.10	A genetic disorder caused by having an extra copy of chromosome number 21	**Down syndrome**
2.11	The Structure formed by the centrioles during cell division	**Spindle fibres**
2.12	The non-sex chromosomes in humans	**Autosomes**
2.13	The condition in a cell where there is only one set of Chromosomes	**Haploid**
2.14	The structure that is responsible for the formation of spindle fibres during cell division in animal cells and is made up of two centrioles	**Centrosomes**
2.15	The phase in the cell cycle during which the cell growth occurs	**Interphase**
2.16	Chromosomes that carry the same set of genes	**Homologous**
	(16 x 1)	**(16)**

Question 3
MATCHING COLUMNS

3.1. None✓✓
3.2. B only✓✓
3.3. Both✓✓
3.4. B only✓✓

3.5 Both✓✓

3.6. B only✓✓

(6x2) **(12)**

Question 4

4.1. (a) Centromere✓ (1)
(b) Homologous chromosomes✓ (1)
(c) Spindle fibres✓/ spindle threads (1)

4.2. Anaphase II✓ (1)

4.3. 2, 1, 3✓✓ (2)

4.4. In metaphase I, the chromosomes arrange at the equator in homologous pairs✓ whereas in metaphase II, the chromosomes arrange at the equator singly✓ (2)
(Mark first ONE only)

(8)

Question 5

5.1. Anaphase II✓ (1)

5.2 (a) Centriole✓ (1)
(b) Centromere✓ (1)
(c) Spindle fibre✓/ Spindle threads (1)

5.3 The chromatids separate✓/ centromere splits (1)

5.4 Crossing over✓ (1)

5.5 Reduces genetic variation✓ (1)

5.6 (a) Four✓/4 (1)
(b) 23✓ (1)
(08)

Question 6

6.1. Metaphase II✓ (1)

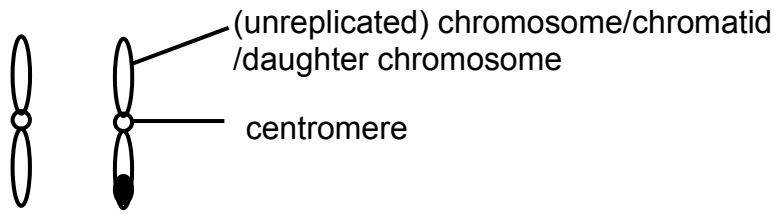
6.2. Individual chromosomes line up at the equator✓✓ of the cell
(Mark first one only) (2)

6.3. a) Cell membrane✓ (1)
b) Spindle fibres✓ (1)

6.4. - It contracts✓/shortens
- to pull the chromosomes✓/ daughter chromosomes/chromatids to opposite poles of the cell (2)

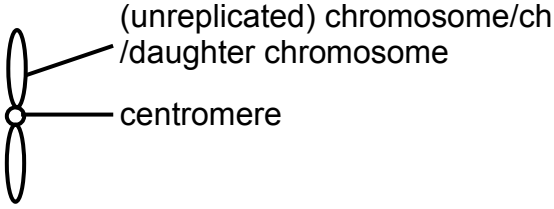
6.5

Structure C in the final phase of Meiosis/ Telophase II



OR

Structure C in the final phase of meiosis/ Telophase II



Guideline for assessing the drawing

CRITERIA	ELABORATION	MARK
Heading (H)	-Structure **C** in the final phase of meiosis/Telophase II	1
Correct drawing (D)	-Daughter chromosome/unreplicated chromosome/chromatid/s drawn from structure **C** only	1
Correct shading (S)	-One unshaded -One with shaded tip **OR** one unshaded	1
Labels (L)	-Any correct label	1

(4)
(11)

Question 7

7.1. (a) Metaphase I✓ (1)
(b) Telophase I✓ (1)
7.2. (a) B✓ (1)
(b) C✓ (1)
(c) D✓ (1)
7.3. Testis✓ (1)
(6)

Question 8

- in prophase I✓ of meiosis
- crossing over✓ occurs
- between homologous chromosomes✓
- resulting in the exchange of genetic material✓
- leading to chromosomes with a mixture of maternal and paternal genetic material✓

- In metaphase✓ of meiosis
- random arrangement of chromosomes occur✓
- leading to chromosomes moving into gametes in different combinations✓ Any 5 **(5)**

Question 9

9.1. Autosomes✓ (1)

9.2. a) – One chromosome comes from the sperm✓/father
- and other comes from the ovum✓/mother (2)

b) – Shape✓
- Size✓/length
- Position of genes✓/alleles
- Genes coding for same characteristic✓
- Location of centromere✓

(Mark the first THREE only) (3)

9.3. - Gonosomes are not identical✓/chromosomes at position 23 are not identical
- Individual 1 has XY gonosomes✓/is a male
- Individual 2 has XX gonosomes✓/ is a female (3)

(9)

Question 10

10.1. (a) Down syndrome✓ (1)
(b) Anaphase I/II✓ (1)
(c) Chromosomal aberration✓ (1)
(3)

Question 11

11.1. - Due to non-disjunction✓/ non-separation of a chromosome pair
- during Anaphase I✓
- Two chromosomes moved to the one pole✓ and
- none moved to the other pole✓ (3)

11.2. - Gamete **A** will have 24 chromosomes✓/ extra chromosome

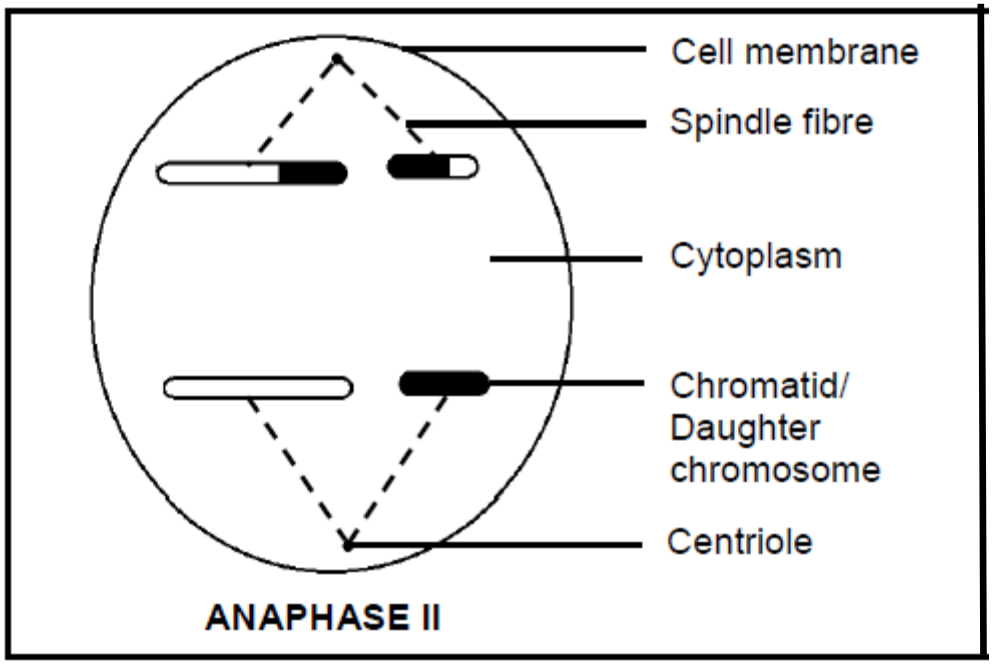
- and when it fertilises a normal ovum✓/ gamete with 23 chromosomes
- the zygote will have 3 chromosomes at position 21✓/ 47 chromosomes (3)

11.3. (a) Prophase I (1)

(b) – Adjacent chromatids of homologous chromosomes cross✓
- at a point called the chiasma✓
- There is an exchange of DNA segments✓/genetic material (3)

