KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GRADE 12

LIFE SCIENCES

REVISION DOCUMENT

Learner's Book

September 2023

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INTRODUCTION

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

The Topics in this Document have been arranged according to the sequence of topics in Paper 1 and Paper 2 as per 2021 Examination Guidelines. Therefore, this document can be used to prepare learners for Paper 1 and Paper 2 respectively.

In each topic questions were selected such that all the core concepts and core skills are included.

THE DISTRIBUTION OF TOPICS FOR THE TWO PAPERS (*CAPS* AMENDED)

PAPER 1

TOPIC	WEIGHTING	
	%	MARKS
Term 1:		
Reproduction in Vertebrates	5	8
Human Reproduction	27	41
Term 2:		
Responding to the environment (humans)	36	54
Term 3:		
Responding to the Environment (plants)	9	13
Term 2 and 3:		
Endocrine and Homeostasis (humans)	23	34
TOTAL	**100**	**150**

PAPER 2

TOPIC	WEIGHTING	
	%	MARKS
Term 1:		
DNA: Code of Life	18	27
Meiosis	14	21
Term 1 and 2:		
Genetics and Inheritance	32	48
Term 3:		
Evolution	36	54
TOTAL	**100**	**150**

FORMAT OF THE QUESTION PAPER

The examination will consist of two question papers of 2½ hours and 150 marks each.
Each question paper has the following format:

SECTION	TYPES OF QUESTIONS	MARKS
A	Short answer questions such as multiple-choice, terminology, columns/statements and matching items	50
B	A variety of question types: Two questions of 50 marks each, divided into a number of subquestions. Each may be further divided.	2 x 50 = 100

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CONTENTS

No	Topic	Page
1.	Reproduction	3 -24
2.	Human Response to the Environment	25 - 58
3.	Plant Response to the Environment	59 - 70
4.	Endocrine System & Homeostasis	71 - 87
5.	DNA: Code of Life	88 - 107
6.	Meiosis	108 - 122
7.	Genetics	123 - 141
8.	Evolution	142 - 174

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PAPER 1

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.

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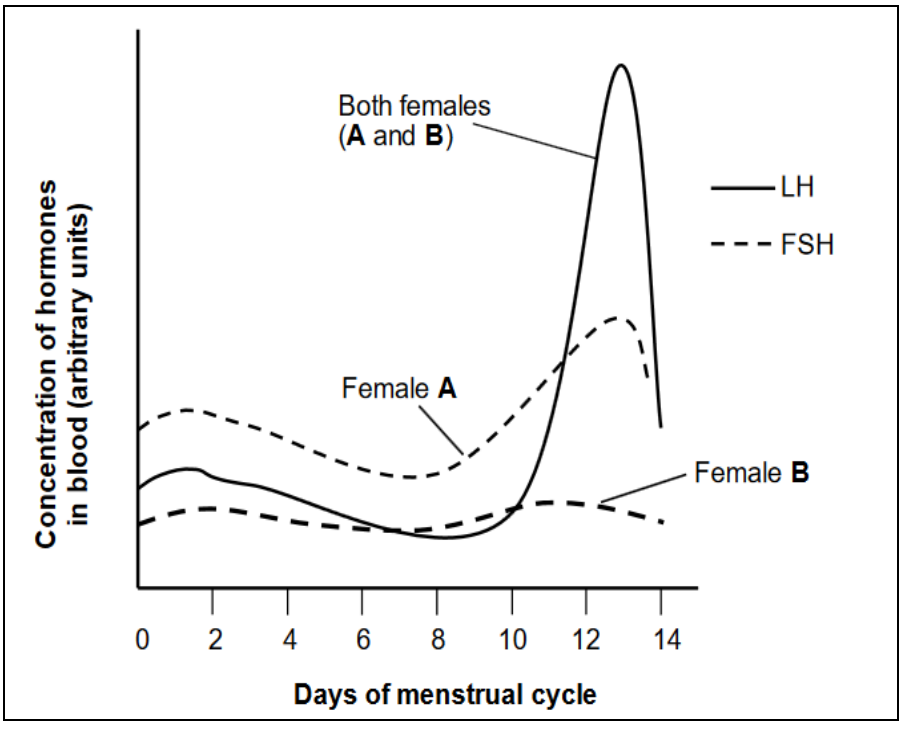
1.5 Oogenesis takes place in the …

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.

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1.8 Which ONE of the following occurs immediately after fertilisation?

A The blastula, which is a hollow ball of cells, is formed bymeiosis.
B The morula, which is a hollow ball of cells, is formed bymeiosis.
C The blastula, which is a solid ball of cells, is formed by mitosis.The morula, which is a solid ball of cells, is formed by mitosis.
D The blastula, which is a hollow ball of cells, is formed by meiosis.

1.9 The normal site of fertilisation in a human female is the …

A uterus.
B ovary.
C vagina.
D Fallopian tube.

1.10 The structure where sperms are temporarily stored is the …

A testis.
B epididymis.
C vas deferens.
D penis.

1.11 Which ONE of the following is a function of the amniotic fluid?

A Provides nutrition to the foetus
B Protects the foetus against mechanical injury
C Supplies oxygen to the foetus
D Removes the metabolic waste from the foetus

1.12 The placenta is formed by the …

A amniotic fluid and amnion.
B chorionic villi and endometrium.
C amnion and endometrium.
D amniotic fluid and chorionic villi.

(12 x 2) **(24)**

Question 2

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.	

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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	
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	
2.44	Finger-like projections that develop from the outer membrane of an embryo	

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	after implantation	
2,45	The fluid that protects the developing foetus against mechanical injury	
2.46	The organelles found in large quantities in the neck region of a sperm cell	
2.47	The type of development in birds in which the young is born fully developed and able to move and feed itself	
2.48	The structure in the sperm that contains enzymes to dissolve the outer layer of the ovum	
2.49	A blood vessel that transports carbon dioxide from the foetus to the placenta	
	(49 x 1)	**(49)**

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 develop 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

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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
3.19	An extra-embryonic membrane found in the amniotic egg	A B	Chorion Allantois
3.20	A structure that transports semen out of the body	A B	Scrotum Urethra
	(20 x 2)		**(40)**

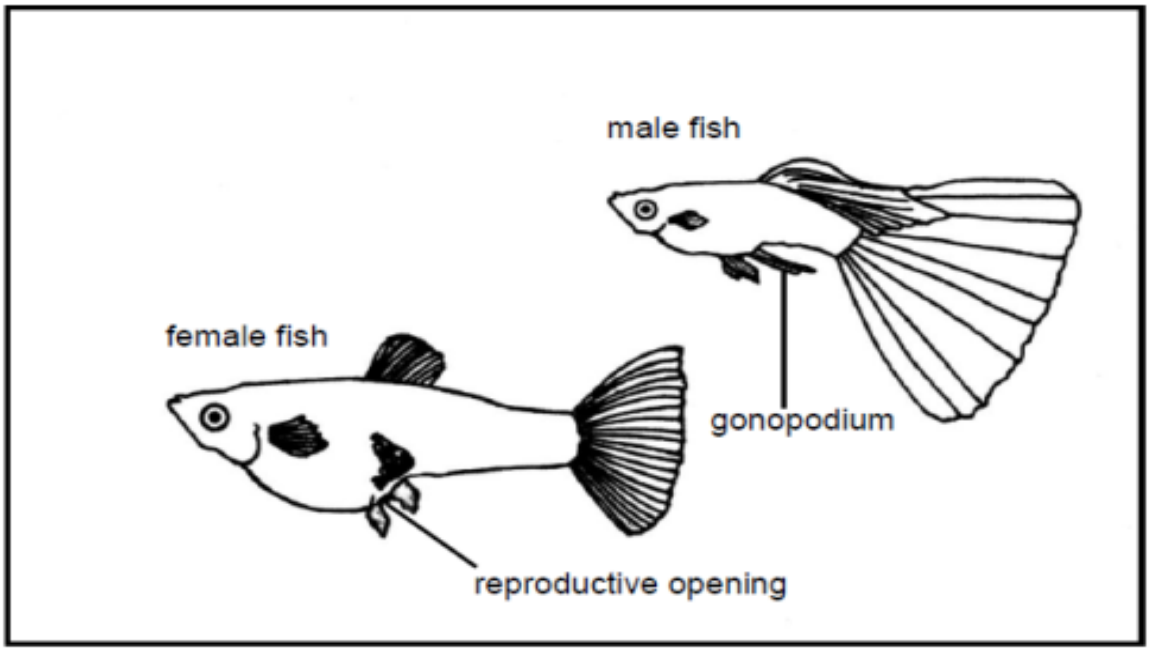
Question 4

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)

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Question 5

Describe how the developing embryo is protected and nourished in ovoviviparous organisms **(7)**

Question 6

Read the extract below.

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

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

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

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

(7)

Question 7

Read the extract below.

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

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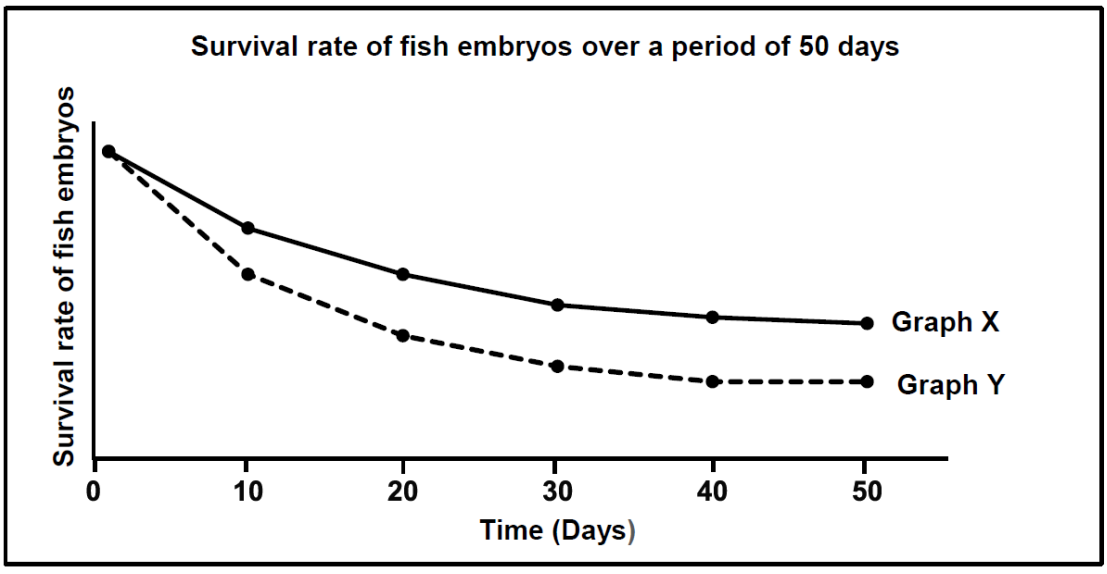

7.1 Name the type of fertilisation that takes place in both fish species. (1)
7.2 Explain why both fish species are oviparous. (2)

7.3 Describe TWO ways in which the chances of fertilisation areincreased in the northern pike fish. (2)
7.4 Which graph (**X** or **Y**) represents the survival rate of the northernpike fish? (1)
7.5 Explain your answer to QUESTION 7.4 (3)
(9)

Question 8

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

8.1 Name the type of fertilisation described above. (1)
8.2 Explain why millions of gametes are released. (3)
8.3 State why the reproduction in frogs is an example of ovipary. (1)
(5)

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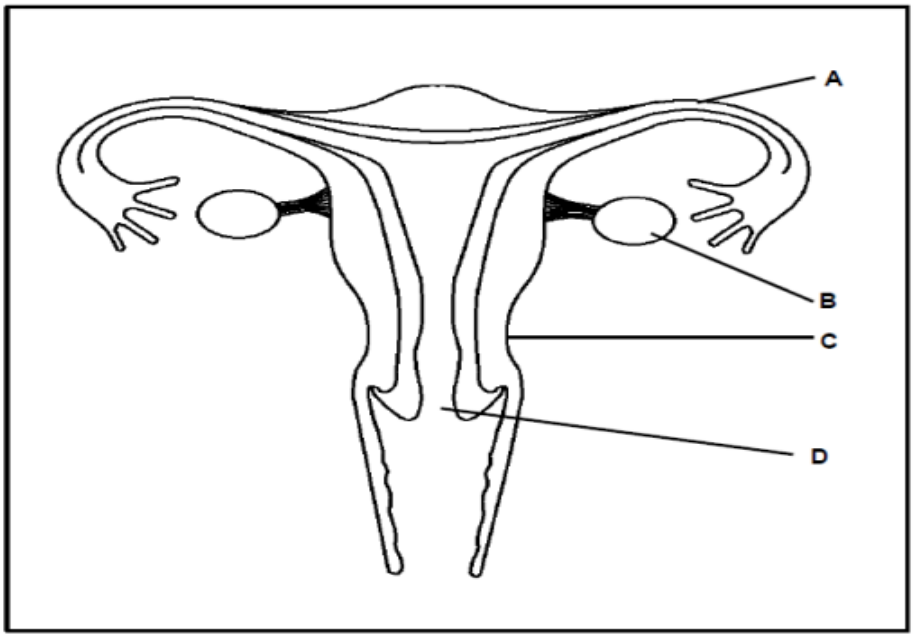
Question 9

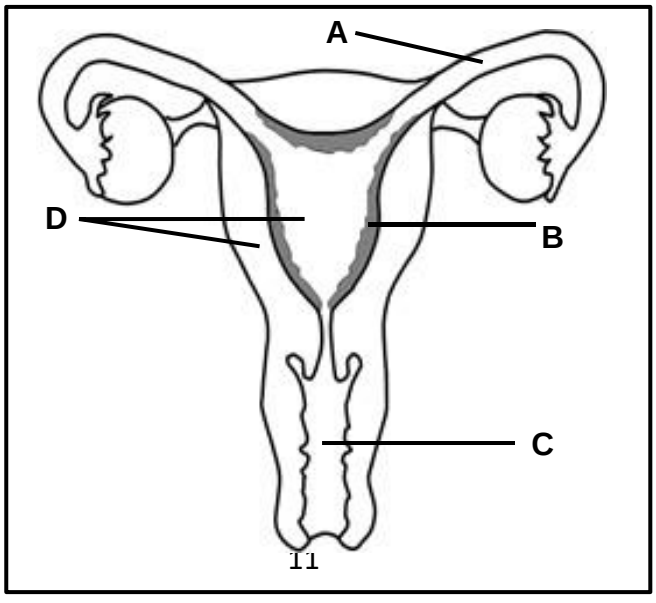
The structure below represents a part of the female reproductive system.



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

Question 10

The diagram below represents the female reproductive system.



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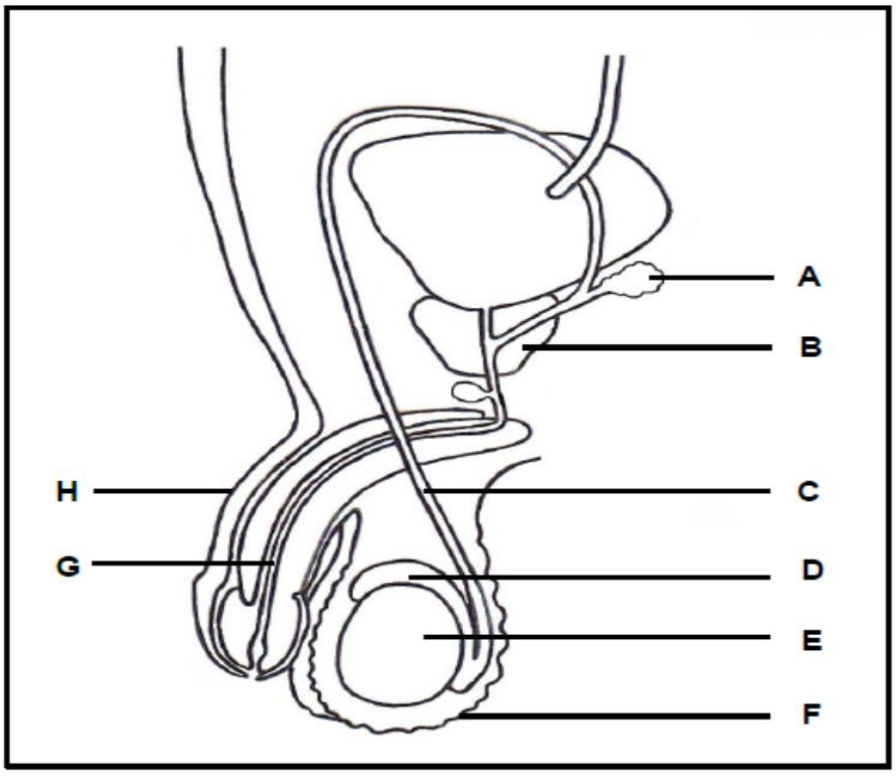
10.1 Identify part **B**. (1)
10.2 Name the process that takes place in part **A** that leads to zygote formation. (1)
10.3 Describe the process named in QUESTION 10.2 (1)
10.4 Describe the development of the zygote until implantation occurs. (4)
10.5 Explain TWO ways in which part **D** is structurally suited for gestation. (4)
10.6 Describe how the secretion of the prostate gland provides protection for the sperm from the conditions in part **C.** (2)
(13)

Question 11

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



11.1 Identify part:
(a) **C** (1)
(b) **F** (1)
(c) **H** (1)
11.2 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)
11.3 Give the LETTERS of TWO parts that contribute to the formation of semen. (2)
(11)

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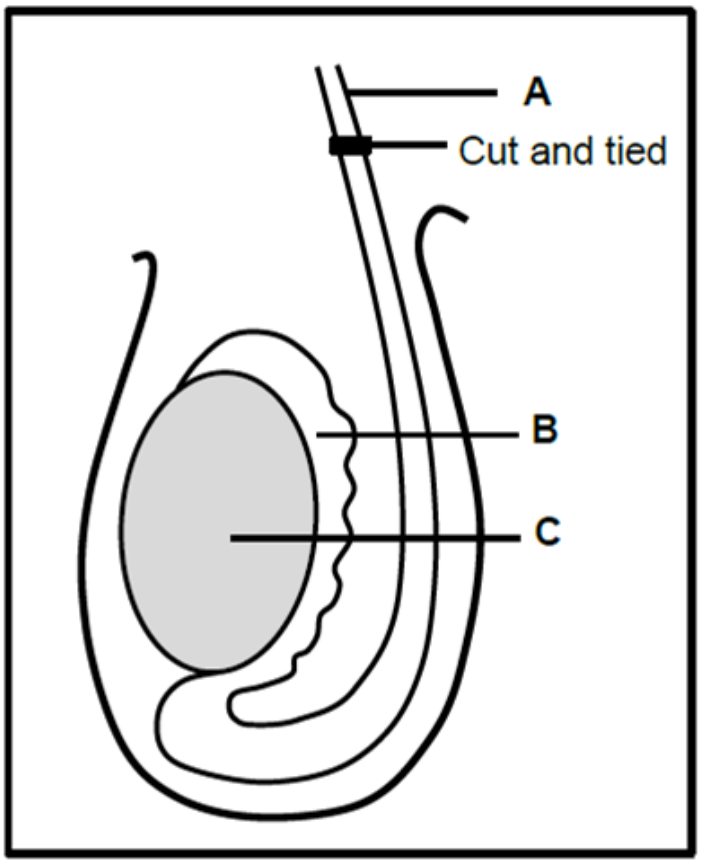
Question 12

The diagram below shows part of the male reproductive system.



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

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

12.3 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)

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

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

12.5 Describe the process of spermatogenesis. (4)

(12)

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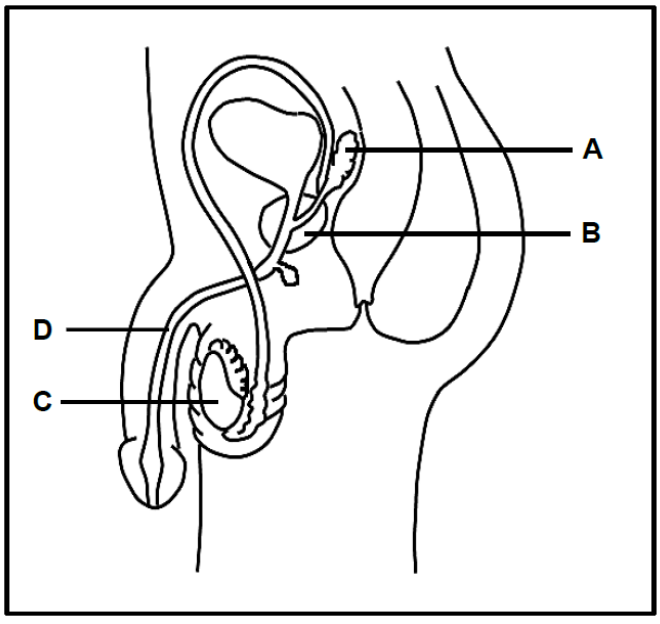
Question 13

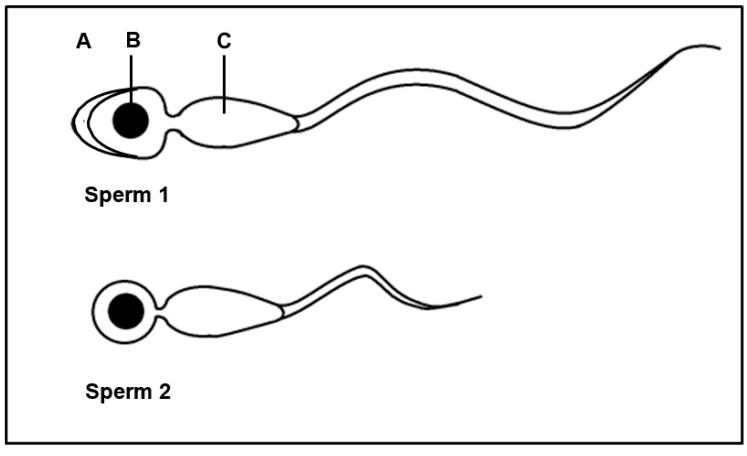
The diagram below represents the human male reproductive system.