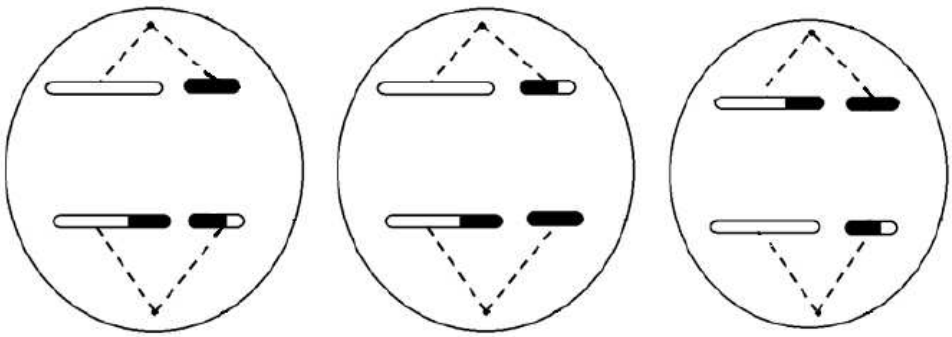
(10)

Question 12



OR

ANY ONE OF THE FOLLOWING ARRANGEMENTS INCLUDING CORRECT LABELS



MARK ALLOCATION FOR DIAGRAM

Correct phase drawn/chromatids separating **(P)**	1
Correct shading of chromatids **(S)**	1
Correct number and size of individual chromatids/daughter chromosomes (2 short and 2 long) **(N)**	1
Any TWO correct labels	2
TOTAL	5

(5)

Question 13

13.1. Centromere✓ (1)

13.2. Metaphase I✓ (1)

13.3. - A pair of chromosomes with the same structure✓/location of centromere/ length and
- the same sequence of genes✓
- One is of maternal origin and the other of paternal origin✓ (3)

13.4. - Some chromatids have a mixture of genetic material✓ from its homologue
- as crossing over✓ took place
- during Prophase I✓ (3)

13.5. 48✓✓ arbitrary units. (2)

(10)

Question 14

14.1. Centriole✓ (1)

14.2. Anaphase I✓ (1)

14.3. - The spindle fibres contract✓
- The centromeres split✓
- Each chromatid is pulled to the opposite poles✓ Any (2)

14.4. Crossing over✓ (1)

14.5. It leads to (genetic) variation✓
(Mark first ONE only) (1)

14.6. 46✓/23 pairs (1)\

14.7. Structure B consists of two DNA molecules✓/ contains a double thread/ is made up of two chromatids
-because of DNA replication✓
- Structure C consists of one DNA molecule✓/ contains a single thread/ chromatid
- because it is unreplicated✓/ as a result of splitting of the chromosome during anaphase 2 Any (3)

(10)

Question 15

15.1. a) Centriole✓ (1)
b) Chromosome✓ (1)
c) Cell membrane✓ (1)

15.2. a) 2✓- Metaphase II✓ (2)
b) 4✓- Prophase I✓ (2)
c) 1✓- Anaphase I✓ (2)

15.3. a) 2✓ (1)
b) 23✓ (1)

c) 46✓ (1)
(12)

Question 16

16.1. a) Meiosis✓/ Meiosis I (1)
b) Prophase I✓ (1)
16.2. Ovary✓ (1)
16.3. C✓- centromere✓ (2)
16.4. 3✓/Three (1)
(6)

Question 17

17.1 (a) centromere✓ (1)
. (b) Chiasma✓/chiasmata (1)
(c) Homologous chromosomes✓/ -chromosome pair/bivalent (1)
(d) Chromatid✓/ sister chromatid (1)

17.2 - Similar shape✓/ similar centromeres
. - size✓ and
- genetic composition✓
(Mark first TWO only) (2)

17.3 - in prophase 1✓
. - Non-sister chromatids/ one chromatid of each homologous chromosome
pair✓
- touch✓/ overlap
- at a point called chiasma✓
- DNA/ genetic material is crossed over✓/ swopped at the chiasma. (5)

17.4 (a) 21✓ (1)
.
(b) 42✓ (1)

(c) 21✓ (1)
(14)

Question 18

- When chromosome pair 21/chromosome 21 fail to separate✓
- during Anaphase✓
- the daughter cells (gametes) will have 24 chromosomes✓/an extra chromosome
- when this gamete is fertilised by a normal gametes✓ with 23 chromosomes.
- the zygote will have 47 chromosomes✓/3 chromosomes at position 21/Trisomy 21

(5)

TOPIC: GENETICS

Question1

Multiple choice questions:

1.1 C✓✓
1.2 C✓✓
1.3 C✓✓
1.4 B✓✓
1.5 A✓✓

(5x2) **(10)**

Question 2

Biological terms:

	DESCRIPTION	TERM
2.1	The study of heredity and variation in organisms	**Genetics**
2.2	All the genes that make up an organism	**Genome**
2.3	Two or more alternative forms of a gene at the same locus	**Alleles**
2.4	The position of a gene on a chromosome	**Locus**
2.5	The non-sex chromosomes in humans	**Autosomes**
2.6	An inherited disorder where blood fails to clot properly	**Haemophilia**
2.7	The number, shape and arrangement of all chromosomes in the nucleus of a somatic cell	**Karyotype**
2.8	A genetic cross involving one gene and its alleles	**Monohybrid**
2.9	A genetic disorder where blood does not clot	**Haemophilia**
2.10	The use of living organisms and their biological processes to improve the quality of human life	**Biotechnology**
2.11	The type of inheritance involving two alleles that are not dominant over one another	**Incomplete dominance**
2.12	Characteristics controlled by genes which are located on the sex chromosomes	**Sex-linked**
2.13	The type of inheritance involving alleles that equally determine the phenotype of heterozygous offspring	**Codominance**
2.14	An allele that is expressed phenotypically only in the homozygous condition	**Recessive**
2.15	The physical and functional expression of a gene	**Phenotype**
2.16	The production of a genetically identical copy of an organism using biotechnology	**Cloning**
2.17	The manipulation of the genetic material of an organism to get desired changes	**Genetic engineering**
2.18	A diagram showing the inheritance of genetic disorders over many generations	**Pedigree diagram**
2.19	An allele that does not influence the phenotype when found in the heterozygous condition	**Recessive**

2.20	Organisms having two identical alleles at a given locus	**Homozygous**
2.21	An allele that is always expressed in the phenotype	**Dominant**
2.22	An individual having two non-identical alleles for a characteristic	**Heterozygous**
2.23	A segment of a chromosome that codes for a particular characteristic	**Gene**
		23 x1 = **(23)**

Question 3
Matching Columns

3.1 Both A and B✓✓
3.2 None✓✓
3.3 A only✓✓
3.4 B only✓✓
3.5 A only✓✓

(4x2) **(8)**

Question 4

4.1 Incomplete dominance✓ (1)

4.2 - The pink flower colour is an intermediate phenotype✓/ a blend of red and white indicating that neither of the alleles is dominant✓ (2)

4.3

P_1 Phenotype: Pink x Pink✓
Genotype: RW x RW✓

Meiosis

G/gametes: R, W x R, W✓

Fertilisation

F_1 Genotype: RR; RW; RW; WW✓

Phenotype: 1 Red: 2 Pink: 1 White✓*

P_1 and F_1✓
Meiosis and fertilisation✓

OR

P_1 Phenotype: Pink x Pink✓
Genotype: RW x RW✓

Meiosis

Fertilisation

Gametes	R	W
R	RR	RW
W	RW	WW

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotype: 1 Red: 2 Pink: 1 White✓*

P_1 and F_1✓
Meiosis and fertilisation✓

1* **compulsory** + Any 5

(6)
(9)

Question 5

5.1

P_1 Phenotype: Male x Female✓
Genotype: XY x XX✓

Meiosis

G/gametes: X, Y x X, X✓

Fertilisation

F_1 Genotype: XX; XX; XY; XY✓

Phenotype: female : male✓

P_1 and F_1✓
Meiosis and fertilisation✓

OR

P_1 Phenotype: Male x Female✓
Genotype: XY x XX✓

Meiosis

Fertilisation

Gametes	X	Y
X	XX	XY
X	XX	XY

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotype: female: male✓

P_1 and F_1✓
Meiosis and fertilisation✓

Any (6)

5.2 - Normal females have two X□chromosomes
- Normal males have one X and one Y□
- The female always provides X in the egg□
- If an egg cell is fertilized by an X bearing sperm□a female/girl□is formed
- If an egg is fertilized by a Y bearing sperm
- a male/boy□is formed

Any (5)

OR

Gametes		male gamete✓	
		X	Y
female gamete✓	X	XX✓	XY✓

2 XX : 2 XY
Female ✓ Male✓ (Any

(11)

Question 6

6.1 Co-dominance✓ (1)

6.2

P_1	Phenotype	Black	x	White ✓
	Genotype	BB	x	WW ✓
Meiosis				
	G/gametes	B,B	x	W,W ✓
Fertilisation				
F_1	Genotype	BW ,BW ,BW ,BW ✓		
	Phenotype	All black with patches of white✓		

P_1 and F_1 ✓
Meiosis and fertilization ✓

Any
Punnet square can also be used (6)

(7)

Question 7

7.1 Purple✓ (1)

7.2 -When purple-flowering plants and white-flowering plants are crossed ✓
− all the offspring have purple flowers ✓/have no white flowers

(2)

7.3 The two alleles for a characteristic✓
− separate during meiosis✓ so that
− each gamete contains only one allele✓ for that characteristic (3)

7.4

P_1 Phenotype: Purple x Purple✓
Genotype: Dd x Dd✓

Meiosis

G/gametes: D, d x D, d✓

Fertilisation

F_1 Genotype: DD; Dd; Dd; dd✓

Phenotype: Purple : White✓*

P_1 and F_1✓
Meiosis and fertilisation✓

*Compulsory 1 + Any 5

OR

P_1 Phenotype: Purple x Purple✓
Genotype: Dd x Dd✓

Meiosis

Fertilisation

Gametes	D	d
D	DD	Dd
d	Dd	dd

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotype: Purple: White✓*

P_1 and F_1✓
Meiosis and fertilisation✓

(6)
(12)

Question 8

(1)

8.1 ffHh ✓

8.2 (a) FfHh✓✓ (2)
(b) 3✓ (1)
(c) h✓ (1)
(d) Long fingers and continuous hairline ✓✓ (2)
(7)

Question 9

9.1 Dihybrid✓ cross (1)

9.2 TTrr✓✓ (2)

9.3 TR✓, Tr✓, tR✓, tr✓ (4)
(7)

Question 10

-An individual inherits one allele from each parent✓
- The Y chromosome was inherited from the father✓✓
- and the recessive allele/X^h was inherited from the mother✓✓
- since the mother has two recessive alleles/X✓^{h} X^h
- A son only nee
ds to get one recessive allele to be haemophiliac✓since the
- Y-chromosome does not carry any allele to mask the haemophilia allele✓
ANY **(4)**

Question 11

11.1 Pedigree✓ diagram (1)

11.2 (a) 6✓ (1)
(b) 1✓ (1)

11.3 X^GX^g✓✓ (2)

11.4 Unaffected✓ /without Goltz syndrome (2)

11.5 - Pilusa is affected ✓ X^GY
- Anju is unaffected✓ X^gX^g
- Males inherit the Y chromosome from Pilusa✓
- and inherit X^g from Anju✓ (4)
(11)

Question 12

12.1 (a) Normal female✓ (1)

(b) X^HX^h✓✓ (2)

12.2
- Haemophilia is caused by a recessive allele✓
- Carried on the X chromosome✓
- Females have two X chromosomes✓/ Males only have one X chromosome
- Females must inherit two copies of the recessive allele✓/ females who inherit only one of the recessive allele are still normal

Any (3)

12.3

P_1/P_3 Phenotype Normal male x Haemophiliac female✓

Genotype X^HY x X^hX^h✓

Meiosis

G/gametes X^H, Y x X^h, X^h✓

Fertilisation

F_1/F_3 Genotype X^HX^h; X^HX^h; X^hY; X^hY✓

Phenotype 2 normal daughters : 2 haemophiliac sons✓

*50%✓ **chance of having a haemophiliac son**

P_1 and F_1✓

Meiosis and fertilisation✓

***1 compulsory** +any 6

OR

P_1/P_3 Phenotype Normal male x Haemophiliac female ✓

Genotype X^HY x X^hX^h✓

Meiosis

Fertilisation

Gametes	X^h	X^h
X^H	X^HX^h	X^HX^h
Y	X^hY	X^hY

1 mark for correct gametes
1 mark for correct genotypes

F_1/F_3 Phenotype 2 normal daughters : 2 haemophiliac sons✓

*50%✓ **chance of having a haemophiliac son**

P_1 and F_1✓

Meiosis and fertilisation✓ ***1 compulsory**+any 6

(7)

(13)

Question 13

13.1 A change in the sequence✓ of nitrogenenous bases✓ /nucleotides in a gene (2)

13.2 Nigeria ✓% (1)

13.3 39 746 ✓ x 100✓ =13✓ % (3)
305 733

13.4 (a) dd✓ (1)
(b) Dd✓ (1)
(8)

Question 14

14.1 The dominant allele is always expressed (in the phenotype) when in the heterozygous condition✓✓
OR
- The dominant allele masks/hides the (phenotype of the) recessive allele ✓✓ (2)

14.2 (a) N✓ (1)
(b) Tt✓ (1)

14.3
- J is a taster and therefore must have one dominant allele✓/ T
- Individual K is tt✓
- Individual O is a non-taster✓/ is homozygous recessive/tt
- She must have inherited a recessive allele/t from each parent✓
- Therefore, J must have one recessive allele✓ /t

OR

- J is a taster and therefore must have one dominant allele✓ /T
- If J is homozygous dominant✓ /TT
- and K is homozygous recessive✓ /tt
- then it is not possible to have child (O) who is homozygous recessive✓ / tt
- as she must have inherited a recessive allele/t from each parent✓ Any (4)

(8)

Question 15

15.1 (a) 3✓ /Three (1)
(b) 2✓ /Two (1)

15.2 Hearing✓ (1)

15.3
- Bob and Ann can both hear✓
- They have a child who is deaf✓ /who has the genotype aa
- This means that each parent carries an allele for deafness✓ /are heterozygous/Aa
- but it is masked✓ by the dominant allele /which is for hearing (4)

15.4 AA✓ and Aa✓ (2)
(9)

Question 16

16.1 - Spine✓
- Hips✓
(Mark first TWO only) (2)

16.2 - A change in the sequence✓
- of nitrogenous bases✓ /nucleotides in DNA (2)

16.3 - To check for the gene mutation✓
- and if it results in the high bone density✓ (2)

16.4 Produces high bone density✓ /reduces the risk of bone fractures (1)

16.5 $\frac{13}{20}$✓ x 100✓ = 65✓% **OR** $\frac{7}{20}$ x 100✓ = 35%
(100 – 35)✓ = 65✓% (3)
(10)

Question 17

17.1 (a) 4✓/Four (1)

(b) 1✓/One (1)

17.2 I^Ai✓✓ (2)

17.3 (a) Son 1✓ (1)

(b) Mother✓ (1)