13.1	Identify structure **A**.	(1)
13.2	State ONE function of part **D** in reproduction.	(1)
13.3	Give TWO reasons why structure **B** is NOT considered to be an endocrine gland.	(2)
13.4	Name the type of gametogenesis that occurs in part **C**.	(1)
13.5	Explain how the secretions of structures **A** and **B** improve thechances of fertilisation.	(4)
		(9)

Question 14

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



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

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14.2 Describe the role of structure **B** during fertilisation. (1)
14.3 Explain the role of the organelles found in large numbers in part **C**. (2)
14.4 Explain TWO reasons why sperm **1** is structurally better suited for fertilisation than sperm **2**. (4)
(8)

Question 15

The 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

15.1 State TWO factors, regarding the females that should have been kept constant during the investigation. (2)
15.2 State TWO ways in which the reliability of the results was ensured. (2)
15.3 State ONE conclusion that can be drawn from the results. (2)
15.4 Explain why the oestrogen levels may remain low in the blood of the females in the 41-50 age group. (3)
15.5 Explain why females that were using progesterone-based pills were excluded from the investigation. (3)
(12)

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Question 16

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

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

The procedure was as follows:

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

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

16.1	Identify the dependent variable in the investigation.	(1)
16.2	State how the dependent variable in QUESTION 16.1 was measured.	(1)
16.3	Name TWO other factors that should be considered when selecting volunteers.	(2)
16.4	Explain how TU reduces fertility.	(2)
16.5	Explain why wearing tight-fitting trousers will decrease male fertility.	(2)
16.6	Suggest ONE reason for doing the sperm count for an additional 12 months after stopping the TU treatment.	(1)
16.7	The contraceptive options that are currently available for men are limited to condoms and vasectomy. Vasectomy involves the cutting and tying of both the vas deferens. Explain how a vasectomy prevents pregnancy.	(2)
		(11)

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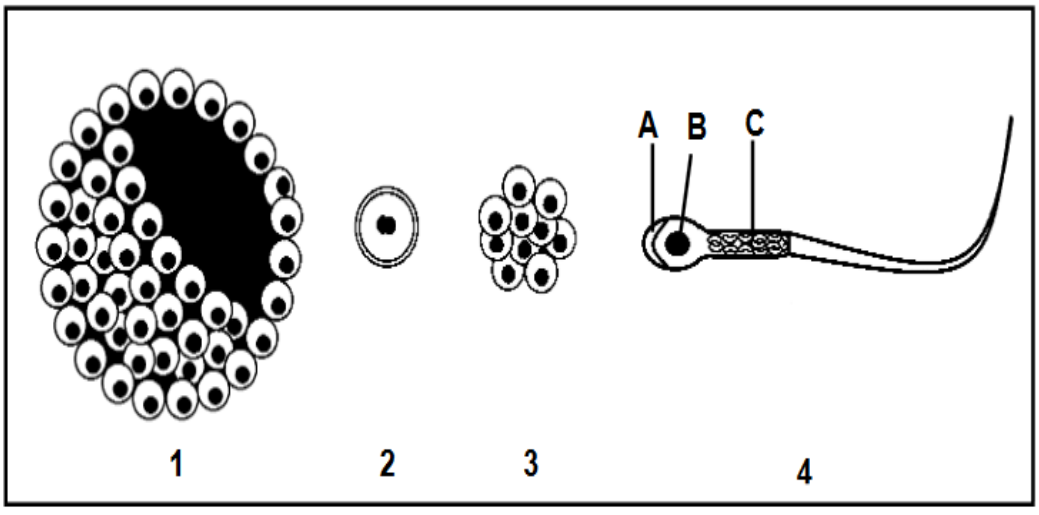
Question 17

The diagrams below show structures formed during human reproduction.



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

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

17.3 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)

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

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

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

(14)

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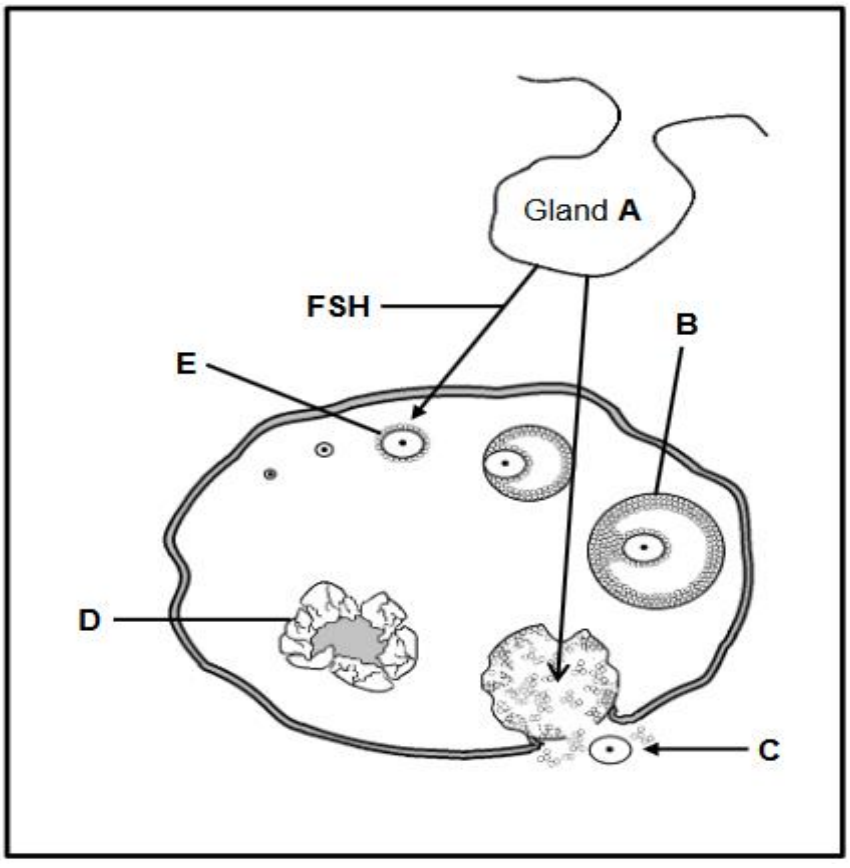
Question 18

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



18.1	(a)	Gland **A**	(1)
	(b)	Structure **B**	(1)
	(c)	Process **C**	(1)
	(d)	Structure **D**	(1)
18.2		State the effect on the oestrogen levels in the blood if gland **A** stops secreting FSH.	(1)
18.3		State ONE function of LH.	(1)
			(6)

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Question 19

Read the extract and study the diagram below.

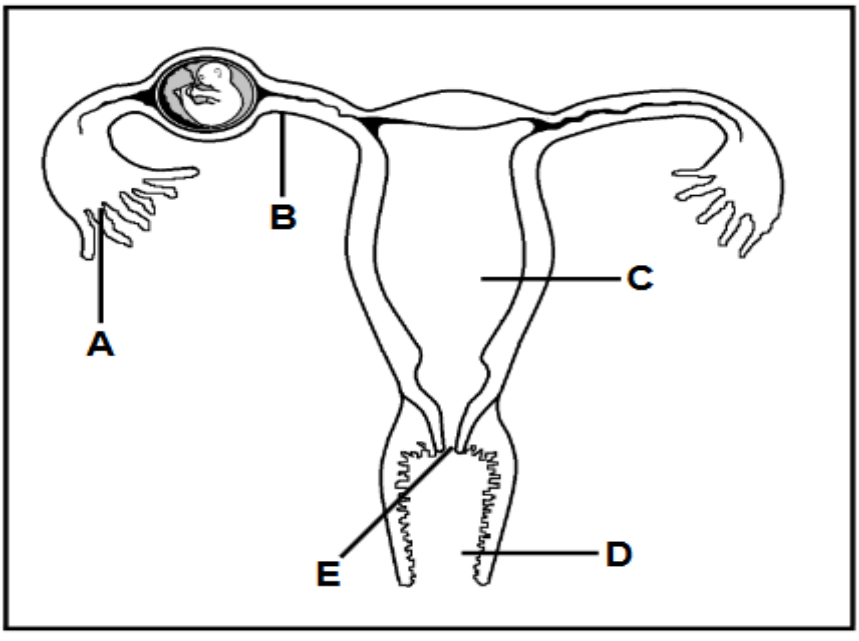
ECTOPIC PREGNANCIES

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.



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

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

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

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

(9)

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Question 20

Read the extract below.

PLASTIC LINKED TO FEMALE INFERTILITY

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

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

20.1	State ONE function of FSH.	(1)
20.2	Name ONE other hormone in females that is secreted by the pituitary gland during the menstrual cycle.	(1)
20.3	Explain how an undersecretion of the hormone in QUESTION 20.2 may lead to infertility	(2)
20.4	Explain why a decrease in the maturation of ovarian follicles may lead to reduced implantation rates.	(5)
		(9)

Question 21

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

Question 22

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).

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- 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.

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

Identify the:

22.2 (a) Independent variable (1)

(b) Dependent variable (1)

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

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

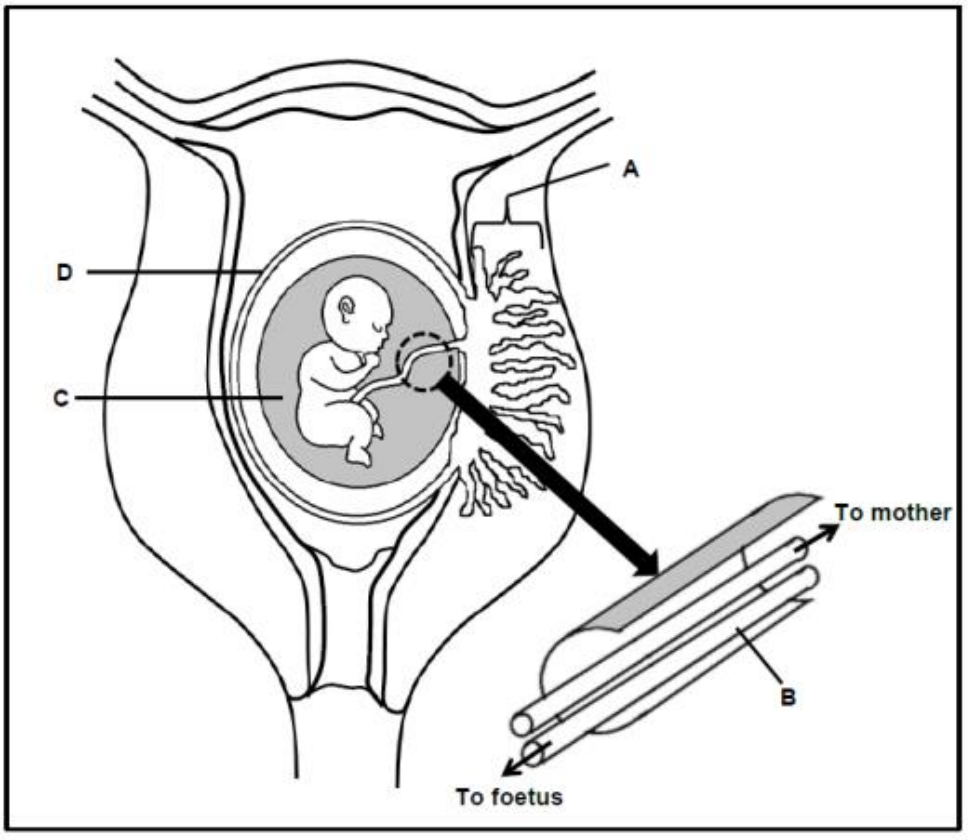
22.5 Group **B** was the control.

Explain the importance of group **B** in this investigation. (2)

(10)

Question 23

The diagram below shows a developing human foetus.



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

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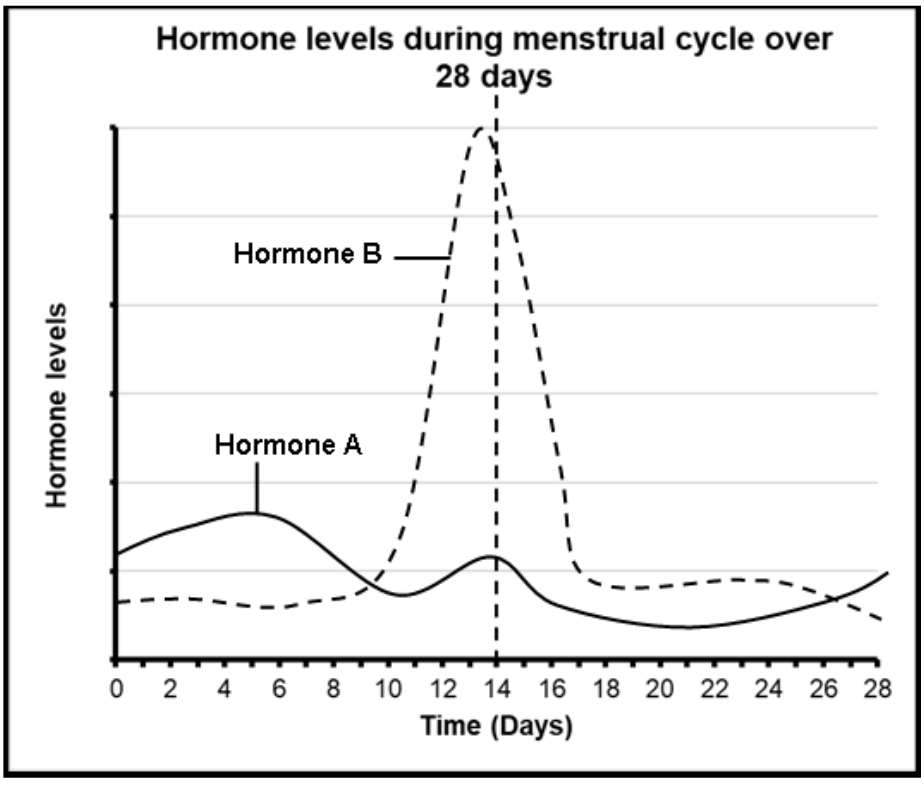
23.2 State TWO functions of the fluid in part **C**. (2)
23.3 Describe the development of the zygote until implantation occurs. (4)
23.4 State TWO ways in which part **A** functions in protecting the developing foetus. (2)
23.5 Identify blood vessel **B**. (1)
23.6 Describe how the nutrition of a human foetus differs from that of oviparous organisms. (3)
(13)

Question 24

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



24.1 State TWO functions of hormone **B**. (2)
24.2 Explain why a female who is struggling to get pregnant:
(a) May be given pills containing hormone **A** as a treatment (3)
(b) Will have her levels of hormone **B** constantly monitored (2)
24.3. Explain how the levels of hormone **A** on days 0 to 5 will differ in apregnant female. (3)
(10)

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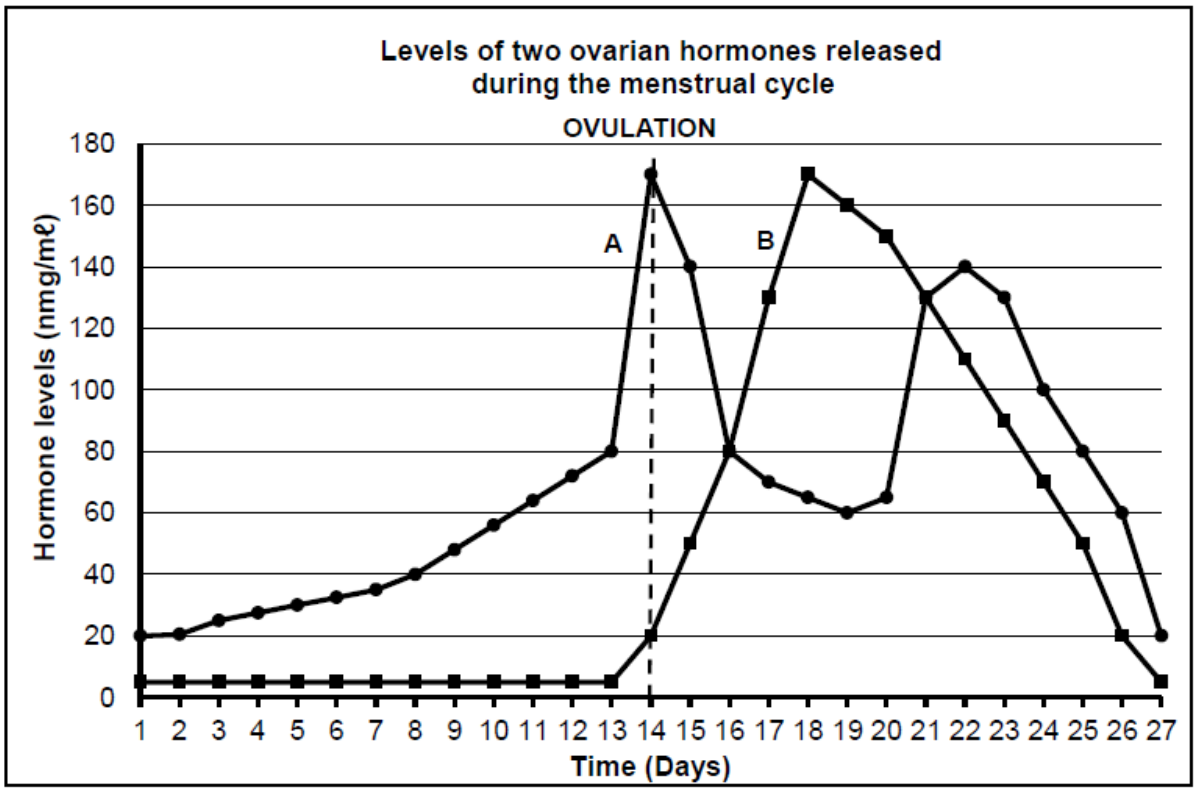
Question 25

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

Question 26

Study the graph below.



Identify:

26.1 (a) Hormone **A** (1)

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

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

26.3 (a) Define ovulation (2)

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

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

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

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

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

(17)

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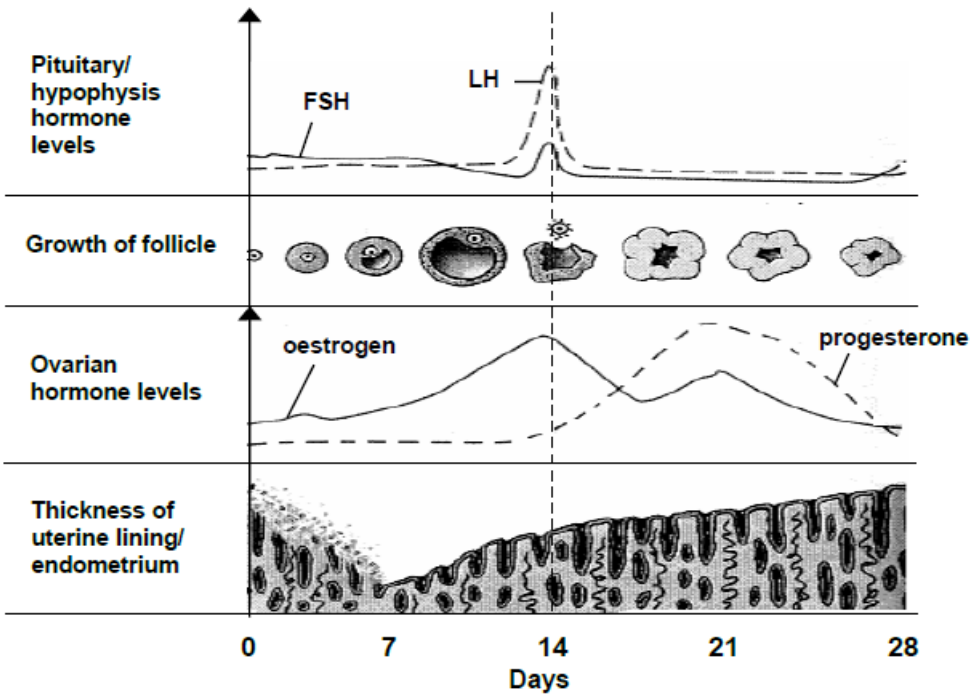
Question 27

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



Hormonal regulation of the female reproductive cycle

27.1	On which day does ovulation take place?	(1)
27.2	Between which days does menstruation take place?	(1)
27.3	State any ONE function of luteinising hormone (LH).	(1)
27.4	Describe the changes in the level of LH shown in the graph.	(3)
27.5	Describe the relationship between the level of oestrogen and the endometrium from day 7 to day 14.	(2)
27.6	Explain why it is necessary for the level of progesterone in the blood to increase after ovulation.	(2)
27.7	Did fertilisation take place in the 28-day cycle illustrated in the graph?	(1)
27.8	Explain your answer to QUESTION 27.7.	(2)
		(13)

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TOPIC: HUMAN RESPONSE TO ENVIRONMENT
THE NERVOUS SYSTEM

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 (1.1.1 to 1.1.3) in your ANSWER BOOK, for example 1.1.4 D.

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

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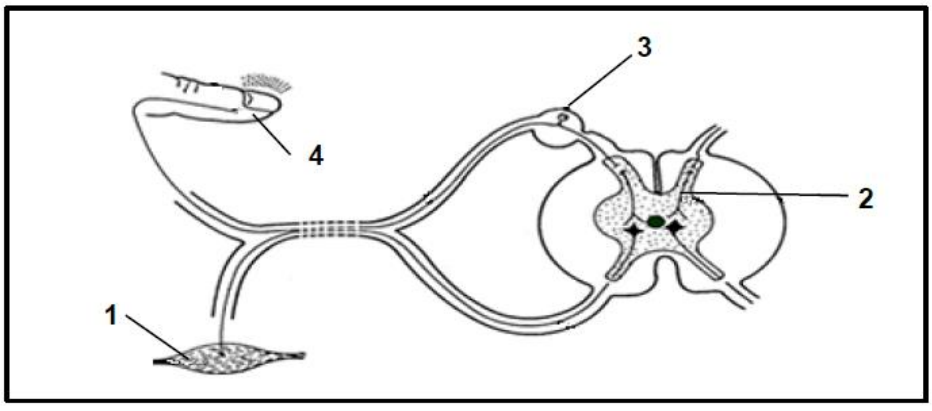
1.4 Which part of the neuron transmits impulses towards the cell body?

A Dendrites
B Myelin Sheath
C Axon
D Synapse

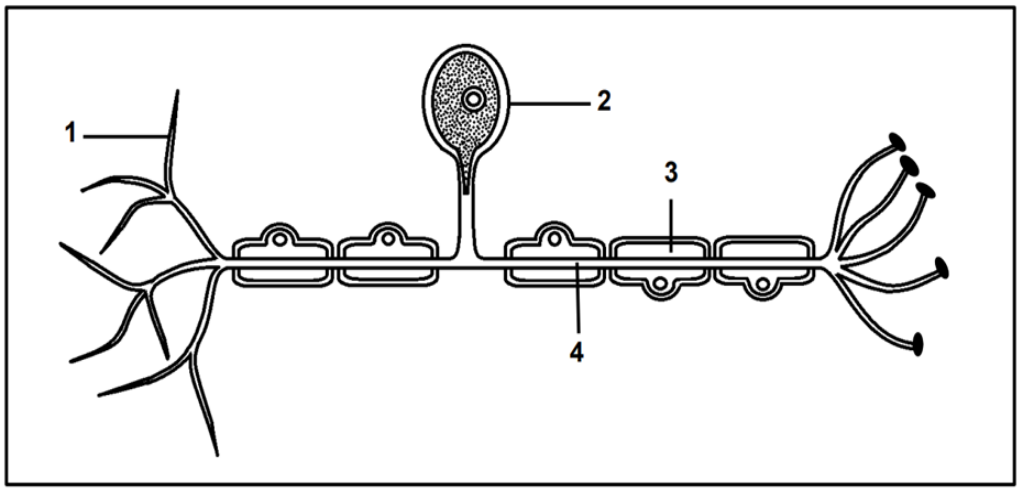
1.5 The diagram below shows the reflex arc



Which part represent the effector?

A 4
B 1
C 3
D 2

QUESTIONS 1.1.7 AND 1.1.8 ARE BASED ON THE DIAGRAM OF THE NEURON BELOW.



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1.6 The axon is represented by structure …

A 1.
B 2.
C 3.
D 4.

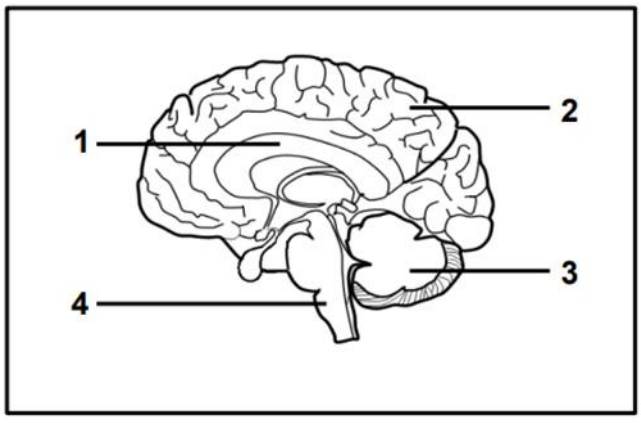
1.7 Which labelled part affects the speed of impulse transmission?

A 1
B 2
C 3
D 4

1.8 The myelin sheath on a nerve cell …

A provides electrical insulation.
B transports impulses towards the cell body.
C receives impulses from the axon.
D converts stimuli into impulses.

QUESTIONS 1.1.9 AND 1.1.10 ARE BASED ON THE DIAGRAM OF THE BRAIN BELOW.



1.9 Which ONE of the following represents the corpus callosum?

A 1
B 2
C 3
D 4

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1.10 Which ONE of the following is the function of part 3?

A Controls voluntary movements
B Controls involuntary actions
C Coordinates voluntary movements
D Controls all sensations

(10x2) **(10)**

Question 2

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 brain that receives impulses from the maculae	
2.2	The structure that connects the left and right hemispheres of the brain	
2.3	The part of the brain that regulates breathing	
2.4	The branch of the autonomic nervous system that restores an increased heart rate back to normal	
2.5	The part of the nervous system that is made up of spinal and cranial nerves	
2.6	A part of the nervous system that consist of sympathetic and parasympathetic section	
2.7	A functional gap between two consecutive neurons	
2.8	Collective name for the membranes that surround the brain and spinal cord	
2.9	Neurons that carry impulses from receptors	
2.10	The part of the skull that protects the brain	
2.11	The part of the brain that controls body temperature	
2.12	The disease characterised by the degeneration of brain tissue, leading to memory loss	
	(12x1)	**(12)**

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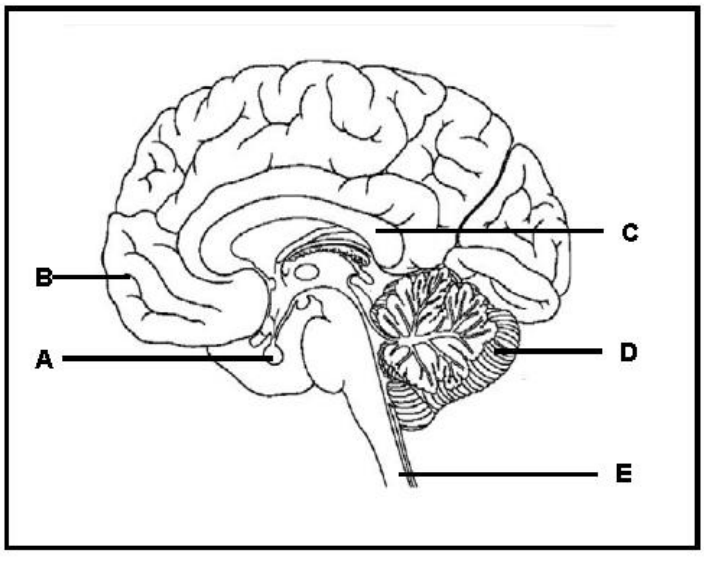
Question 3

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
3.5	The functional connection between two consecutive neurons	A B	Synapse Effector
	(5X2)		**(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)

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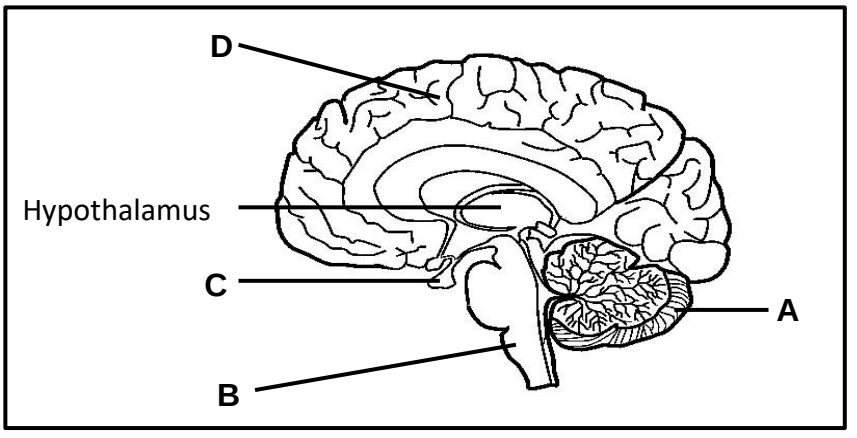
Question 5

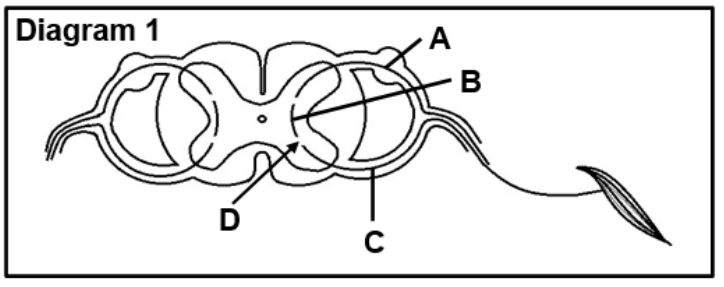
The diagram below shows the part of the human brain.

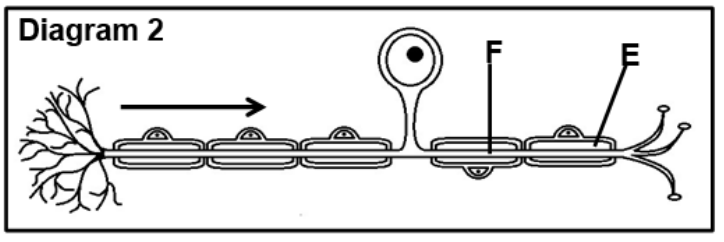


5.1. Identify part **A**. (1)
5.2. State TWO functions of part **D**. (2)
5.3. State ONE way in which the brain is protected (1)
5.4. Name the TWO effectors that part B sends impulses to (2)
(6)

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)

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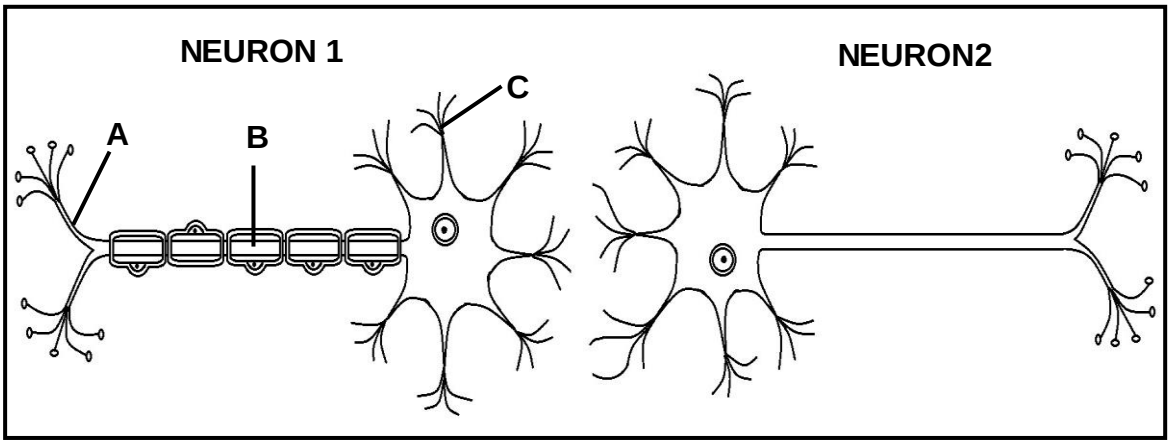
6.3. Give the LETTER and NAME of the part that ensures one-directional flow of impulse. (2)

(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)

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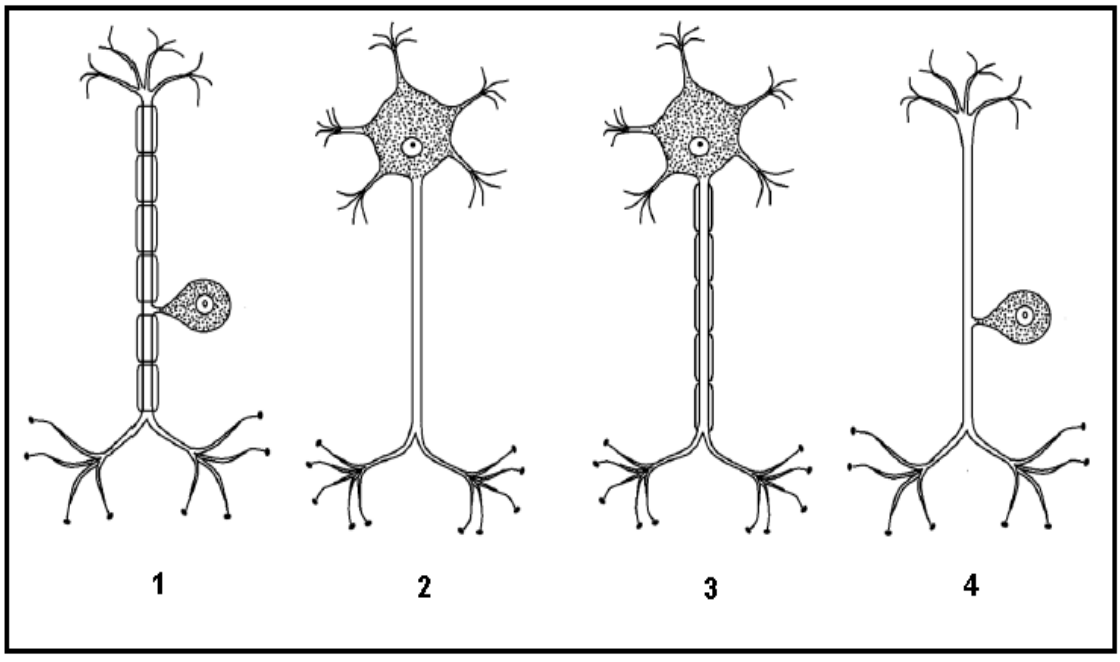
Question 8

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)

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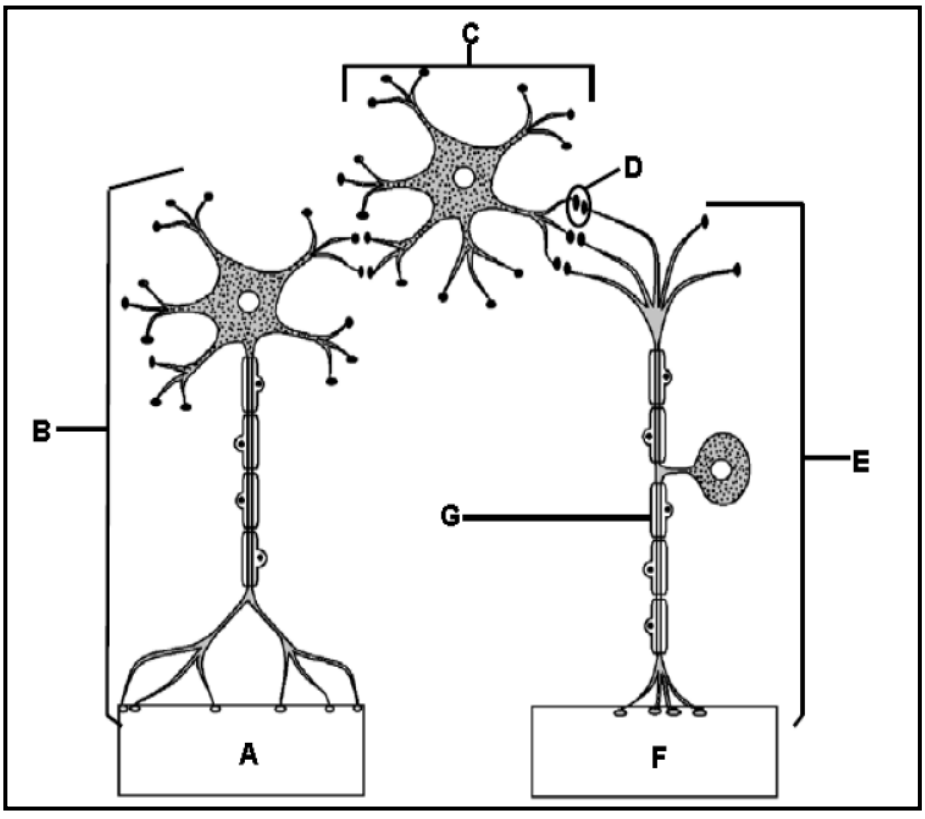
Question 9

The diagram below represents 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)

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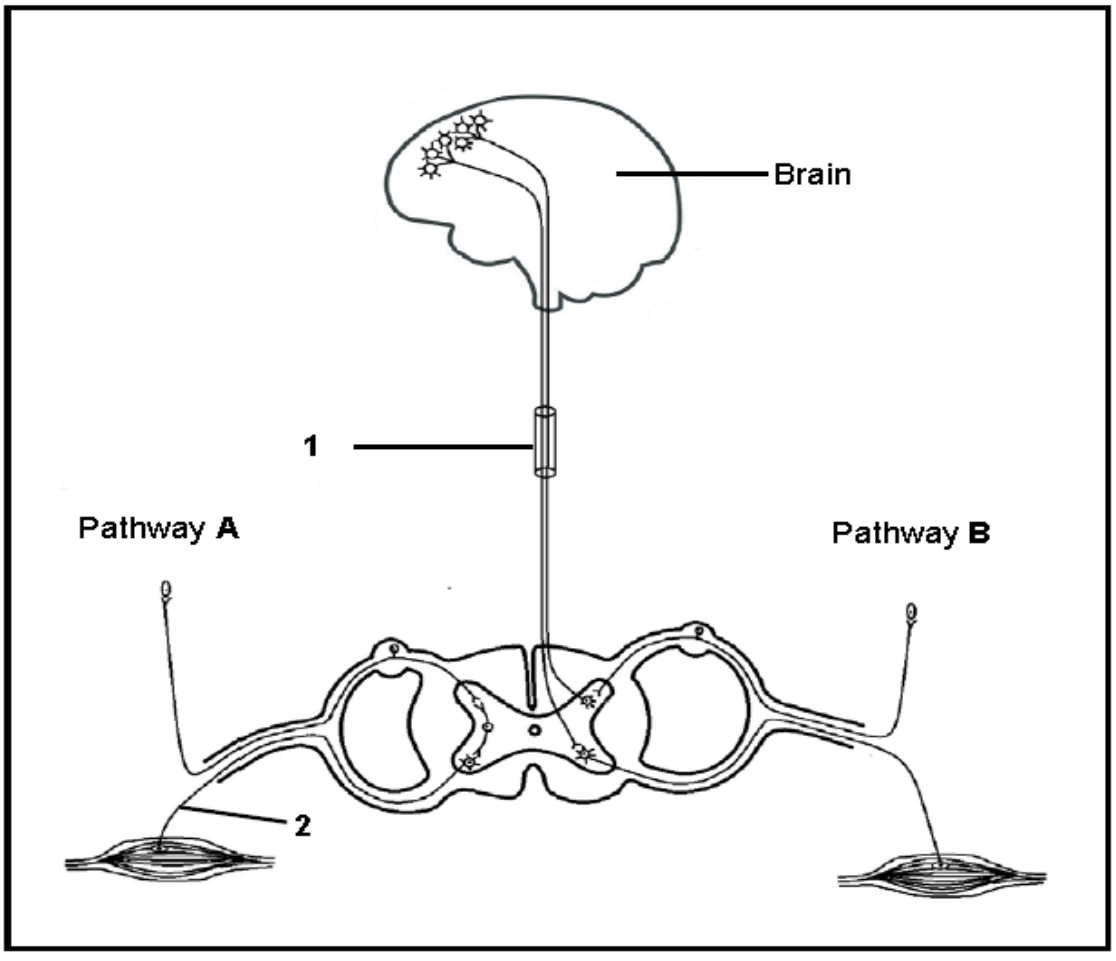
Question 10