(c) Son 1✓ (1)
(7)

Question 18

18.1 - The nucleus of the somatic cell is diploid✓/ has a full set of chromosomes/has all the genetic material whereas
- the nucleus of the sperm cell is haploid✓/contains half the set of chromosomes/ has half the genetic material
- The somatic cell carries the desired characteristic✓/straight hair (3)

18.2 -To ensure that:
- The DNA (of the ovum)/characteristic of curly hair is removed✓
- Only the desired DNA is present in the clone✓
- Correct number of chromosomes is present in the clone✓ Any (2)

18.3 (Horse) S ✓ (1)

18.4 - To produce organisms with desired traits✓ e.g. health, appearance, nutritious, yield, shelf life etc.
- Conservation of threatened species✓
- To create tissue/organs for transplant✓ Any (2)
(Mark first TWO only)
(8)

Question 19

19.1 I^A✓ I^B✓ i✓ (3)

19.2 2✓ (1)

19.3 - Any individual inherits one allele✓
- from each parent✓ (2)

19.4 - Each child✓
- has an equal✓/25% chance of having
- any blood group✓/ A, B, AB, or O. (3)
(9)

Question 20

20.1 (a) I^BI^B✓of I^Bi✓ (2)
(b) ii✓ (1)

20.2 - The baby inherited one allele for type O blood/i from each parent✓since
- her genotype is ii✓
- Mr Phonela does not have an allele for O blood✓ (3)

20.3 Blood type can be used to exclude a particular man✓as the parent
but it cannot confirm that a particular man is the father✓
Since a large portion of the population have the same blood type✓
Any (2)
(8)

Question 21

21.1 3✓/ Three (1)

21.2 - Complete dominance✓
- The allele for blood group B/ I^B is dominant✓ and
- the allele for blood group O/ i is recessive✓ (3)

21.3

P Phenotype: Blood group AB x Blood group B✓

Genotype: I^AI^B x I^Bi✓

Meiosis

G/gametes I^A I^B x I^B i✓

Fertilisation

F_1 Genotype: I^AI^B I^Ai I^BI^B I^Bi✓*

Phenotype: Blood group:

AB; A; B✓*

P_1 and F_1✓

Meiosis and fertilisation✓

Compulsory 2*+ Any 4

OR

P_1 Phenotype: Blood group AB x Blood group B✓

Genotype: I^AI^B x I^Bi✓

Meiosis

Fertilisation

Gametes	I^A	I^B
I^B	I^AI^B	I^BI^B
i	I^Ai	I^Bi

1 mark for correct gametes
1 mark for correct genotypes*

F_1 Phenotype: Blood group:

AB; A; B✓*

P_1 and F_1✓

Meiosis and fertilisation✓

Compulsory 2*+ Any 4 (6)

(10)

Question 22

22

- The blood group of a child is determined by the alleles received from both parents✓
- The blood group of the mother, the child and the possible father is determined✓
- If the blood group of the mother and possible father cannot lead to the blood group of the child✓
- the man is not the father✓
- If the blood group of the mother and the possible father can lead to the blood group of the child✓
- the man might be the father✓
- This is not conclusive✓
- because many men have the same blood group✓

Any 6 (6)

TOPIC: EVOLUTION

Question1

1.1 B✓✓
1.2 C✓✓
1.3 C✓✓
1.4 D✓✓
1.5 D✓✓
1.6 C✓✓

(6 x 2) **(12)**

Question 2

		DESCRIPTION	**TERM**
	2.1	A type of variation where there is a range of phenotype for the same characteristics	**Continuous variation**
	2.2	Present day distribution of living organisms	**Biogeography**
	2.3	The selection of desirable characteristics by humans	**Artificial selection/ selective breeding**
	2.4	The process whereby new species are formed	**Speciation**
	2.5	The type of variation in a population with no intermediate phenotype	**Discontinuous variation**
	2.6	An explanation describing evolution as consisting of long phases of little change alternating with short phases of rapid change	**Punctuated Equilibrium**
	2.7	The permanent disappearance of species from earth	**Extinction**
	2.8	An explanation for something that has been observed in nature and which can be supported by facts, laws, and tested hypothesis	**Theory**
	2.9	Organisms with similar characteristics, able to interbreed randomly and produce fertile offspring	**Species**
	2.10	Structured in different organism that have similar basic plan which suggest that they share common ancestor	**Homologous structures**
	2.11	The process that enables organisms with desirable characteristics to survive and reproduce in a particular environment	**Natural selection**
	2.13	Remains of life forms preserved in rocks, ice, and dried sap trees	**Fossils**
	2.14	Change in the characteristics of species over time	**Biological evolution**
	2.15	Large, pointed teeth in African apes that are used for tearing food	**Canine**
	2.16	The part of the skull that houses the brain	**Cranium**

	2.17	Having a protruding jaw	**Prognathous**

	2.18	A diagrammatic representation showing possible evolutionary relationships between different species	**Phylogenetic tree/Cladogram**	
	2.19	The opening in the base of the skull through which the spinal cord passes	**Foramen magnum**	
	2.20	Family to which humans belong	**Hominidae**	
	2.21	An upright posture and walking only on two legs	**Bipedalism**	
	2.22	The type of vision shared by apes and humans that allows for depth perception	**Stereoscopic vision**	
	2.23	The act of walking on all four limbs	**Quadrupedal**	
			(23 x 1)	**(23)**

Question 3

3.1 A only✓✓
3.2 B only✓✓
3.3 Both A and B✓✓
3.4 A only✓✓
3.5 Both A and B✓✓
3.6 A only✓✓

(6 x 2) **(10)**

Question 4

4.1 Genetic✓ evidence (1)

4.2 1 – **A**✓ **C**

2 – **C**✓ OR **A**

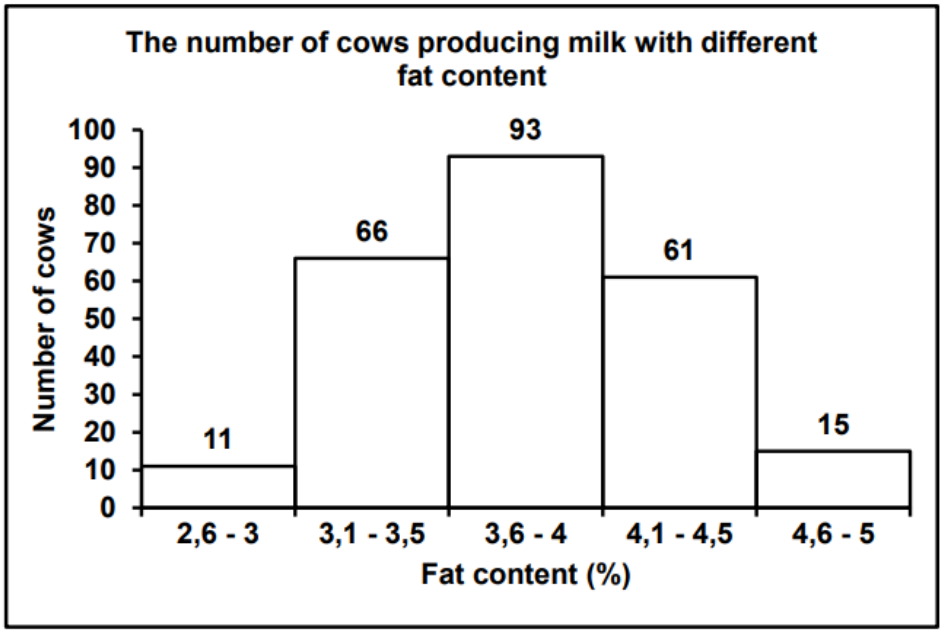
3 – **B**✓ **B**

(3)

(4)

Question 5

5.1



Guideline for assessing the graph

CRITERIA	ELABORATION	MARK
Correct type of graph **(T)**	Histogram drawn	1
Caption of graph **(C)**	Both variables included	1
Axes labels **(L)**	X- and Y-axis correctly labelled with units	1
Scale for X- and Y-axis **(S)**	- Same width of bars for X-axis and - Correct scale for Y-axis	1
Plotting of bars **(P)**	1 to 4 bars plotted correctly All 5 bars plotted correctly	1 2

(6)

5.2 $\frac{11}{246}$ ✓ x 100✓ = 4,47✓ % (Accept 4,5) (3)

5.3 Continuous✓ variation (1)

5.4 There is range of intermediate phenotypes✓ /the fat content % is a range (1)

(11)

Question 6

6.1
- Crossing over✓
- Random arrangement of chromosomes✓
- Random mating✓
- Random fertilisation✓
- Chromosomal mutations✓

(Mark first THREE only) (3)

6.2 (a) Mutant gene✓ /inherited from their ancestors (1)

(b) Influenced by altitude✓ /level of oxygen (1)

6.3
- More haemoglobin present✓
- to allow for maximum absorption of the available oxygen✓

OR

- More oxygen will be available✓
- to meet their energy needs✓ (2)

6.4
- Originally the amount of red blood cells was similar in all humans✓ /the Tibetans did not produce a large number of red blood cells
- As a result of low oxygen content at high altitudes✓
- the redd blood cells tried to increase the amount of oxygen absorbed✓
- As a result ancestral Tibetans produced more red blood cells✓ /developed ways of using oxygen more efficiently to increase the availability of oxygen to the body
- This acquired characteristic✓
- was the passed on to their offspring✓ (5)
- All Tibetans now produce more red blood cells✓ /use oxygen more efficiently to survive at high altitudes Any **(12)**

Question 7

7.1 (a) Gall size✓ (1)

(b) Percentage of gallfly larvae killed✓ (1)

7.2
- Nutrition✓/food
- Protection✓
- Space✓ Any

(Mark first ONE only) (1)

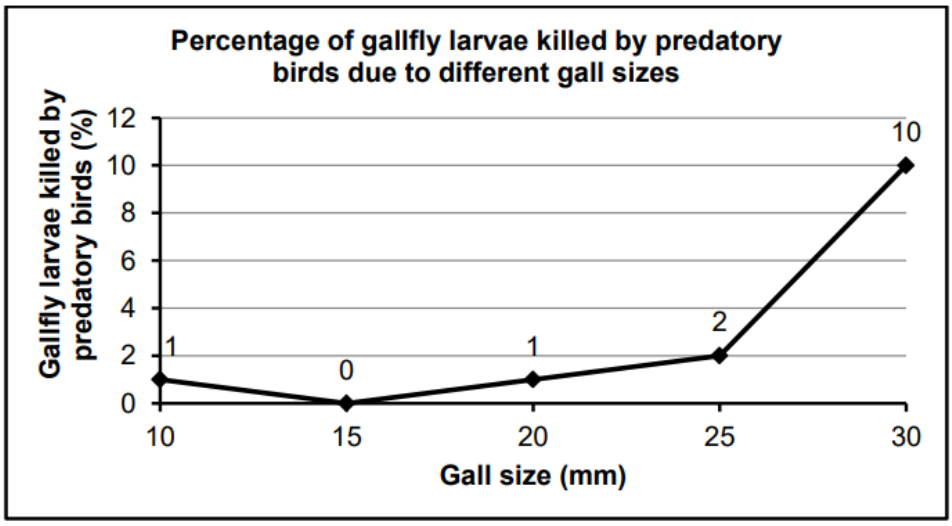
7.3 - There is a range of (intermediate) values✓ in gall size (1)

7.4
- Larvae in 30mm galls are eaten more✓
- since they are more visible✓ to birds and
- contain more/larger larvae✓

OR

- Larvae in galls that are 25mm and smaller are eaten less✓
- since they are less visible✓ to birds and
- contain fewer/smaller larvae✓ (3)

7.5



Guideline for the assessing of the graph

CRITERIA	ELABORATION	MARK
Correct type of graph **(T)**	Line graph drawn	1
Caption of graph **(C)**	Both variables included	1
Axes labels **(L)**	Correct labels and units on X- and Y-axes	1
Scale for X- and Y-axes **(S)**	Equal spacing between intervals for each axis	1
Plotting of points **(P)**	1 to 4 points plotted correctly All 5 points plotted correctly	1 2

(6)
(13)

Question 8

8.1
- Organisms produce a large number of offspring✓
- There is variation✓ amongst the offspring
- Some have favourable characteristics and some do not✓
- When there is a change in the environmental conditions✓/ there is competition
- organisms with favourable characteristics, survive✓
- whilst organisms with unfavourable characteristics, die✓
- The organisms that survive, reproduce✓
- and pass on the allele for the favourable characteristic to their offspring✓
- The next generation will therefore have a higher proportion of individuals with the favourable characteristic✓

Any **(7)**

Question 9

(a)
- He would use his of use and disuse✓
- and law of iheritance of acquired characteristics✓
- The ancestor of spider monkeys had short tails✓
- to be able to hold onto tree branches✓
- As a result their tails became longer✓
- and this characteristic was passed on to the next generation✓ Any (6)

(b)
- Evolution occurs by natural selection✓
- There was variation in the ancestral population
- Some spider monkeys had short tails✓
- and some had long tails✓
- The spider monkeys with long tails were able to hold onto tree branches✓ /did not
- fall to the ground
- and survived✓ /were not attacked by predators
- Those with short tails could not hold onto tree branches✓ /fell on the ground
- They died✓ /were attacked by predators
- The characteristic for long tails was passed to the offspring✓ Any (8)

(14)

Question 10

	Lamarckism		Darwinism
1	Variation of the offspring occurs when individuals in the population change. ✓	1	Variation in the offspring is inherited. ✓
2	Change occurs because of adaptation to the environment/ Law of use and disuse.✓	2	Natural selection – individuals best suited to the environment survive.✓
3	Individuals in the population change.✓	3	The population as a whole changes.✓
4	Acquired characteristics are inherited by offspring.✓	4	Characteristic are passed on from generation to generation to enable individuals to survive in the environment.✓

(Mark first THREE only) (Any (3 x 2) + 1 for table) **(7)**

Question 11

11.1
- As the wings were used less✓
- they became reduced in size✓/less developed
- and could not be used for flying✓
- This acquired characteristic was passed on to the offspring✓ (4)

11.2 - Breeding at different times of the year✓
- Species-specific courtship behaviour✓
- Adaptations to different pollinators✓
- Infertile offspring✓
- Prevention of fertilisation✓

(Mark first THREE only) Any (3)
(7)

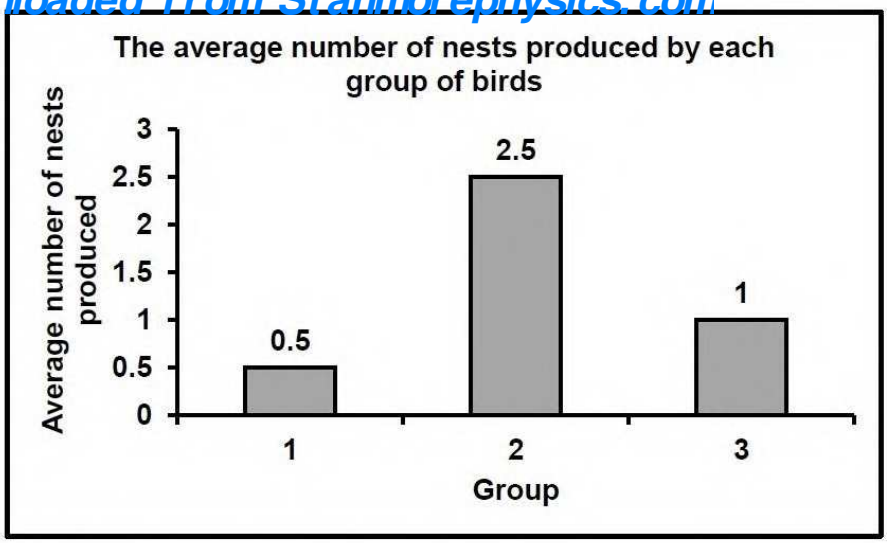
Question 12

12.1 (a) (Species-specific) courtship behaviour✓ (1)
(b) Length of the (male long-tailed widowbird's) tails✓ (1)