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)

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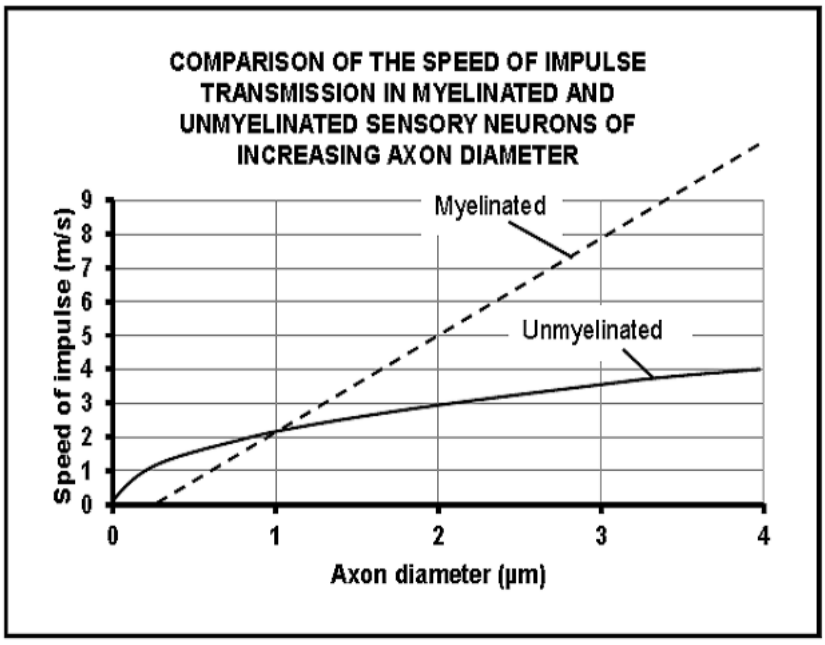
Question 11

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



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)

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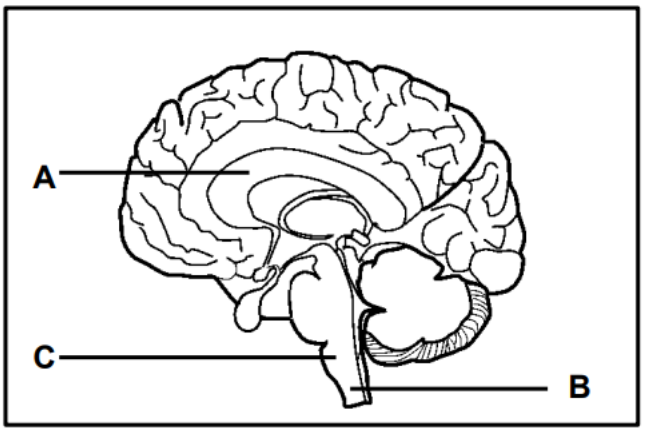
Question 12

The diagram below shows a part of the human brain.



12.1 Identify part A (1)
12.2 Explain why a person may die if part C is damaged. (2)
12.3 Part B is damaged in a person's lower back.
(a) Identify part B. (1)
(b) Explain why the person will have no control of the skeletal muscles of the legs. (2)
(6)

Question 13

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

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

13.1 Which region has the smallest number of severe brain injuries? (1)
13.2 Explain why this data may not be accurate for the region named in QUESTION 13.2 (2)
13.3 Draw a bar graph to represent the data in the table. (6)
(9)

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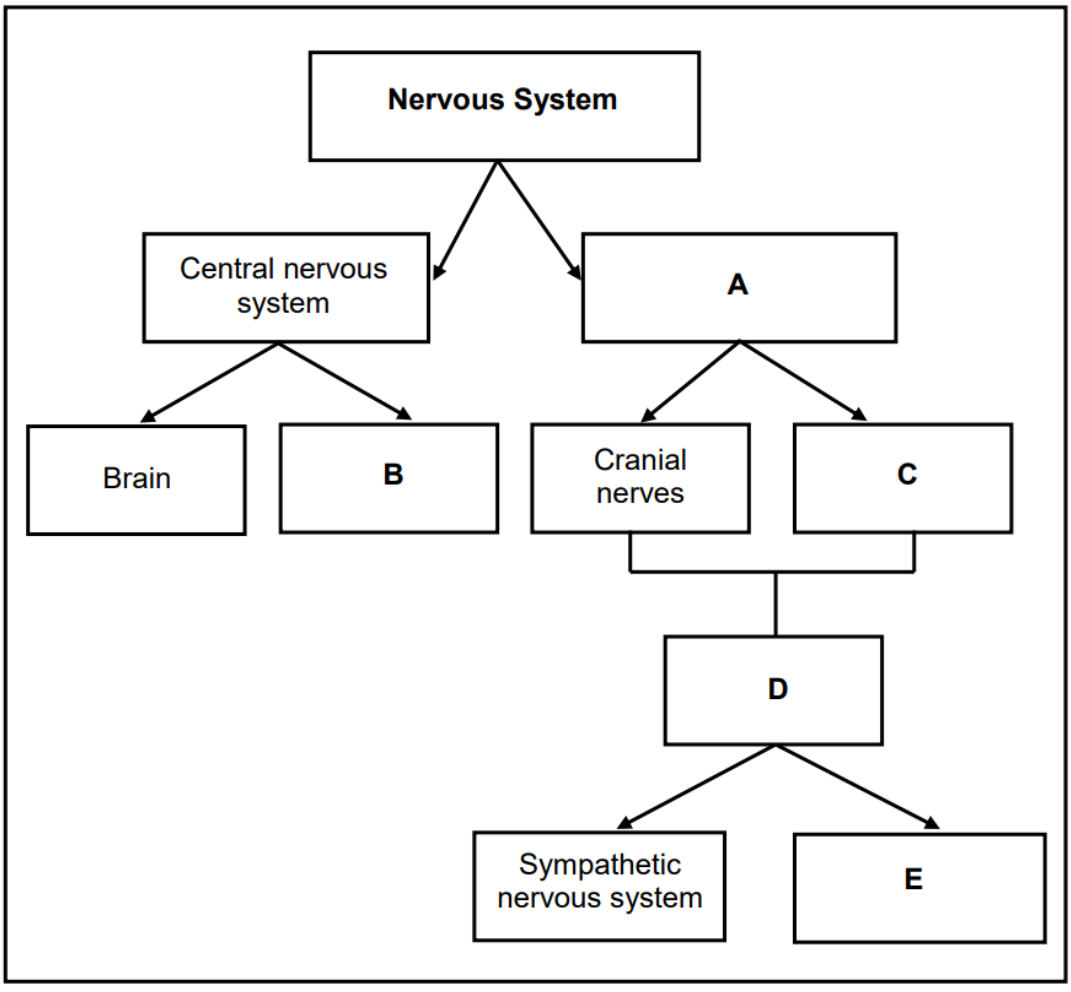
Question 14

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



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

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

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

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

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

(8)

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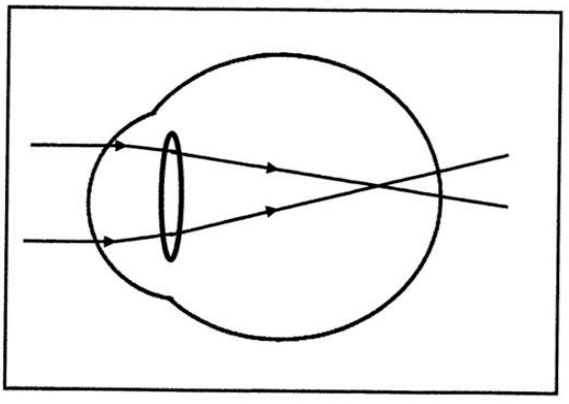
THE EYE

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 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

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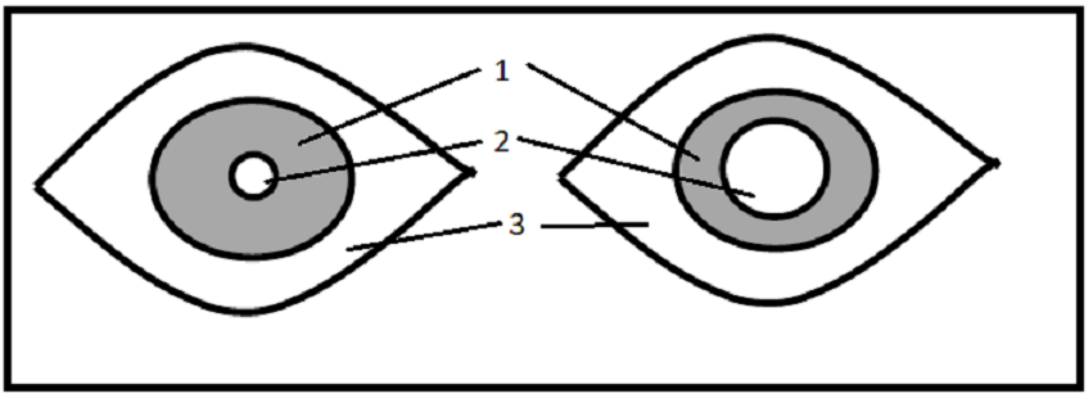
QUESTIONS 1.4 AND 1.5 ARE BASED ON THE DIAGRAM BELOW.



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

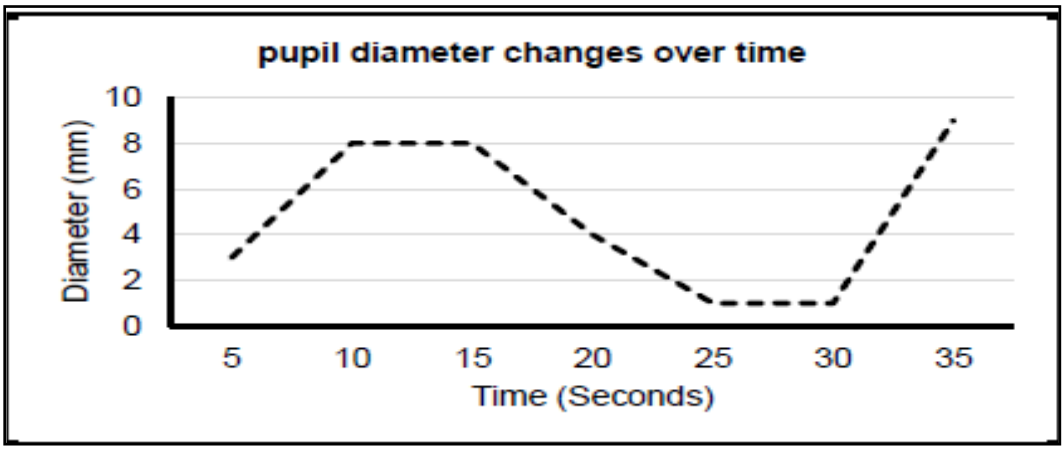
C Diagram **A** is in bright light and has radial muscles contracted

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.



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

A 5-10 s
B 15-25s
C 15-35s
D 30-35s

1.7 Which ONE of the following maintains the shape of the eyeball?

A Cornea
B Lens
C Vitreous humour
D Retina

1.8 The choroid …

A is richly supplied with blood vessels.
B contains photoreceptors.
C refracts the light rays.
D sends impulses to the brain.

1.9 Which ONE of the following best describes the events of accommodation when a person is viewing an object that is less than 6 m away?

	Ciliary muscle	Suspensory ligaments	Tension on the lens
A	Relaxes	Tighten	Increases
B	Contracts	Slacken	Decreases
C	Relaxes	Slacken	Decreases
D	Contracts	Tighten	Increases

(9x2) **(18)**

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Question 2

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.	
2.6	The visual defect characterised by a cloudy lens	
2.7	The area of the retina that contains the highest concentration of cones	
2.8	The layer in the eye that is richly supplied with blood vessels	
	(8x1)	**(8)**

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)**

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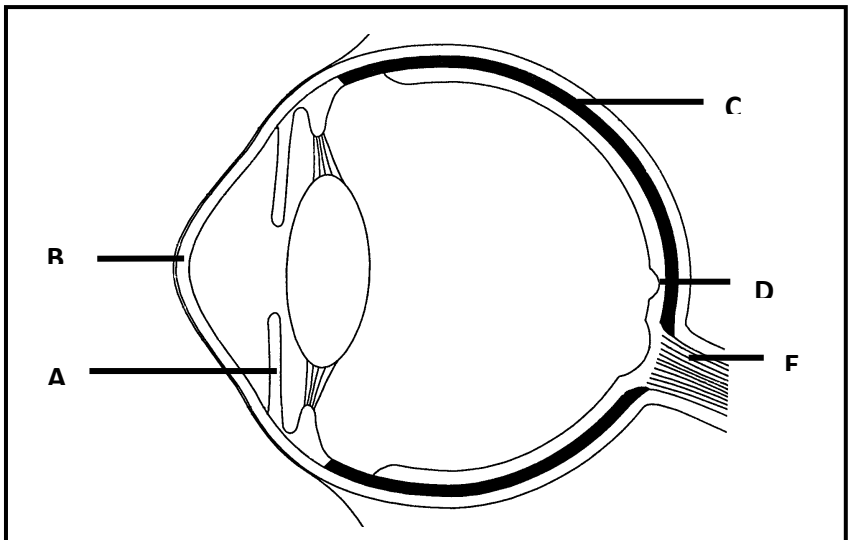
Question 4

The diagram below shows parts of the eye.



Structure of the human

Give the LETTER and the NAME of the part which:

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

(10)

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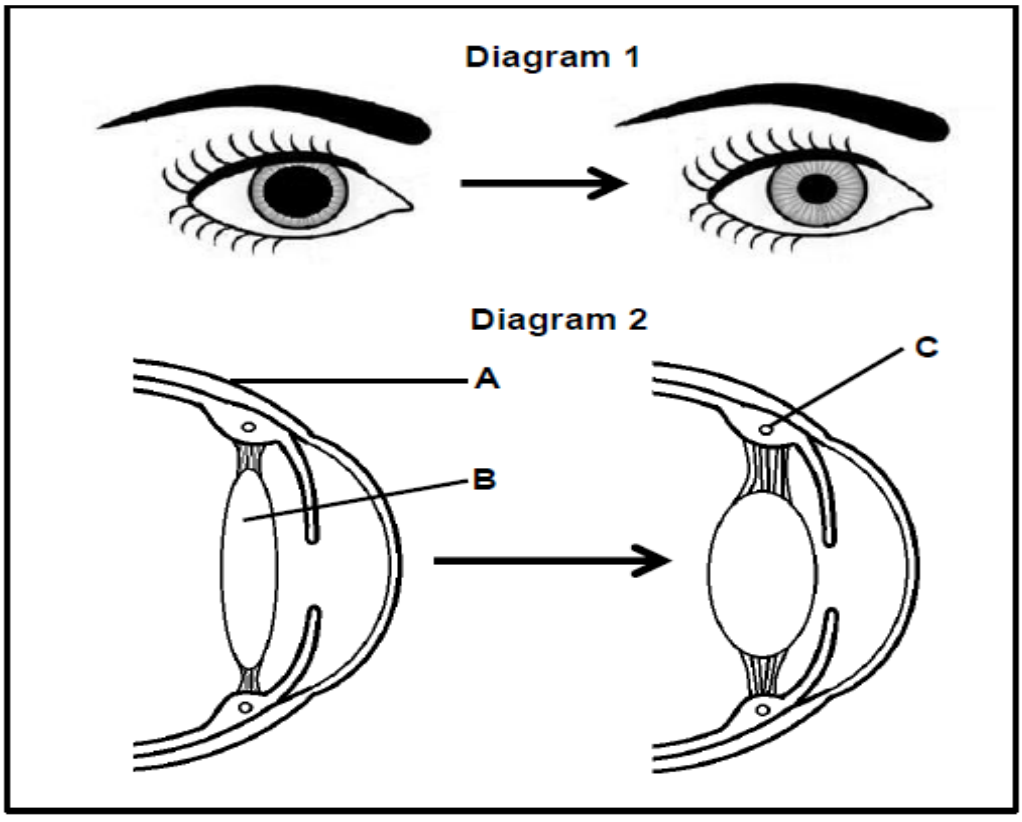
Question 5

The diagram below shows 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)

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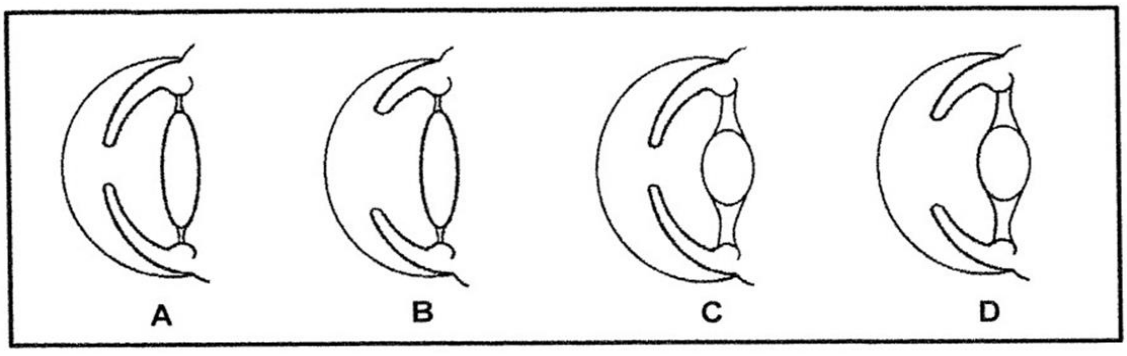
Question 6

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)

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7.3 Explain why long-sighted people need to wear glasses with biconvex lenses as a corrective measure (3)
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)
(14)

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. (2)
8.5 Name TWO structures in the eye that are responsible for the changes in the curvature of the lens. (2)
(10)

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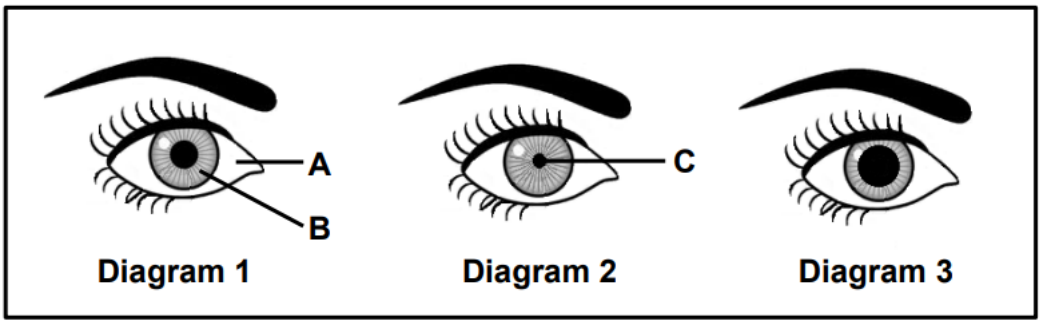
Question 9

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



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

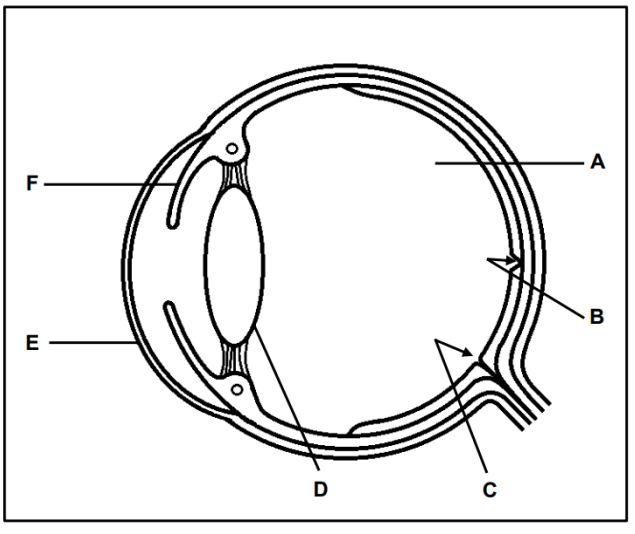
9.2 Which diagram (1, 2 or 3) represents the eye of a person:
(a) In a very bright area Where the rods are stimulated the most (1)
(b) In a very bright area Where the rods are stimulated the most (1)

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

(8)

Question 10

The diagram below represents the human eye.



10.1 Identify structure **F**. (1)

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10.2 State TWO functions of fluid **A**. (2)
10.3 Describe the structural difference between area **B** and area **C**. (2)
10.4 Name the visual defect that occurs when the curvature of part **E** is uneven. (1)
10.5 Explain how the sight of a person will be affected if cataracts developed in part **D**. (3)
10.6 Describe the process of accommodation that takes place when an object is less than 6 metres away from the eye. (6)
(15)

THE 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.

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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

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)**

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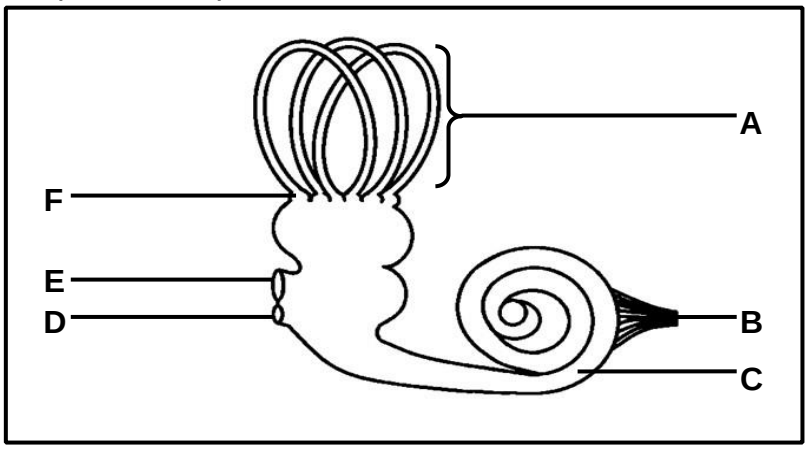
Question 3

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
3.4	A structure in the ear that absorbs excess pressure waves from the cochlea	A: Pinna B: Auditory canal
	(4X2)	**(8)**

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)

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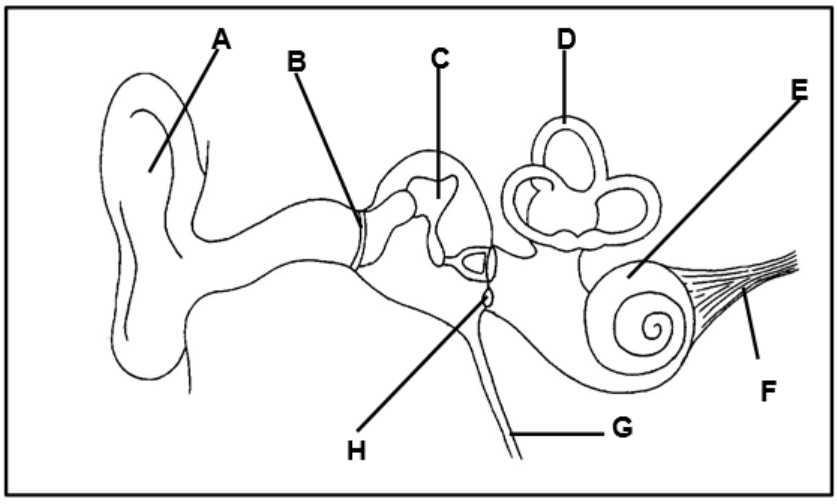
Question 5

TWO types of hearing loss occur in humans:

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

5.3 State ONE way in which middle-ear infections are treated. (2)

5.4 Name the part of the ear where ear wax is produced. (1)

5.5 Explain why hearing loss due to ear wax is usually temporary. (2)

(13)

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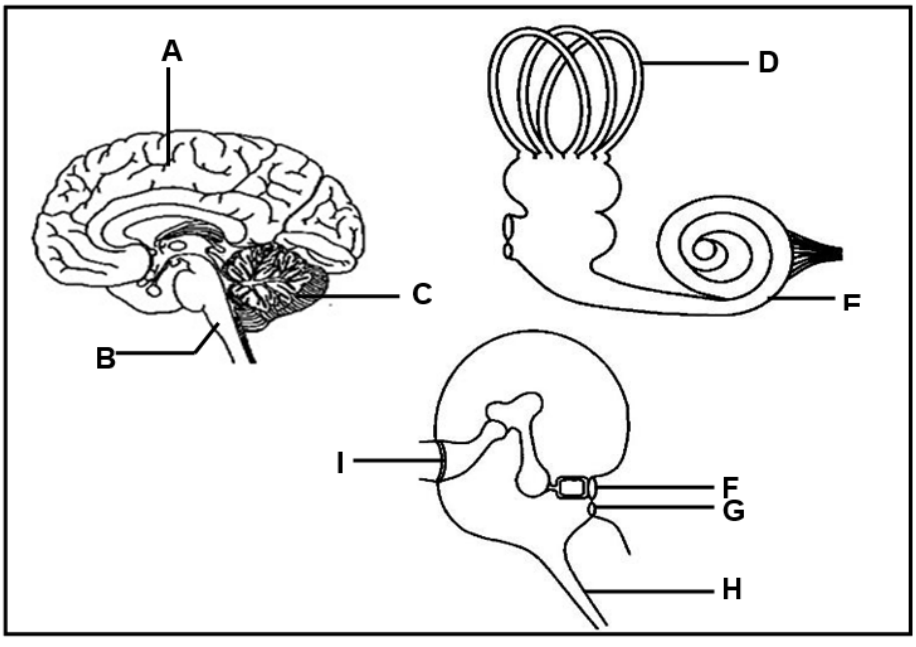
Question 6

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)

(15)

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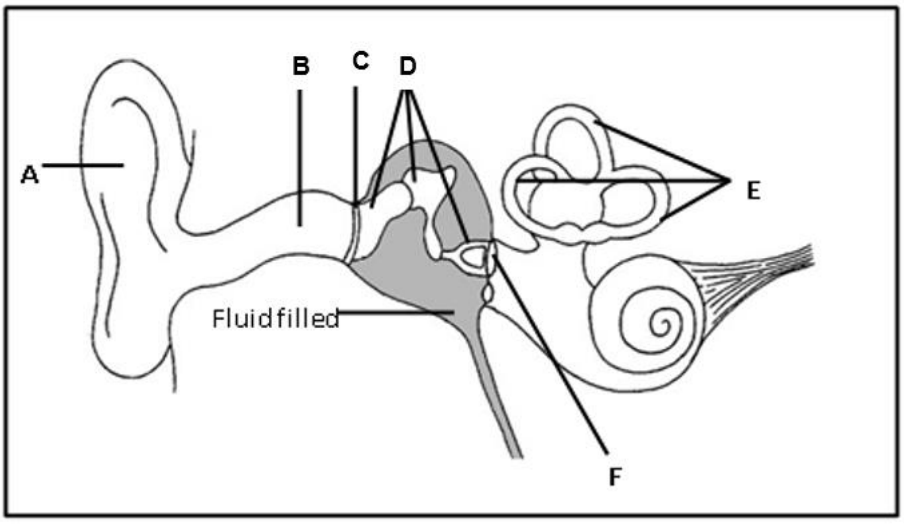
Question 7

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)

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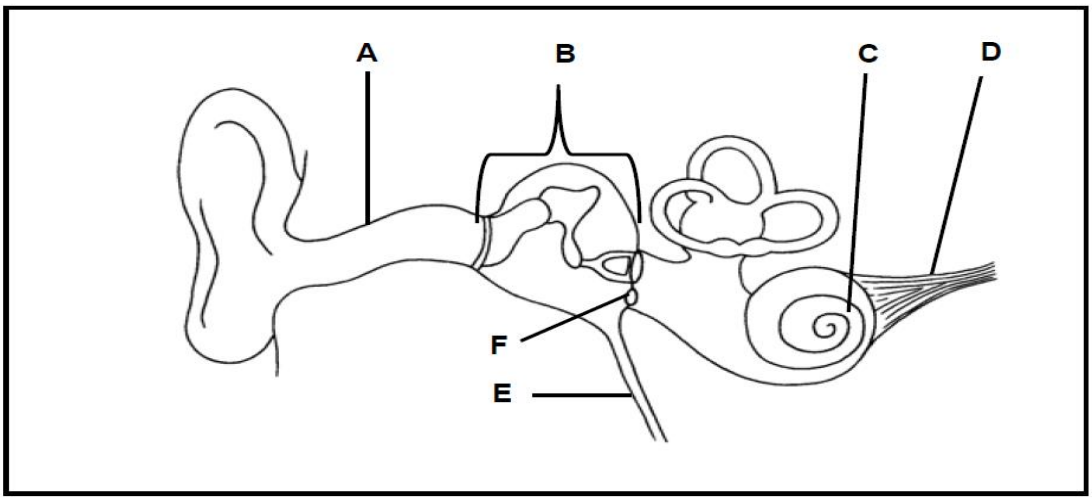
Question 8

The diagram below shows 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)

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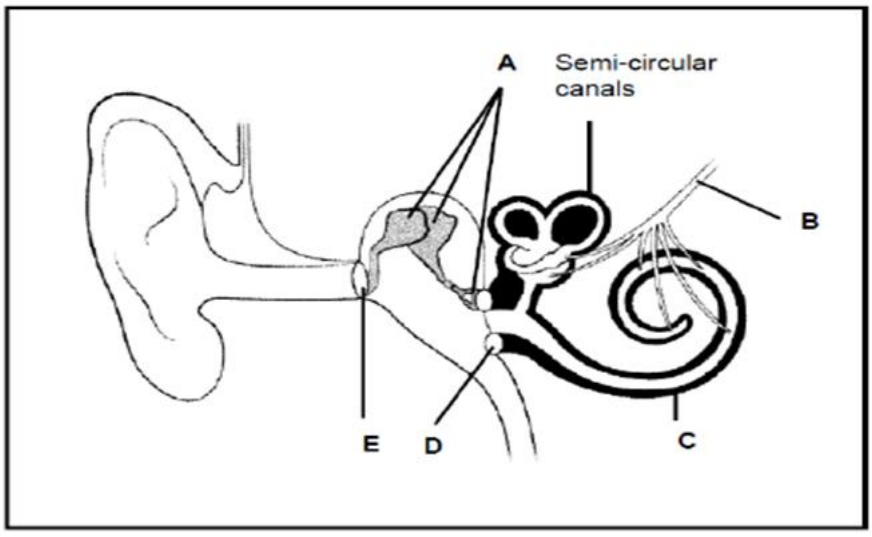
Question 9

The diagram below shows parts of human ear



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 how fusion of the structures at part **A** may lead to hearing loss. (2)

(13)

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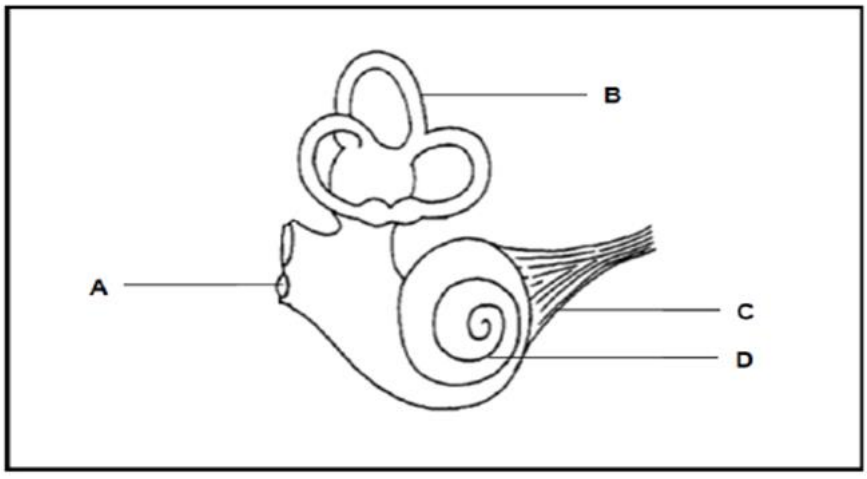
Question 10

The diagram below represents a part of the human ear.



10.1 Identify parts:
(a) **A** (1)
(b) **D** (1)

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

10.3 Explain the consequences 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)**

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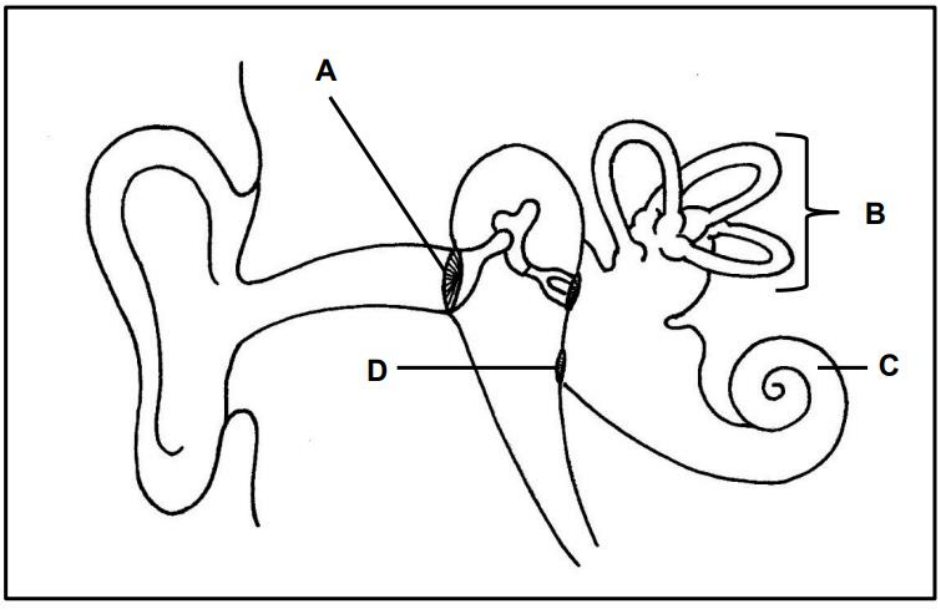
Question 12

The diagram below represents a part of the human ear.



12.1 Identify part C. (1)

12.2 State ONE function of:

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

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

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

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

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

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

(13)

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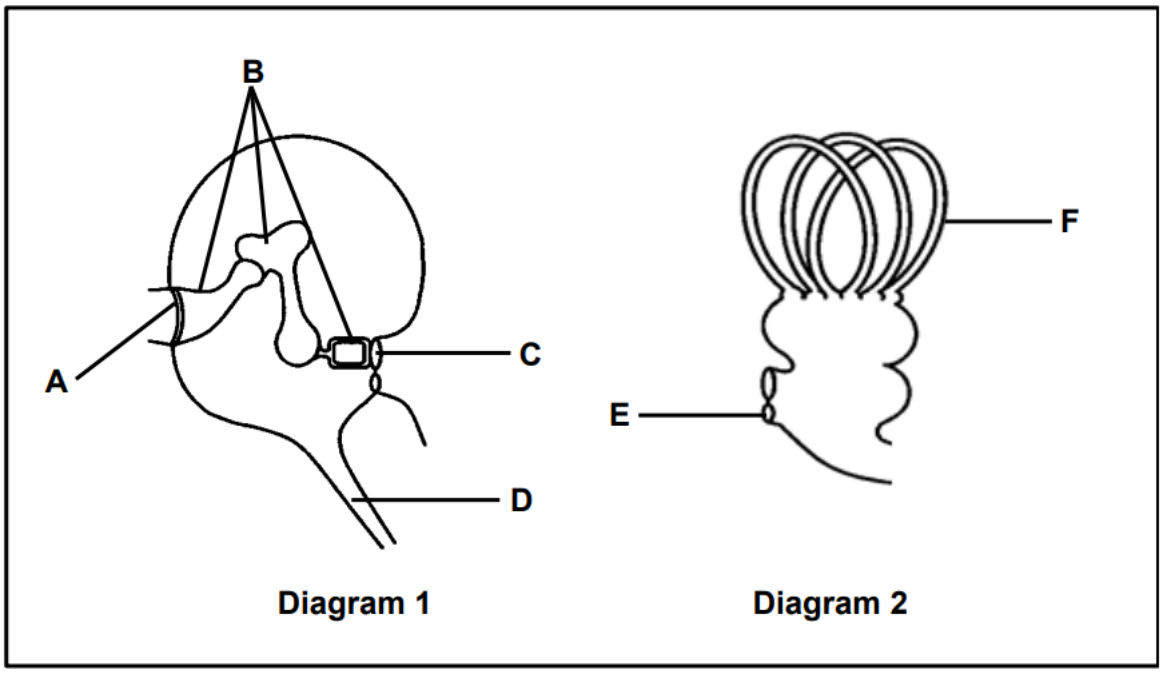
Question 13

The diagrams below show parts of the middle and inner ear.



13.1 Identify part F. (1)

13.2 Give the collective term for bones B. (1)

Give the LETTER and NAME of the structure that:

(a) Equalises pressure between the outer and middle ear (2)

(b) Creates pressure waves in the inner ear (2)

13.3 Name the receptors that are stimulated by a change in the:

(a) Position of the head (1)

(b) Direction and speed of movement of the head (1)

(8)

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Question 14

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

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

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

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

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

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

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

(13)

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TOPIC: PLANT RESPONSE TO THE ENVIRONMENT

Question 1

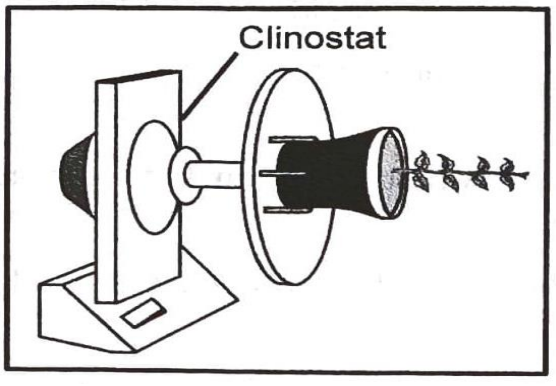
Various options are provided as possible answers to the following questions.
Choose the correct answer and write only the letter (A to D) next to the question number.

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.

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1.3 **QUESTION 1.3 1AND 1.4 REFER TO THE DIAGRAM BELOW THAT SHOWS AN INVESTIGATION DONE TO DETERMINE THE EFFECT OF AUXINS ON TROPISM**.

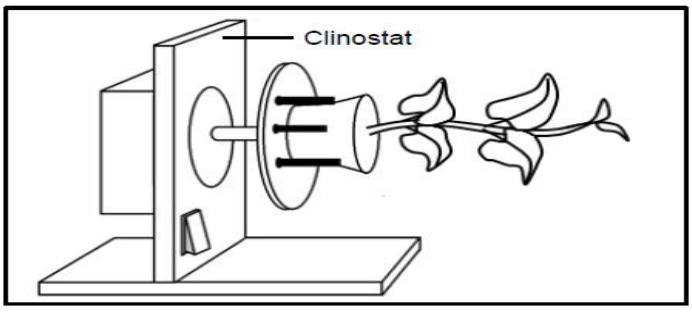
The procedure was as follows:

- A pot plant was placed on a stationary clinostat.
- The plant was exposed to light from all directions.
- The growth was then observed after few days.

The diagram below shows the set-up of the investigation.

The results after a few days showed the stem growing upwards

Which ONE of the following is an explanation of the results?



A Phototropism occurred because the auxins moved towards light, which inhibited growth on the lower side of the stem.
B Geotropism occurred because the auxins moved downwards, which stimulated growth on the lower side of the stem.
C Phototropism occurred because the auxins moved away from light, which stimulated growth on the upper side of the stem.
D Geotropism occurred because the auxins moved upwards, which inhibited growth on the upper side of the stem

1.4 A control for the same investigation was set up by putting an identical pot plant on a rotating clinostat

Which ONE of the following would be the expected results observed after a few days?

A There will be no growth.
B The stem will grow upwards.
C The stem will grow downwards.
D The stem will grow horizontally.

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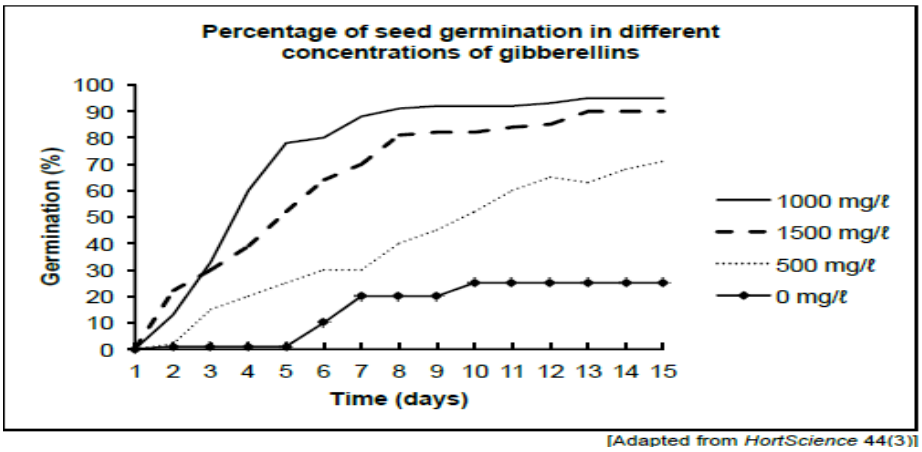
1.5 The graph below shows the effect of different concentrations of gibberellins on the germination of seeds.