12.2 - A larger sample size✓
- Increases the reliability✓ of the investigation (2)

12.3 - To serve as a control✓
- so that it can be compared✓ with the other groups
- and show that the tails length is the only factor that affects the results✓ /improves the validity of the investigation Any (2)

12.4



Guideline for assessing the graph

CRITERIA	ELABORATION	MARK
Correct type of graph **(T)**	Bar graph drawn	1
Caption of graph **(C)**	Both variables included	1
Axes labels **(L)**	X- and Y-axis correctly labelled	1
Scale for X- and Y-axis**(S)**	- Equal space between bars and width of bars for X-axis and - Correct scale for Y-axis	1
Plotting of bars **(P)**	1 to 2 bars plotted correctly All 3 bars plotted correctly	1 2

(6)

12.5 The longer the (male long-tailed widowbird's) tail, the higher the mating success✓✓

OR

The shorter the (male long-tailed widowbird's) tail, the lower the mating success✓✓ (2)

(14)

Question 13

13.1
- The mating call can be easily heard✓/can be heard over a distance
- to ensure that a mate is attracted✓ (2)

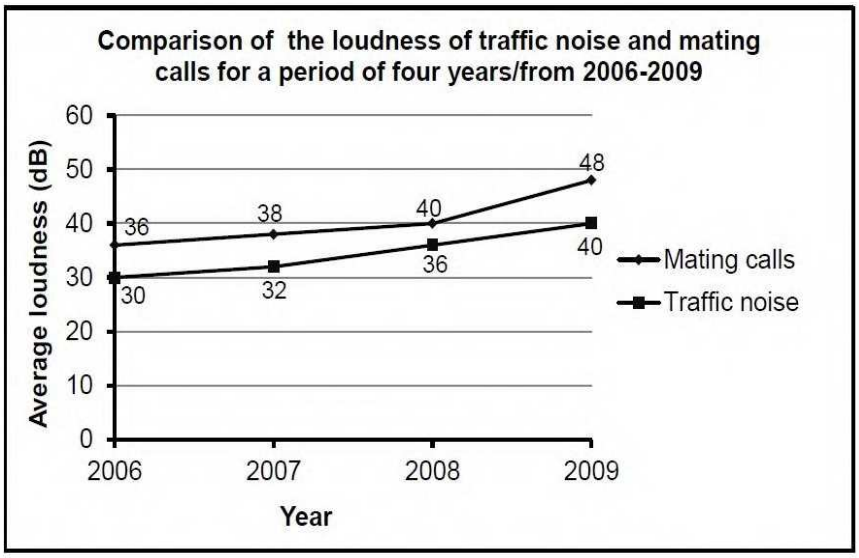
13.2
- The investigation was done over a long period✓/6 years
- Many recordings were done in each year✓/ an average was calculated Any 1 (1)

13.3 As the traffic noise increased, the loudness of frogs' mating calls increased ✓✓ (2)

13.4
- Type of apparatus used✓
- Time of recordings✓
- Distance recordings are taken from✓
- Person taking measurements✓ Any 2 (2)

(Mark first TWO only)

13.5



CRITERION	ELABORATION	MARKS
TYPE	Two line graphs on the same set of axes (T)	1
KEY	A key or labels for each graph is present (K)	1
TITLE	Title of graph includes 3 variables	1
SCALE	Correct scale for X-axis and Y-axes (S)	1
LABELS	Correct label and unit for X-axis and Y-axis (L)	1
PLOTTING	Correct plotting of points	1: 1 to 7 points plotted correctly 2: Graph drawn for **required years** only, with all 8 points plotted correctly.

(7)

(14)

Question 14

14.1 Survival of the owls✓ (1)

14.2 The brown owls are less suited to survive than the white owls✓✓

OR

14.3 The white owls are more suited to survive than the brown owls✓✓ (2)

14.4
- There is a decrease in the number of white owls✓ because
- there is less snow✓ and
- white owls will not be camouflaged✓/will be more visible to predators (3)

14.5
- They counted/sampled the number of owls at the beginning✓ of the 4-month period
- and again, at the end✓
- Then they calculated the difference✓between the two numbers (3)

14.6 (Same):
- Time period✓/4 months
- Population✓
- Season✓/winter
- Method of calculation✓

Any (1)

(Mark first ONE only)

(10)

Question 15

15.1
- They measured the jaw size of lizards on both islands✓ and
- determined the average jaw size for each population✓
- They calculated the difference✓ between the two (3)

15.2
- A larger jaw allows for better muscle attachment✓
- Thereby increasing the bite force✓/ability
- to break down the fibrous plant material✓ (3)

15.3
- They allowed the lizards of the two islands to mate✓
- and determined if they were able to interbreed✓ and
- give rise to fertile offspring✓

Any (2)

15.4
- Biodiversity remains the same✓/there is no effect
- because the number of species remains the same✓/a new species has not been formed

OR

- Biodiversity decreases✓
- because some species of plants eaten on Island **B** could become extinct✓ (2)

15.5
- There is variation in the size of the lizards' jaws✓
- Some have small jaws and others have large jaws✓
- Due to the larger supply of plants✓/fewer insects
- the lizards with the larger jaws will have more food✓
- and survive✓
- while those with smaller jaws will be unable to feed✓
- and die✓
- The lizards that survive will reproduce✓ and
- the allele for larger jaws will be passed on to the offspring✓
- The next generation will have a higher proportion of lizards with larger jaws✓ Any (7)

(17)

Question 16

16.1 1900✓ (1)

16.2 $\left\{\frac{80}{20}\right\}$✓ x 100✓ = 400✓%

OR

$\left\{\frac{(100-20)}{20}\right\}$✓ x 100✓ = 400✓% (3)

16.3

Natural selection	Artificial selection
The environment or nature is the selective force✓	Humans represent the selective force✓
Selection is in response to suitability to the environment✓	Selection is in response to satisfying human needs✓
Occurs within a species✓	May involve one or more species✓ (as in cross breeding)

(Mark first TWO only) 1 for Table + Any 2 x 2 (5)

(9)

Question 17

17.1 - It is characterised by long periods of little or no change✓
- alternating with short periods of rapid change✓
- during which new species may form✓ (3)

17.2 They contain toxins✓which kill the snakes
OR
Too large✓to be swallowed Any (1)

17.3 - Having a small jaw✓
- means cane toads cannot be consumed✓
- thereby protecting the snakes from ingesting the toxins✓ (3)

17.4 Since the snake's jaws were used less✓ /not used
the snakes developed smaller jaws✓
This characteristic (of a smaller jaw) was inherited by the offspring✓
Over many generations the jaw of the snake became smaller✓ (4)
(11)

Question 18

- A population of a particular species becomes separated✓
- by a geographical barrier✓
- There is no gene flow between the separated populations✓
- Natural selection occurs independently in each population✓
- due to exposure to different environmental conditions✓/selection pressures
- The populations become very different✓from each other
- genotypically and phenotypically✓
- Even if the populations were to mix again✓
- they will not be able to interbreed✓
- The different populations are now new species✓