[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.

(5x2) **(10)**

Question 2

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

	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)**

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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
3.4	A plant hormone that inhibits the germination of seeds.	A: Gibberellins B: Abscisic acid
	(4x2)	**(8)**

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)

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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

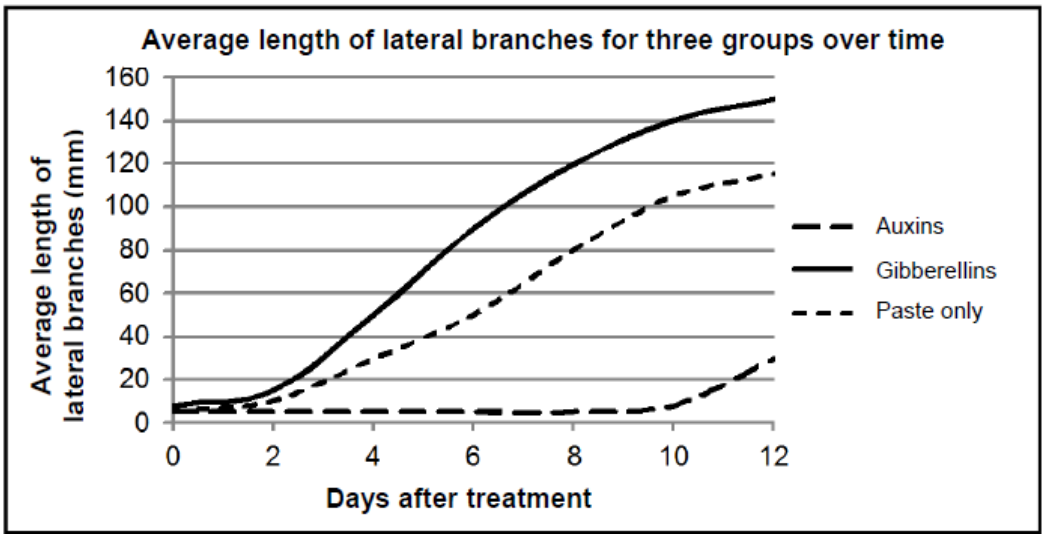
A learner investigated the effects of two plant growth substances, gibberellins and auxins, on apical dominance. The apical buds of nine pea plants of the same species, age and height were removed. These plants were then divided equally into three groups. In each group the cut surface of the remaining 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)

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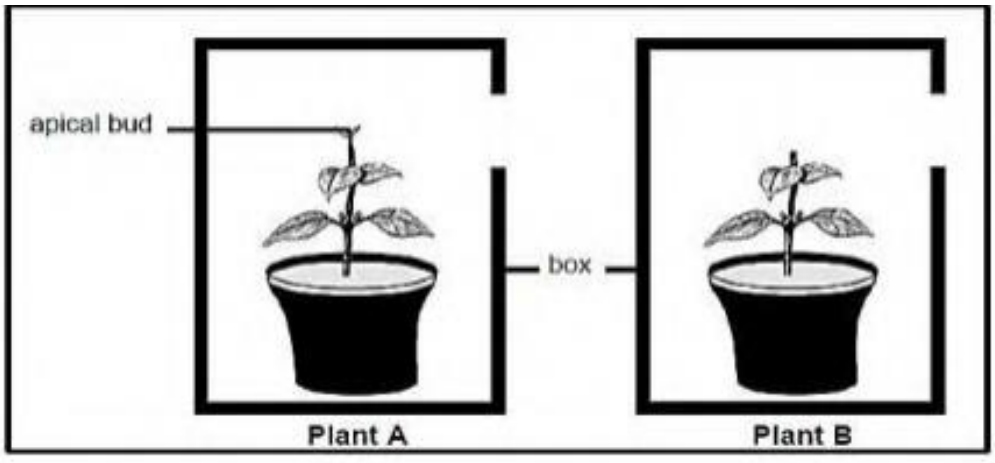
5.2 Calculate the difference in the average length of the lateral branches between the plants treated with gibberellins and the plants treated with the paste only on the 8th day after the treatment. Show ALL working. (3)
5.3 State TWO ways in which the reliability of the investigation could be increased. (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.

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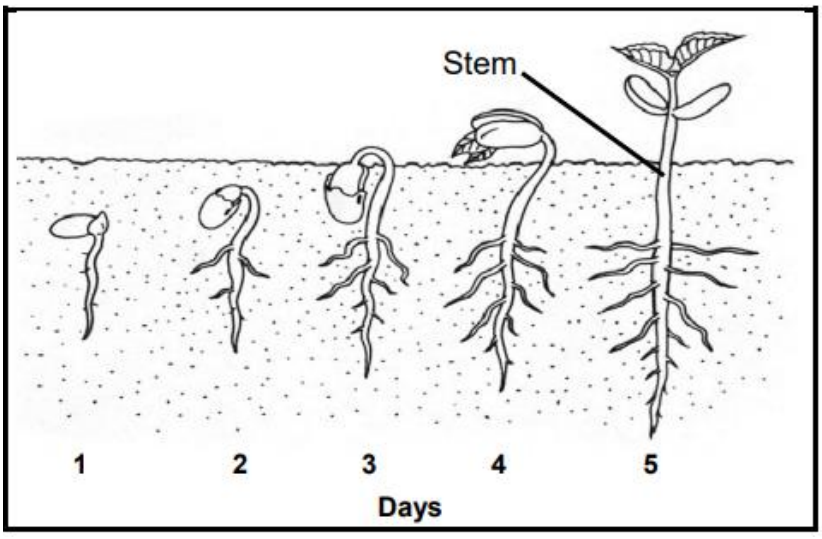
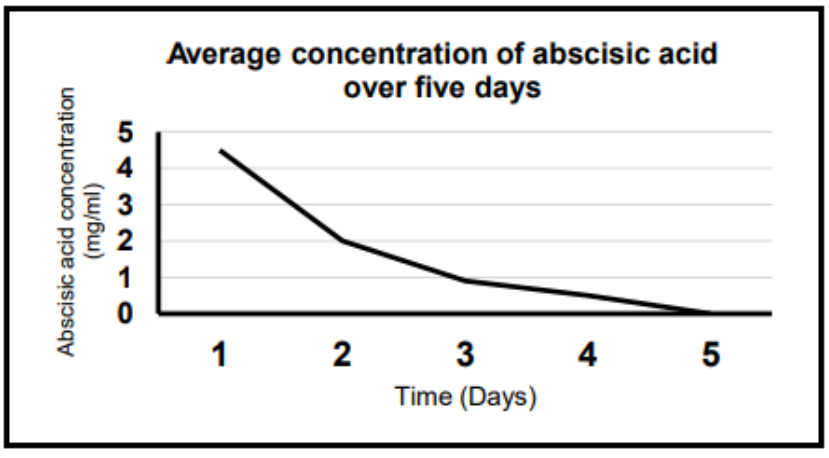


The graph below shows the average concentration of abscisic acid in the 10 seeds.



7.1 Identify the:
(a) Independent variable. (1)
(b) Dependent variable. (1)
7.3 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)

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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.

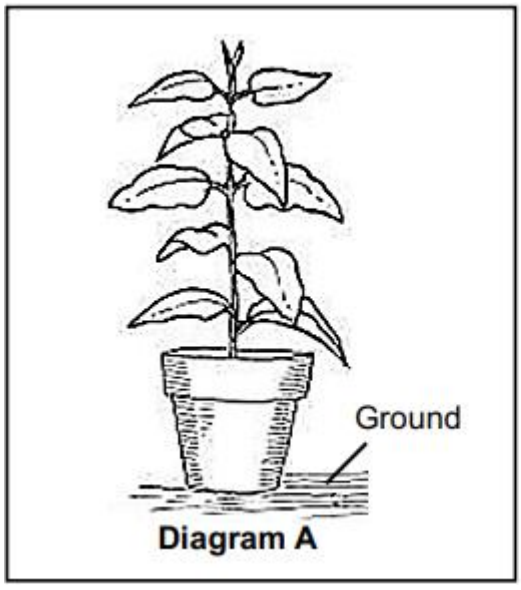

Diagram A

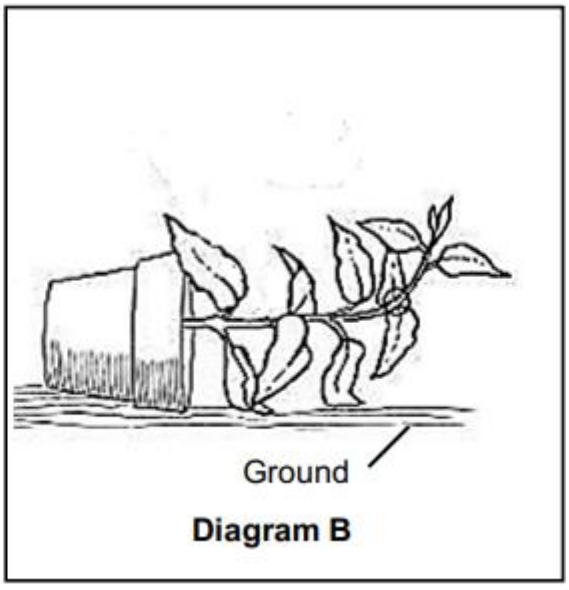

Diagram B

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)

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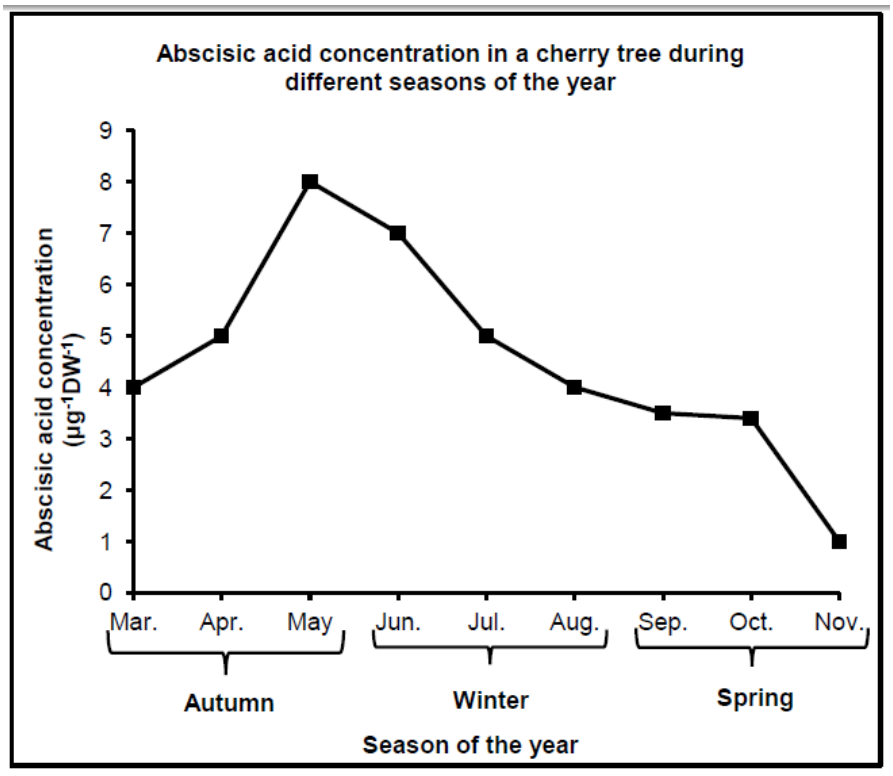
Question 9

The graph below shows the concentration of abscisic acid in a cherry tree during different seasons of the year.
This tree species loses all its leaves in autumn and goes into a state of dormancy during the winter months.



9.1 During which month was the abscisic acid concentration the lowest? (1)
9.2 Explain the trend of the graph from March to May. (3)
9.3 Suggest ONE reason for the dormancy in cherry trees during the winter months. (2)
(6)

Question 10

Geotropism refers to the plant movement of the part of the plant in response to gravity.
This tropism is controlled by auxins.

10.1 Describe the role of auxins in roots (3)

10.2 When a plant is placed horizontally, with light coming from all directions, the auxins will accumulate on the lower side of the stem and the roots.
Explain the differences in the response of the stem and the roots after a few days. (4)
(7)

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Question 11

Read the extract below:

> Auxins control different aspects of growth and development in plants. They are known to influence the growth of stems and they also stimulate the development of new roots on stem cuttings in plant propagation.
> During plant propagation, a stem of a plant is cut and is then placed in water containing small quantities of artificial auxins. The auxins stimulate root development in the cuttings.

11.1 Name TWO places in plants where auxins are produced. (2)
11.2 State TWO ways in which auxins causes an increase in the length of stems (2)
11.3 Name ONE other plant hormones that causes an increase in the length of stems. (1)
11.4 Explain how auxins can be used in plant propagation to the advantage of nature conservation. (2)
(7)

Question 12

The table below shows the concentration of abscisic acid and gibberellins in germinating seeds over 10 days.

TIME (DAYS)	HORMONE CONCENTRATION IN GERMINATING SEEDS (ARBITRARY UNITS)	
	ABSCISIC ACID	GIBBERELLINS
0	20	0
2	8	1
4	4	4
6	3	7
8	2	10
10	1	12

12.1 Draw a line graph to show the changes in the concentration of abscisic acid over the period of the investigation. (6)
12.2 State what happened to the concentration of each of the following hormones over the period of the investigation:
(a) Abscisic acid (1)
(b) Gibberellins (1)
12.3 Explain the growth response of a plant when the stem is exposed to light coming from one side only. (4)
(12)

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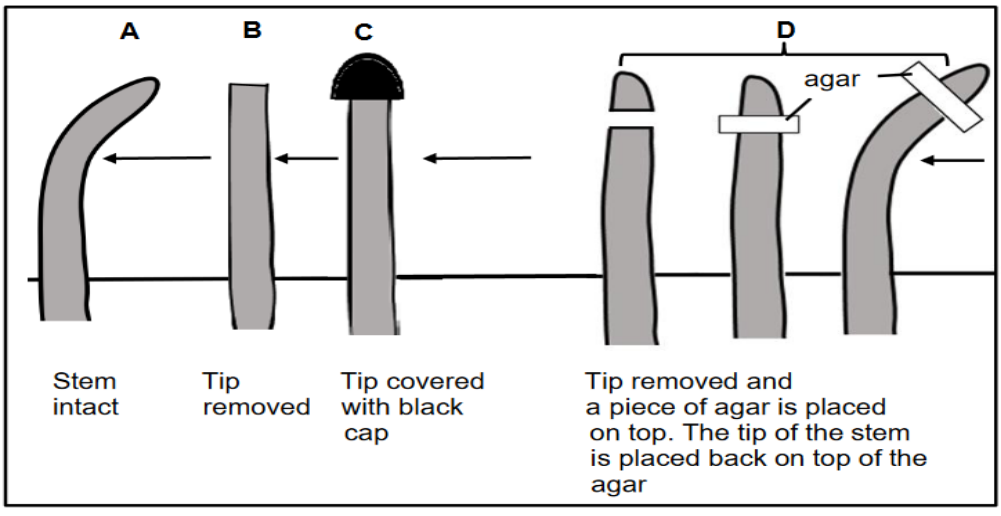
Question 13

Phototropism was investigated in young stems.

A group of stem tips were exposed to a unilateral light. The stem tips were treated differently.
Stem A's tip was intact, stem B's tip was removed, and stem C's tip was covered with a black cap. In diagram D the tip was removed, and agar (jelly-like substance) was placed between the tip and the stem.
The diagrams below show the different treatments and results. The arrows indicate the position of a unilateral light source.



13.1	Name the plant hormone that causes the growth movements illustrated in the diagrams.	(1)
13.2	Define phototropism.	(2)
13.3	Explain why stem D grows towards the light source.	(6)
13.4	Explain the result of the experiment with stem C.	(3)
		(12)

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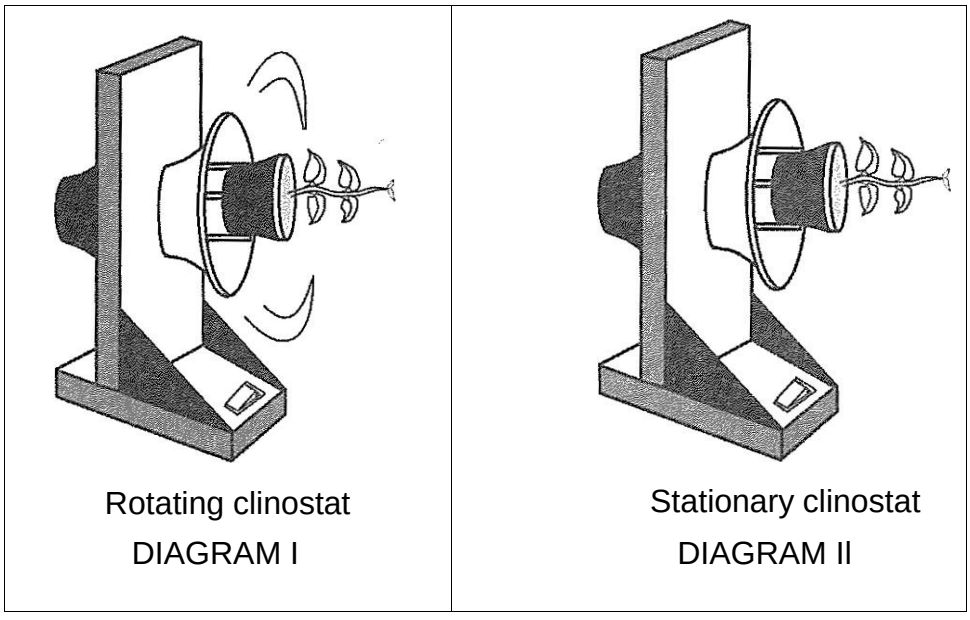
Question 14

An investigation was done to determine the effect of gravity on the direction of growth of the stem.

The procedure was as follows:

- Two plants of the same species, height and age were selected
- Plants were exposed to the same environmental conditions (water, nutrients and type of soil)
- Both plants were attached to a clinostat.
- They were then exposed to light from all directions.

The experiments were setup as shown in the diagram below.



14.1 Suggest ONE reason why it is important for the stem of the plant to grow towards the light. (1)

14.2 What is the term given to the growth movement of a part of a plant in response to gravity? (1)

14.3 State the purpose of rotating the clinostat in DIAGRAM 1 during the investigation. (1)

14.4 Explain the results that will be obtained after 2 weeks in DIAGRAM II. (5)

14.5 If the growth tip of the stem in DIAGRAM I was removed at the start of the investigation, explain the results that will be obtained after 2 weeks. (4)

(12)

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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.

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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

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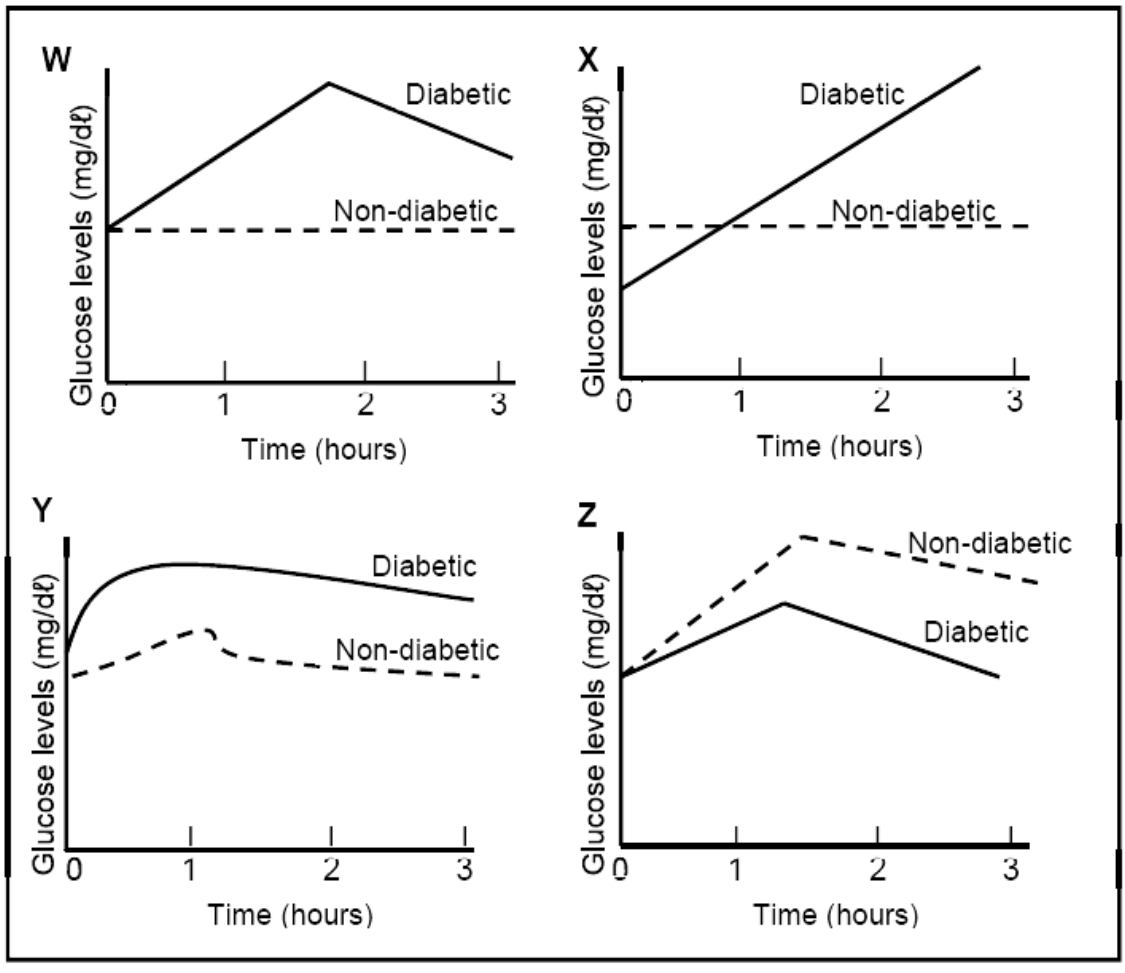
1.5 Two men were given a glucose-rich meal at the same time (0 hours). One man is diabetic and the other is non-diabetic. The diabetic did not receive any medical treatment. Their blood glucose levels were measured over a period of 3 hours.

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

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1.6 Diabetes mellitus is caused by an …

A oversecretion of glucagon.
B undersecretion of glucagon.
C oversecretion of insulin.
D undersecretion of insulin.

1.7 Receptors that are stimulated by low water levels in the blood are located in the …

A renal tubules
B hypothalamus
C pituitary gland
D Carotid artery

1.8 On a hot day …

A less blood flows to the surface of the skin.
B the sweat glands become inactive.
C more blood flows to the surface of the skin.
D vasoconstriction takes place.

1.9 An oversecretion of the hormone produced by the thyroid gland may result in a person …

A gaining weight, because of an increased metabolic rate.
B gaining weight, because of a decreased metabolic rate.
C losing weight, because of an increased metabolic rate.
D losing weight, because of a decreased metabolic rate.

(9 x 2) **(18)**

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Question 2

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.	
2.20	The part of brain that controls body temperature	
2.21	Groups of cells in the pancreas that secrete insulin and glucagon	
2.22	The homeostatic process whereby temperature is controlled in the body	
	(22 x 1)	**(22)**

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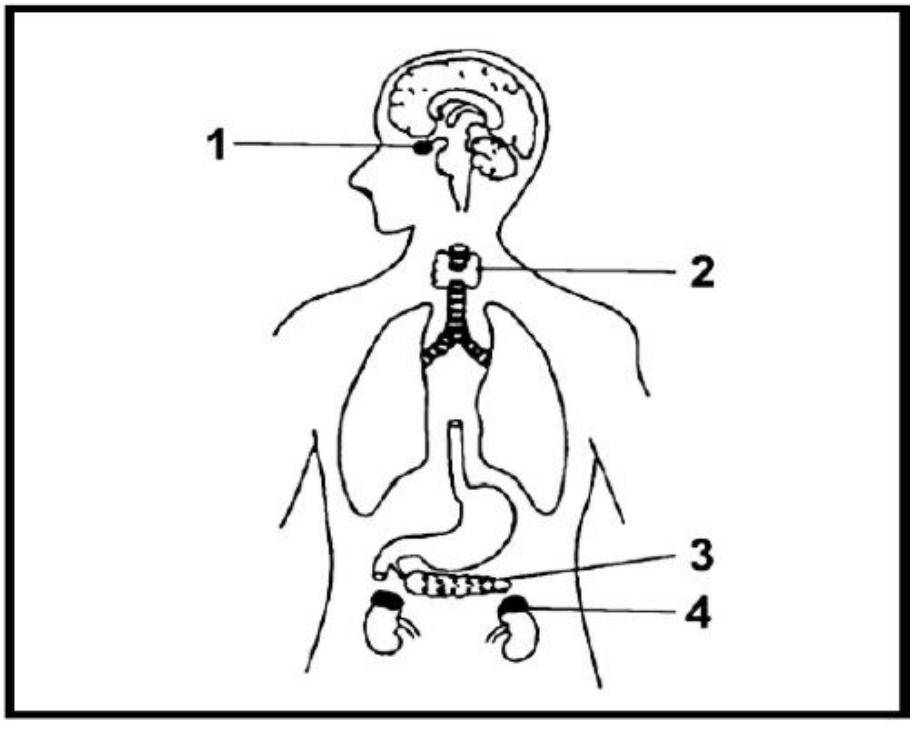
Question 3

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)

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

(a) Produces the hormone glucagon (2)

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

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

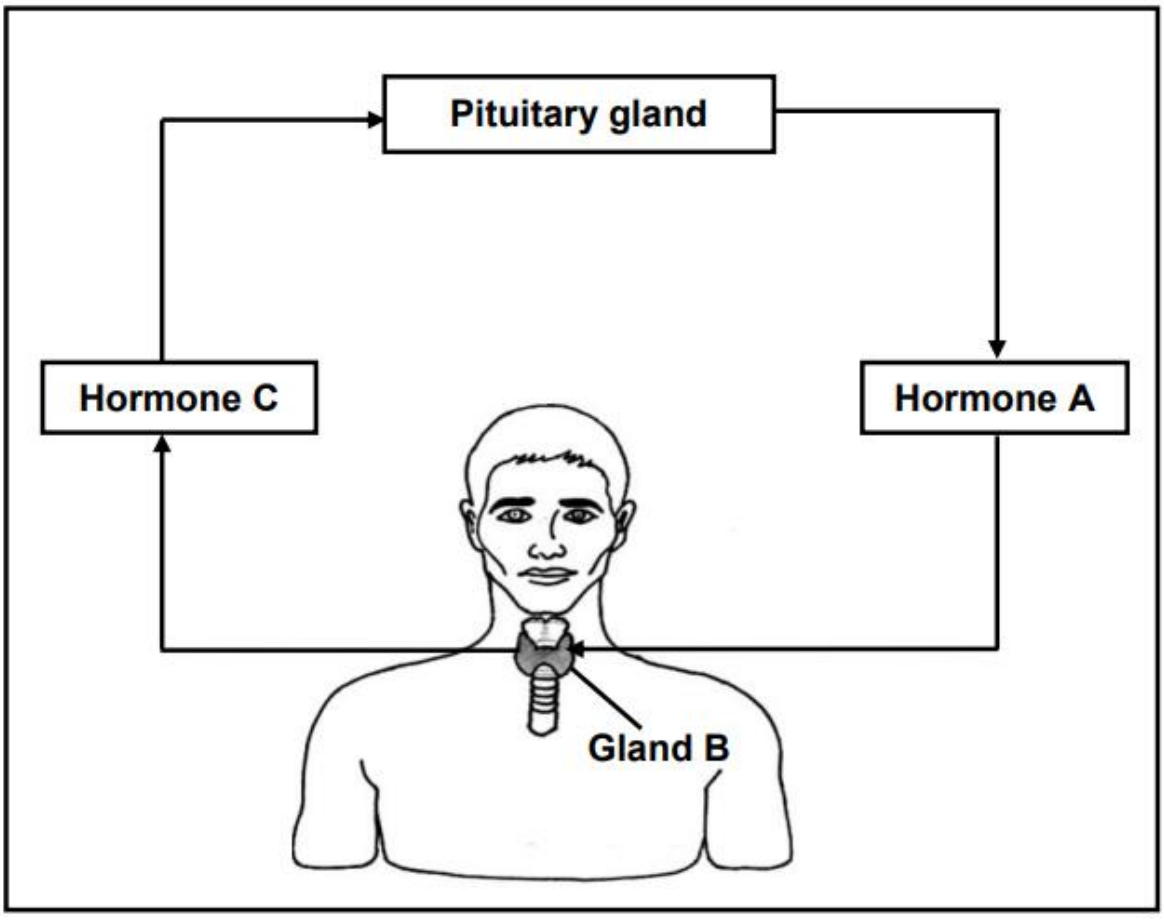
(d) Produces a hormone that is involved in the re-absorption of some salts by the kidneys (2)

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

(12)

Question 5

The diagram below shows the interaction between two endocrine glands.



5.1 Name the type of interaction that occurs between hormone **A** and gland **B.** (1)

5.2 Identify:

(a) Glands **B** (1)

(b) Hormone **A** (1)

(c) Hormone **C** (1)

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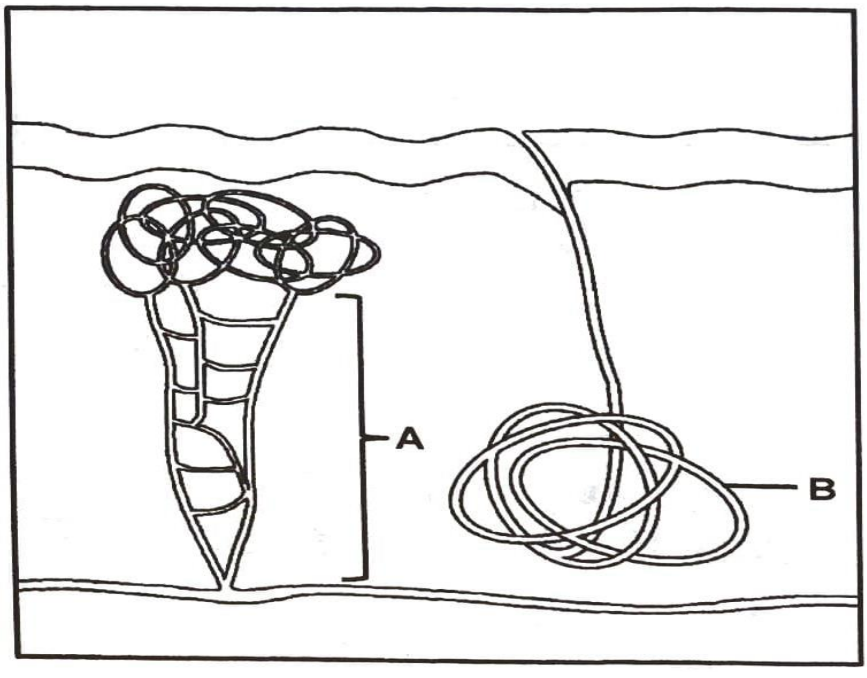
5.3 Name the disorder that results when gland **B** is overstimulated and becomes enlarged. (1)

5.4 Which hormone (**A** or **C**) will be expected to be high in the blood of the person with the disorder named in QUESTION 5.3? (1)

(6)

Question 6

The diagram below represents a part of the human skin



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

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

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

(6)

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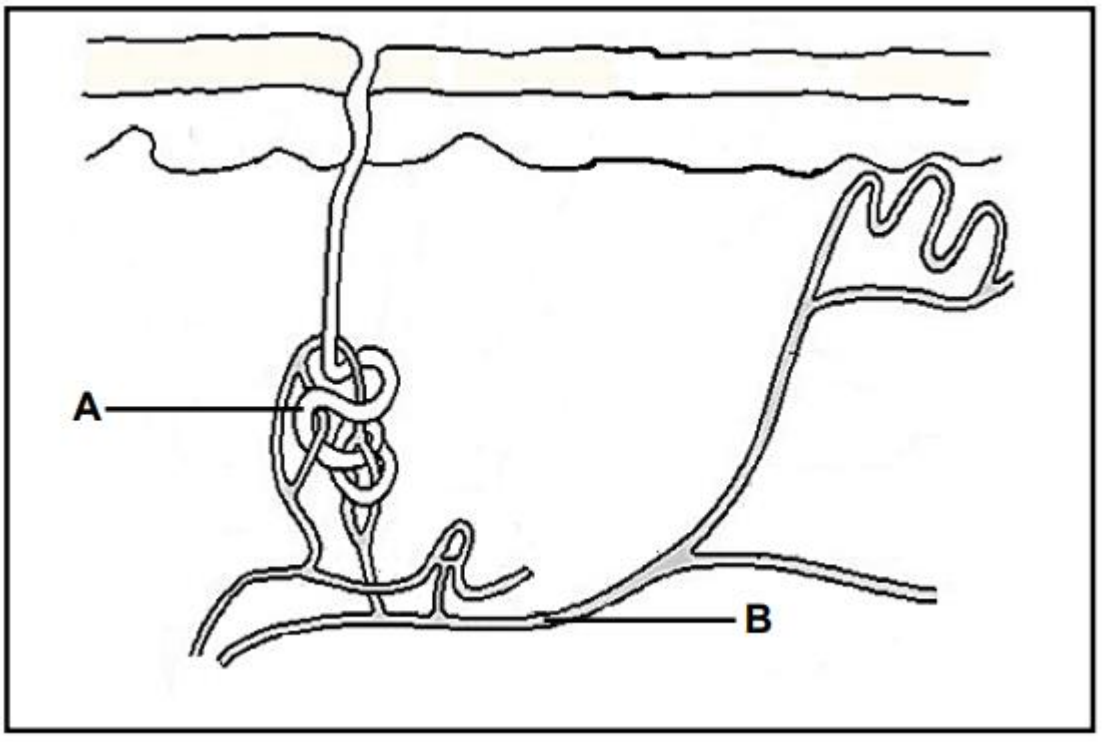
Question 7

The diagram below shows parts of the skin that are involved in thermoregulation.



7.1 Give TWO reasons why part **A** is classified as an exocrine gland. (2)
7.2 Describe the role of skin receptors in thermoregulation. (2)
7.3 Explain why structure **B** dilates on a hot day. (2)

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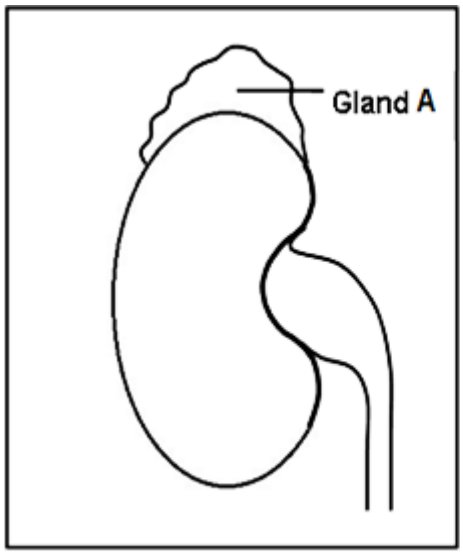
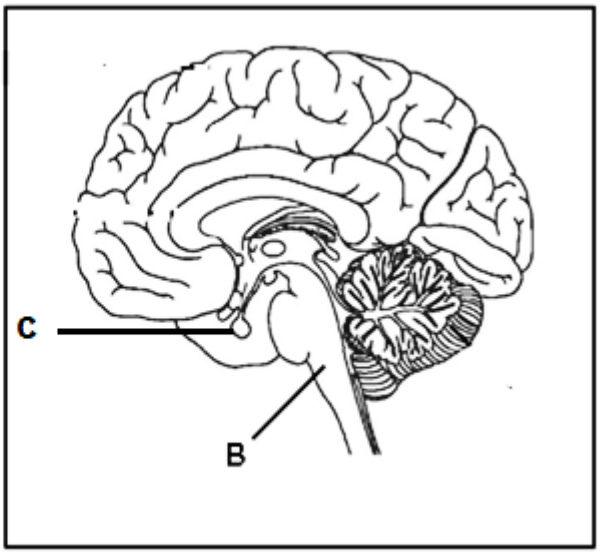
Question 8

The diagrams below show the human kidney and human brain.





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

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

8.2 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)

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

(11)

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Question 9

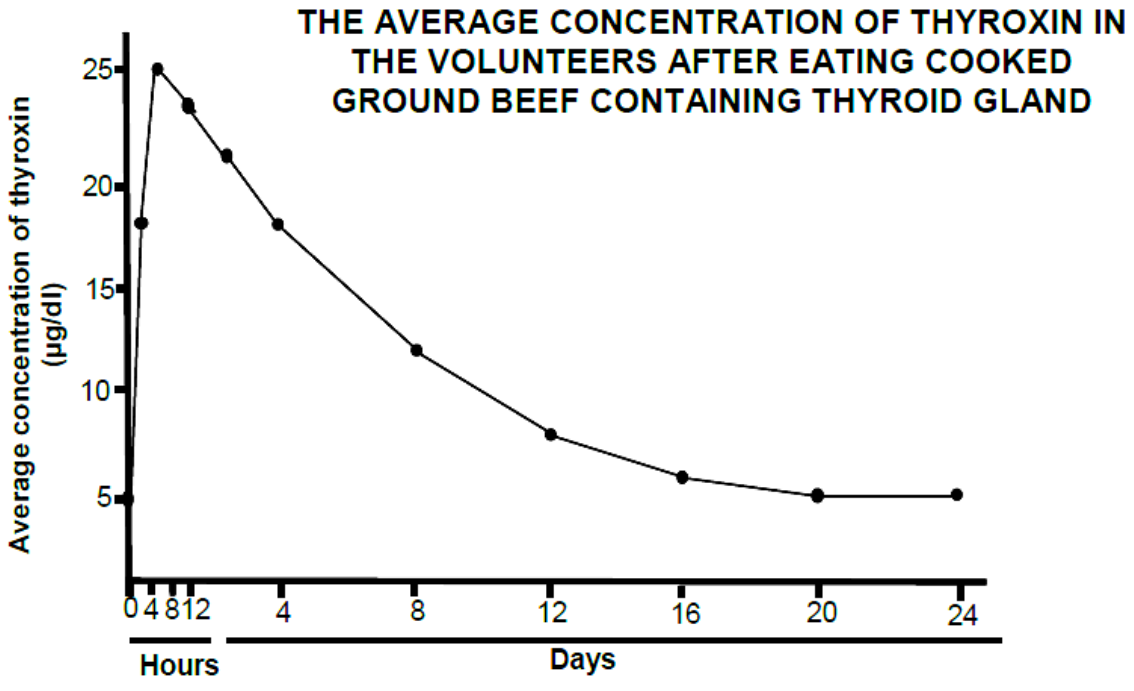
Read the extract below.

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.



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

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

9.3 Explain why thyrotoxicosis causes weight loss. (3)

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

(11)

Question 10

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

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

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

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

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

10.5 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 11

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

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

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

11.3 Caffeine causes vasoconstriction and an increase in metabolism.

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

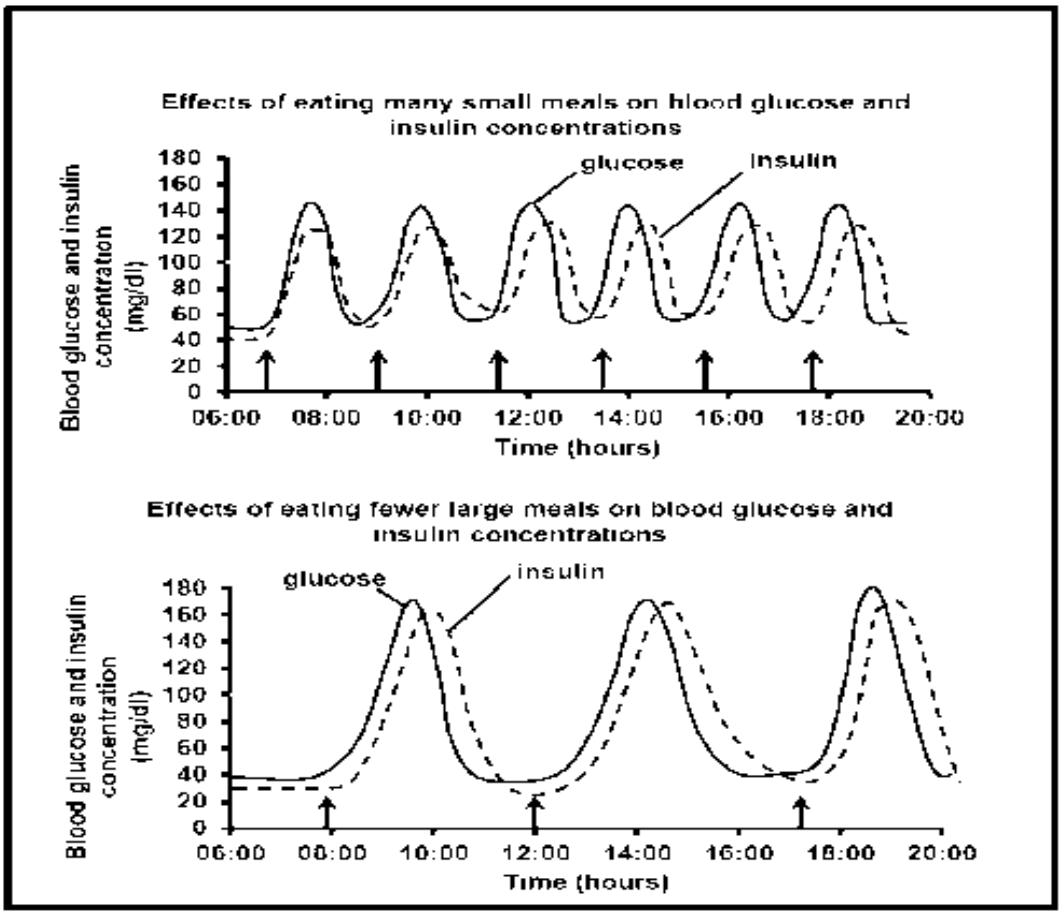
11.4 State TWO factors that were kept constant during this investigation. (2)

(9)

Question 12

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.