Any (6)

Question 19

19.1 - There was once one large continent✓ and
- the common ancestor existed throughout this continent✓
- When Madagascar separated✓
- the common ancestor was found in both✓ regions (4)

19.2
- The common ancestor became separated into two **groups** by the ocean✓*
- There was no gene flow between the two **groups**✓
- Each **group** experienced different environmental conditions✓
- and underwent natural selection independently✓
- The individuals in each **group** became different✓
- genotypically and phenotypically✓
- to form the pottos and lemurs✓*
- Eventually if the two groups are mixed again, they cannot interbreed✓/produce fertile offspring. *2 **Compulsory** + Any 4

(6)

Question 20

20.1 Biogeography✓ (1)

20.2 - Similar organisms✓ (3)
- that can interbreed✓
- to produce fertile offspring✓

20.3 - The original population /common ancestor once lived on a large continent✓
- and became separated by continental drift✓/oceans - There was no gene flow amongst the three populations✓*
- Each population experienced different environmental conditions✓
- and underwent natural selection independently✓
- The individuals in each population became different✓ - genotypically and phenotypically✓
- Even if the (three) populations are mixed again✓
- they would not be able to interbreed✓/produce fertile offspring - forming the different species, the coyote, jackal, and dingo✓ *

2 compulsory* + any 5 (7)

(11)

Question 21

MUTATIONS AND EVOLUTION IN PRESENT TIMES

- In a population of insects✓/bacteria/Hi viruses/Galapagos finches
- mutations are a source of variation✓
- which may make some organisms more resistant✓/better suited
- to insecticides✓/antibiotics/antiretroviral medication/drought
- Those individuals that are not resistant/suited will die✓ whereas
- those that are resistant/well suited, will survive✓
- This is known as natural selection✓
- As a result, individuals of the future generations will be resistant to the
- insecticides✓/antibiotics/antiretroviral/adapted to drought

Any **(8)**

Question 22

22.1 - It decreases the number of harmful bacteria the most✓
- thereby preventing disease in cattle✓/resulting in less medical expenses
- Decreasing mortality✓/maintaining the number of cattle
- to sell✓/breed /increase profit (4)

22.2 - Natural selection✓ occurs - There is variation✓/mutation in the population of bacteria
- Some are resistant to antibiotics, some are non-resistant ✓
- When antibiotic is added✓ to the animal feed
- The bacteria that are non-resistant are killed by the antibiotic✓
- Those that are resistant survive and reproduce✓
- The characteristic for resistance to antibiotics is passed on to the offspring✓
- The next generation will have a higher proportion of antibiotic resistant bacteria✓ (6)

(10)

Question 23

23.1 Type of antibiotic✓ (1)

23.2 Same:

- Environmental conditions✓/example

- Amount of antibiotic✓
- Concentration of antibiotic✓
- Time of initial injection of antibiotics✓

- Age of the piglets✓
- Species of piglets✓
- Type food given to piglets✓
- Amount of food given to piglets✓
- Size/mass of piglets✓

- Size of petri dishes✓
- Growth medium in both sets of petri dishes✓
- Sample size of *E. coli* ✓
- Method of measurement✓
- Person doing the measurements✓
- Time interval for measurements✓

Any (2)

(Mark the first TWO only)

23.3

- Investigation was done over a period of six months✓
- Took many measurements✓/calculated the average resistance
- Used a large sample size✓ 100 piglets

Any (2)

(Mark the first TWO only)

23.4 Antibiotic **B**✓ (1)

23.5
- The average percentage resistance of *E.coli* to antibiotic **B** is lower✓ than its resistance to antibiotic **A** therefore
- more *E. coli* bacteria die in the presence of antibiotic **B**✓

(2)

23.6
- There was variation✓ in the population of *E. coli* bacteria
- Some were resistant to antibiotic **A**✓
- others were not resistant✓
- Those *E. coli* bacteria which were not resistant to antibiotic **A** were killed✓
- Those which were resistant to antibiotic **A** survive✓/reproduced
- passing on the alleles for resistance to their offspring✓
- Over time, the resistance to antibiotic **A** increased✓/the percentage of *E. coli* bacteria dying decreased

Any (5)

(13)

Question 24

24.1
- They invade farm fields✓
- They outcompete the crop plants for space✓ Any (1)

24.2
(a) Type of herbicide ✓ (1)
(b) Time taken for development of resistance✓ (1)

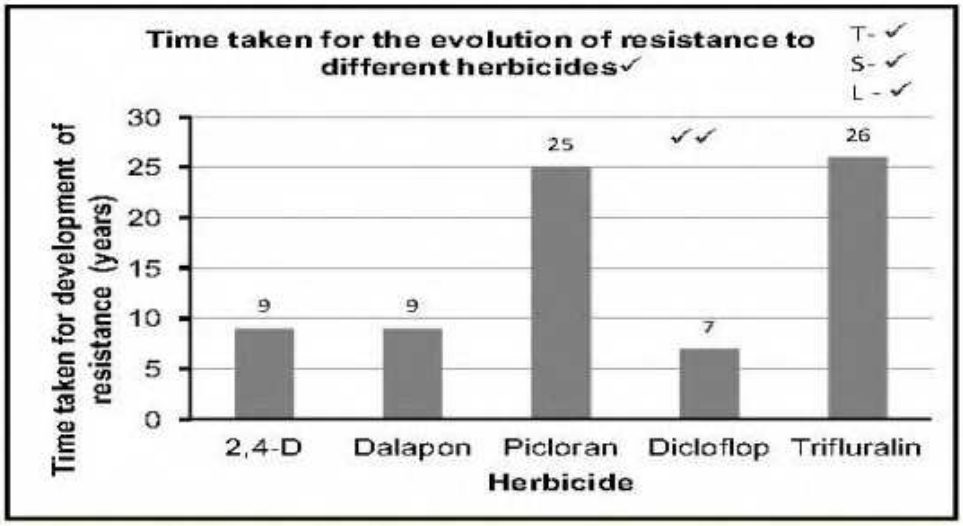
24.3
(a) Dicloflop✓ (1)
(b) Trifluralin✓ (1)

24.4 (a)
- They would apply the herbicide to the weed✓ and
- observe if the weed survives✓ over many generations (2)

(b)
- They used the same weed species as other weed species may have developed resistance to that herbicide✓
- Each weed species may respond differently✓ to a herbicide

OR

- It allows for a single variable✓
- to which all results can be attributed✓ (2)



Guideline for assessing the graph

Type: Bar graph drawn (T)	1
Title of graph	1
Correct: – **Scale** for Y-axis and (S) – Width and interval of bars on X-axis	1
Correct: – **Label** for X-axis and – **Label** and unit for Y-axis (L)	1
Plotting of bars	1- 1 to 4 bars plotted correctly 2- All 5 bars plotted correctly

(6)
(15)

Question 25

25.1
- Bare fingertips✓/nails instead of claws
- Opposable thumbs✓/ gripping ability
- Fingerprints✓
- Five fingers✓

Any (1)

(Mark first ONE only)

25.2

Differences between African apes and humans	
African apes	**Humans**
- Small cranium✓	- Large cranium✓
- Brow ridges are well developed✓	- Brow ridges are not well developed✓
- Large canines✓	- Small canines✓
- Palate is long and rectangular✓ / U-shaped	- Palate is small and semi-circular✓/ C-shaped
- Large jaws✓	- Small jaws✓
- More protruding jaws✓/ prognathous	- Less protruding jaws✓/non-prognathous
- Cranial ridges present✓	- No cranial ridge✓
- Foramen magnum in a backward position✓	- Foramen magnum in a forward position✓
- Sloping face✓	- Flat face✓
- Less developed zygomatic arch✓	- More developed zygomatic arch✓
- Less developed chin✓	- More developed chin✓
- Diastema between the teeth✓	- No diastema between the teeth✓

(Mark first THREE only) Table 1 + (3 x 2) (7)

25.3
- Short✓ and
- wide✓/broad
- Cup-shaped✓

Any (2)

(Mark first TWO only)

(10)

Question 26

26.1 Walking on two legs✓✓ (2)

26.2 (a)
- Foramen magnum moved to a more forward position✓
- to allow the spinal cord to enter vertically✓

(2)

(b)
- Pelvic girdle is short and wide✓/broad
- to support the upper body✓

(2)

(c)
- Spine is more curved✓/S shaped
- to absorb shock✓/allow flexible movement/support

(2)

(8)

Question 27

27.1

Skull 1	Skull 2
Brow ridges pronounced✓	Brow ridges less pronounced✓
More protruding jaws✓/prognathous	Less protruding jaws✓/non-prognathous
Larger jaws✓	Smaller jaws✓
Smaller cranium size✓	Larger cranium size✓
Larger teeth✓/ canines	Smaller teeth✓/canines
Poorly developed chin✓	Well developed chin✓
Sloping face✓	Flat face✓

(Mark first THREE only) Table 1 + (3 x 2) (7)

27.2
- Freely rotating arms✓
- Long upper arms✓
- Rotation around elbow joints✓
- Rotation around the wrists✓
- Opposable thumbs✓
- Bare fingertips✓/ nails instead of claws
- Five fingers✓/pentadactyl limb
- Fingerprints present✓

(Mark first FOUR only) Any (4)

27.3
- Since the cranium houses the brain✓
- a large cranial volume indicates a larger brain✓/more brain cells
- which suggests greater intelligence✓ (3)

(14)

Question 28

28.1 B✓ (1)

28.2 - The foramen magnum is in a more forward position✓✓ (2)

(Mark first ONE only)

28.3

	A		B
1	Larger canines✓	1	Smaller canines✓
2	Jaws with teeth in a rectangular/U shape✓	2	Jaws with teeth on a gentle/round curve✓
3	More protruding jaw✓/ prognathous	3	Less protruding jaw✓/non-prognathous

(Mark first TWO only) Table 1 + Any (2 x 2) (5)

28.4
- The spine is S-shaped✓*
- for flexibility✓ and
- shock absorption✓

1* compulsory + Any 1 (2)

(10)

Question 29

29.1 (a) X✓, Z✓ **(in any order)**
(Mark first TWO only) (2)

(b) C✓ (1)

29.2
- The pelvis is long✓
- and narrow✓ (2)

29.3
- The spine✓
- is S-shaped for the bipedal organism✓
- and C-shaped for the quadrupedal organism✓

OR

- The foramen magnum✓
- is in a more forward position in bipedal organisms✓
- and in a backward position in quadrupedal organisms✓

(Mark first ONE only) (3)

(8)

Question 30

30.1 X - Foramen magnum✓
Y - Canine✓ (2)

30.2
- The foramen magnum is located in a more forward position✓below the skull
- showing that organism C is bipedal✓
- This allows for the vertebral column/spine to extend vertically✓from the base of the skull
- to balance the body weight in upright walking✓ Any (3)

30.3 (a) B✓ (1)

(b) A✓ (1)

30.4
- There is an increase✓
- in the cranium size✓ from organism **B** to organism **C**
- This will allow it to house a larger brain✓/cerebrum which suggests greater intelligence (3)

(10)

Question 31

31.1
- The jaw is large in the chimpanzee✓ and small in *Homo sapiens*✓
- The jaw/ palate is rectangular in the chimpanzee✓ and rounded in *Homo sapiens*✓
- Large spaces between the teeth in the chimpanzee✓ and small/no spaces in *Homo sapiens*✓
- Large canines/teeth in the chimpanzee✓ and small canines/teeth in *Homo sapiens*✓ Any 1 x 2 (2)

(Mark first ONE only)

31.2
- The diet changed from eating raw food✓ in *Australopithecus*
- to a diet of cooked food✓ in *Homo sapiens* (2)

31.3 (a) A transitional species shows intermediate characteristics between two genera/species✓

OR

It has characteristics common to both the ancestor species and the species that follows✓ (1)

(b) The jaw is smaller than that of the chimpanzee but larger than that of *Homo sapiens*✓✓

OR

The canines/ teeth are smaller than those of the chimpanzee but larger than those of *Homo sapiens*✓✓

OR

The jaw/ palate shape is more rounded than that of the chimpanzee but less rounded than that of *Homo sapiens*✓✓

Any 1 x 2 (2)

(Mark first ONE only)

(7)

Question 32

32.1 (a) -The foramen magnum was in a backward position✓ in the ape-like beings
- but in more forward position✓ in modern humans (2)

(b) - Modern humans have larger cranium✓ than ape-like beings
- Modern humans have less sloping forehead✓ than ape-like being
- Modern humans have cranium that is more rounded✓ than ape- like being Any (2)

32.2 Foramen magnum
- This shows a change from quadrupedalism in ape-like beings to bipedalism in humans✓*
- This creates increased awareness of the environment in sensing danger✓/food
- Freeing hands to use implements✓/carry offspring
- Exposure of large surface area for thermoregulation✓
- Display of sex organs/breast as part of courtship behaviour✓

1* compulsory + Any 1 (2)

Cranium
- This allows space for larger brain✓* in humans than ape-like beings which makes the following possible:
- Better co-ordination of movement✓
- Processing of large amount of information✓
- Processing of information faster✓
- Development of spoken and written languages to communicate

1* compulsory + Any 1 (2)
(8)

Question 33

33.1 (a)
- *Sahelanthropus*✓
- *Australopithecus*✓
- *Homo*✓

(Mark first TWO only) Any (2)

(b)
- Taung child✓
- Mrs Ples✓
- (Little foot)✓

(Mark first TWO only) Any (2)

(c) *Sahelanthropus*✓ (1)

33.2 *Homo neanderthalensis*✓ (1)

33.3 650✓ cm^3 (1)

33.4 2,0 mya✓/2 000 000 years ago (1)

33.5 Genetic✓ evidence
Cultural✓ evidence
(Mark first TWO only) (2)

(10)

Question 34

34.1 Phylogenetic✓ (1)

34.2 (a) 5✓ (1)
(b) 4✓ (1)

34.3 *(Paranthropus) robustus*✓ and *(Paranthropus) boisei*✓ (2)

34.5 (a) Accept any value in the range 4,3 to 4,5 million years ago✓/mya (1)

(b) 1 mya✓ (1)

34.6 (a) *Homo neanderthalensis*✓ (1)
(b) *Homo habilis*✓ (1)

(9)

Question 35

35.1 *Hominidae*✓ (1)

35.2
- Evidence such as tools✓ /weapons/ language/ artefacts
- is used to show advances✓ in human development (2)

35.3 3 mya✓ (1)

35.4
- *H. ergaster* shows characteristics of both✓ *A. afarensis* and *H. heidelbergensis*
- therefore it is a transitional✓ species (2)

(6)

Question 36

36.1
- Modern humans originated in Africa✓ and
- then migrated to other continents✓ (2)

36.2 Hominidae✓ (1)

36.3 Mitochondrial DNA✓ (1)

36.4
- Fossils of *Ardipithecus* were found in Africa only✓
- Fossils of *Australopithecus* were found in Africa only✓
- Fossils of *Homo habilis* were found in Africa only✓
- The oldest fossils of *Homo erectus* were found in Africa✓
- The oldest fossils of *Homo sapiens* were found in Africa✓

Any (4)

(8)