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

12.2 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)

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

(10)

Question 13

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

13.2 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 14

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

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

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

(9)

Question 15

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

Question 16

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

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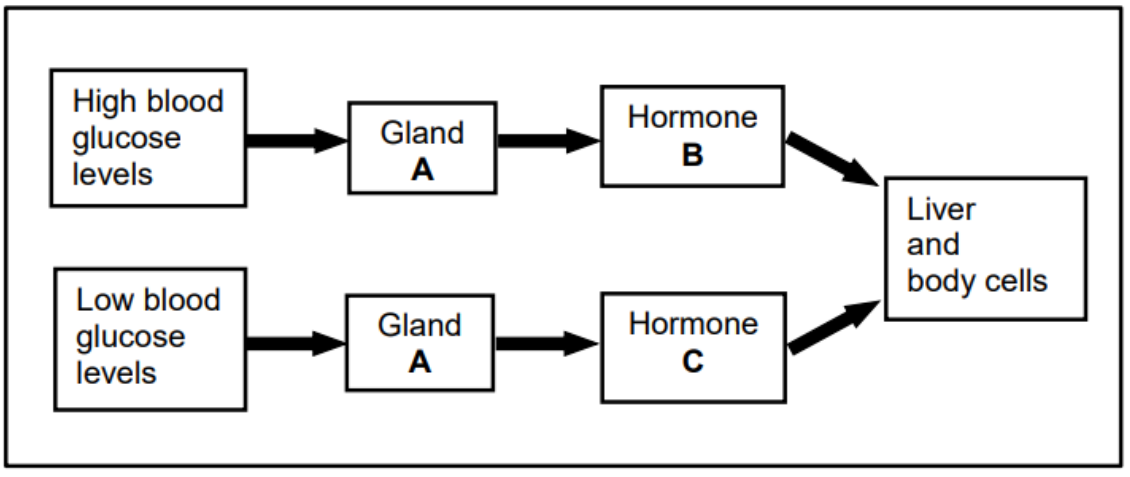
Question 17

The diagram below shows the homeostatic control of blood glucose levels.



17.1 Identify:
(a) Gland **A** (1)
(b) Hormone **C** (1)

17.2 A certain disorder causes decreased production of hormone **B**.
(a) Explain how this will affect the blood glucose levels. (3)
(b) Name the disorder. (1)

17.3 Scientists have been investigating the use of adrenalin as a treatment for people who cannot produce hormone **C**.
Explain why this treatment may work. (3)

Question 18

Wearing a face mask is recommended to reduce the spread of the coronavirus. There are some concerns about the efficiency of breathing when wearing a face mask.

Scientists investigated the effect of wearing face masks on carbon dioxide levels in blood.

They:

- Obtained permission from 150 healthy volunteers, aged 30, to participate in the investigation
- Applied a sensor to the participants' skin to measure the carbon dioxide levels in the blood
- Asked the participants to:
  - Sit still for 10 minutes without wearing a face mask
  - Sit still for 10 minutes while wearing a face mask
  - Exercise for 10 minutes without wearing a face mask

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- Exercise for 10 minutes while wearing a face mask
- Allowed a 15-minute interval between each 10-minute phase
- Recorded the carbon dioxide levels at the end of each 10-minute phase
- Ensured that the face mask covered the nose and mouth

18.1 Identify the:

(a) Independent variable (1)

(b) Dependent variable (1)

18.2 State TWO factors that were taken into consideration in the selection of the participants. (2)

18.3 Give ONE reason why the results at the end of this investigation may be considered reliable. (1)

18.4 Explain why scientists allowed a 15-minute interval between each phase. (2)

18.5 Give a reason why the carbon dioxide levels were measured while participants were sitting still. (1)

18.6 Describe the *homeostatic control* of carbon dioxide when it is high in blood (7)

(15)

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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.

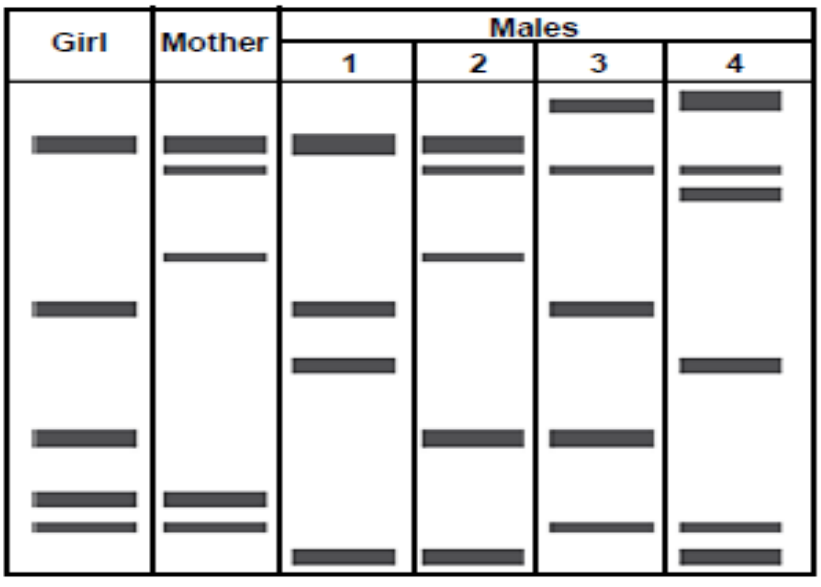
1.1 The scientists who won the Nobel Prize for the discovery of the structure of DNA were …

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 diagram below shows the DNA profiles of a girl, her mother and four males.



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Which male is the girls biological father?

A 1
B 2
C 3
D 4

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

A Amino acids
B Nucleotides
C Glucose
D Fatty acids

1.5 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)

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

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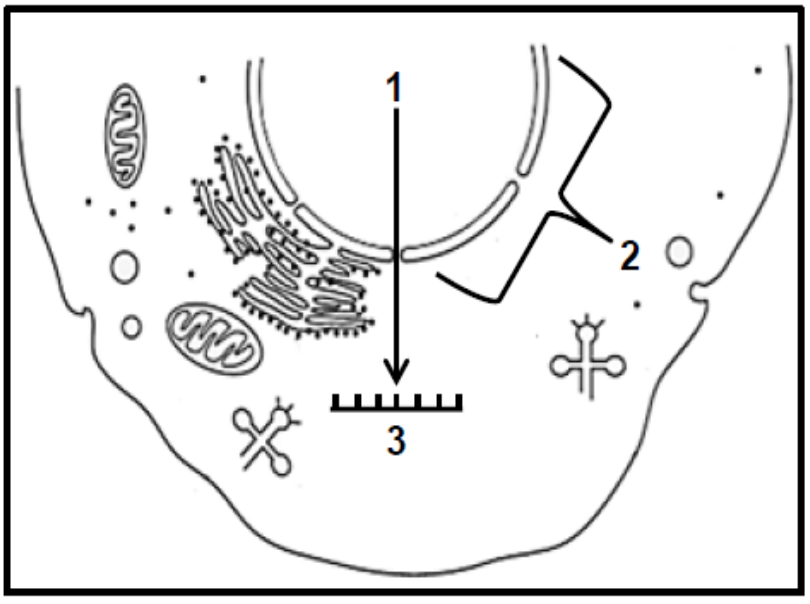

Which ONE of the following is the CORRECT labels for 1, 2 and 3 in the diagram?

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

1.7 A short piece of DNA, containing 19 nucleotides in each strand was analysed. The number of some of the different nitrogenous bases in each strand is shown below.

	Number of nitrogenous bases.			
	A	**T**	**G**	**C**
Strand 1	8	-	-	-
Strand 2	-	8	3	4

How many nucleotides containing thymine (T) were present in strand 1?

A 8
B 4
C 6
D 2

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

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Question 2

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)**

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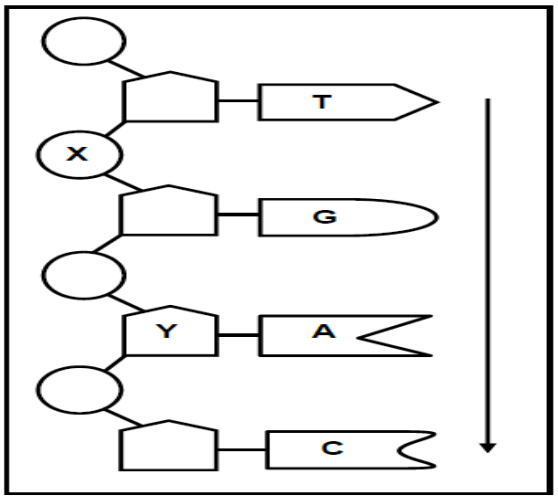
Question 4

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)

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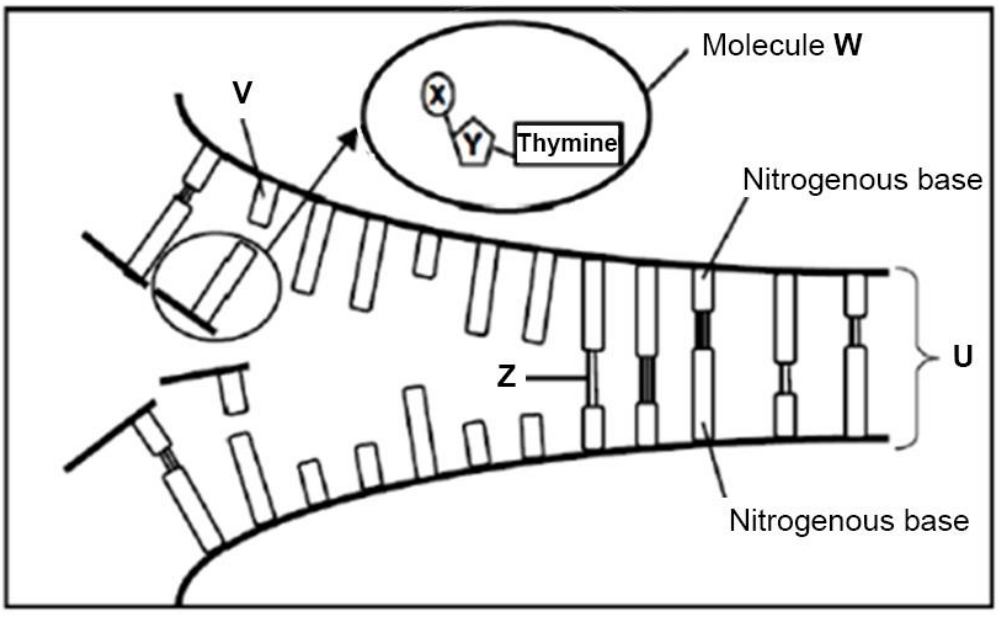
Question 5

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)

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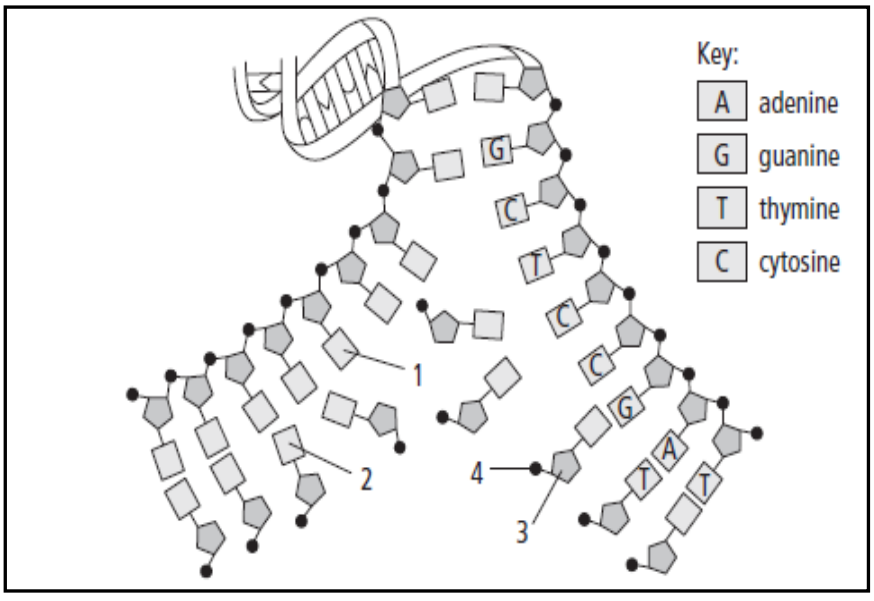
Question 6

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)

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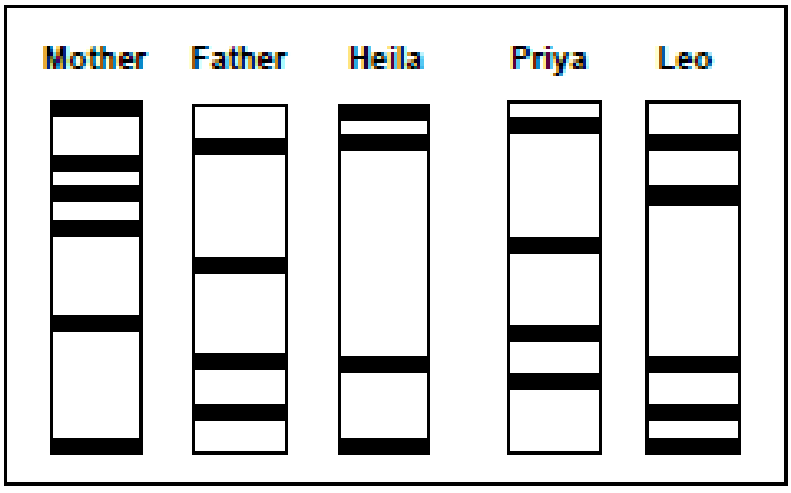
Question 8

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



8.1	Identify the TWO biological children.	(2)
8.2	Explain your answer to QUESTION 8.1	(2)
8.3	State THREE other uses of DNA profiling	(3)
		(7)

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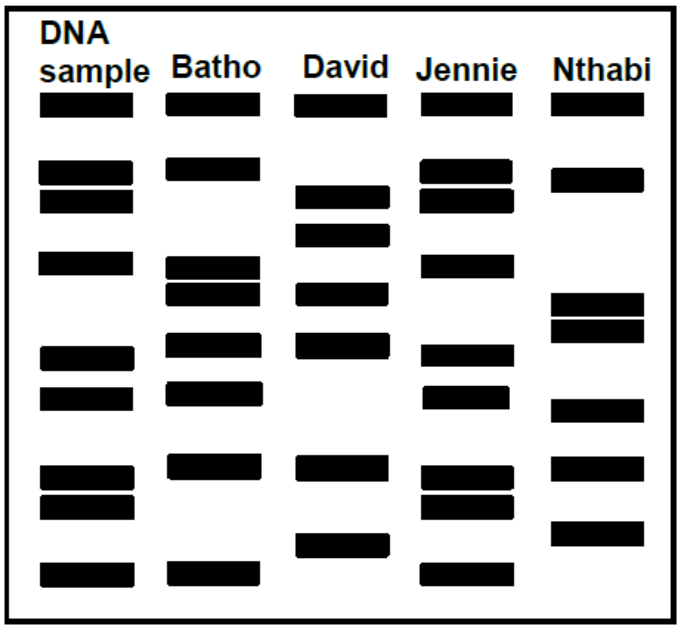
Question 9

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



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

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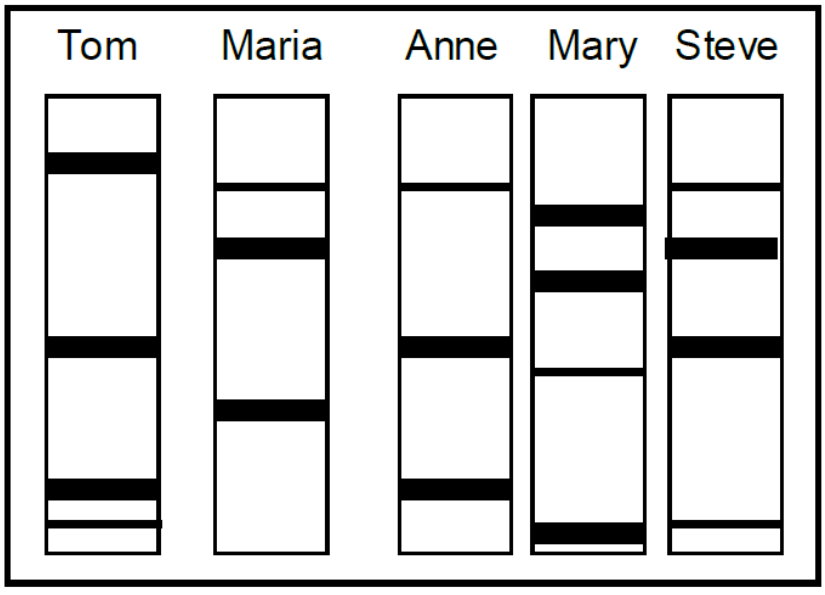
Question 10

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



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

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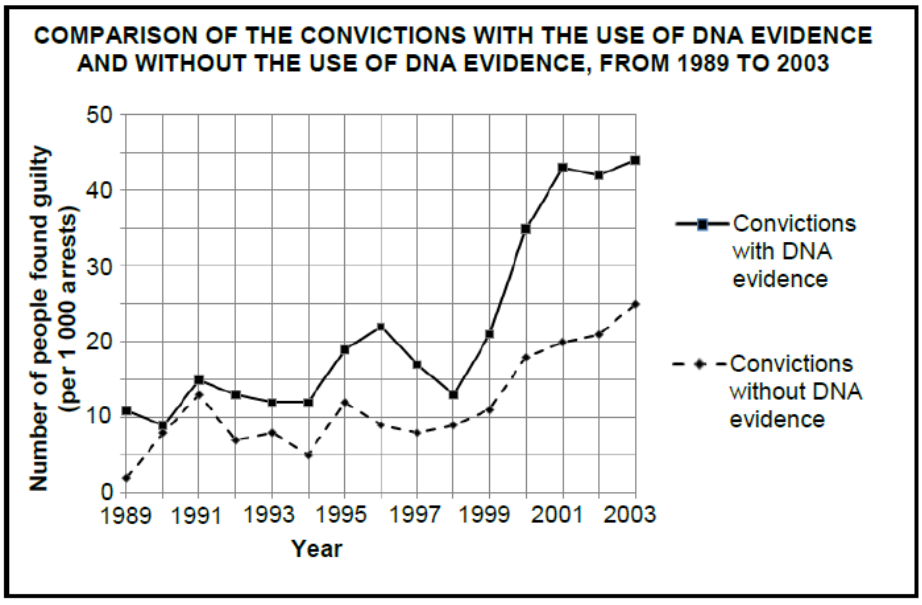
Question 11

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



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

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

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

(7)

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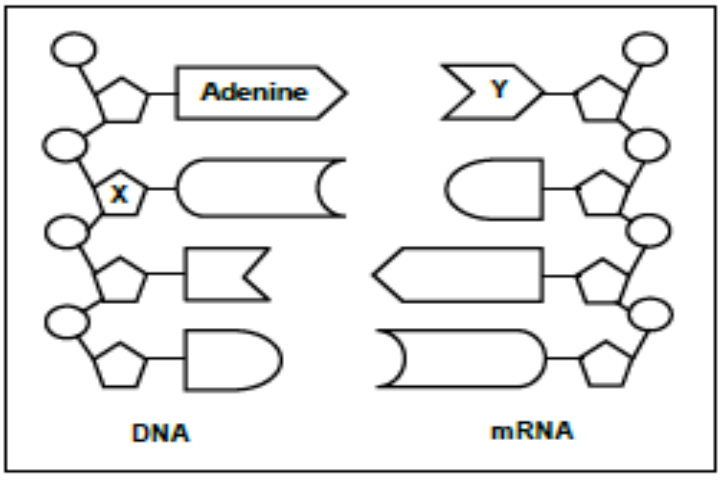
Question 12

The diagram below represents transcription during protein synthesis.



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

12.2 Identify:

(a) Sugar X (1)

(b) Nitrogenous base Y (1)

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

(8)

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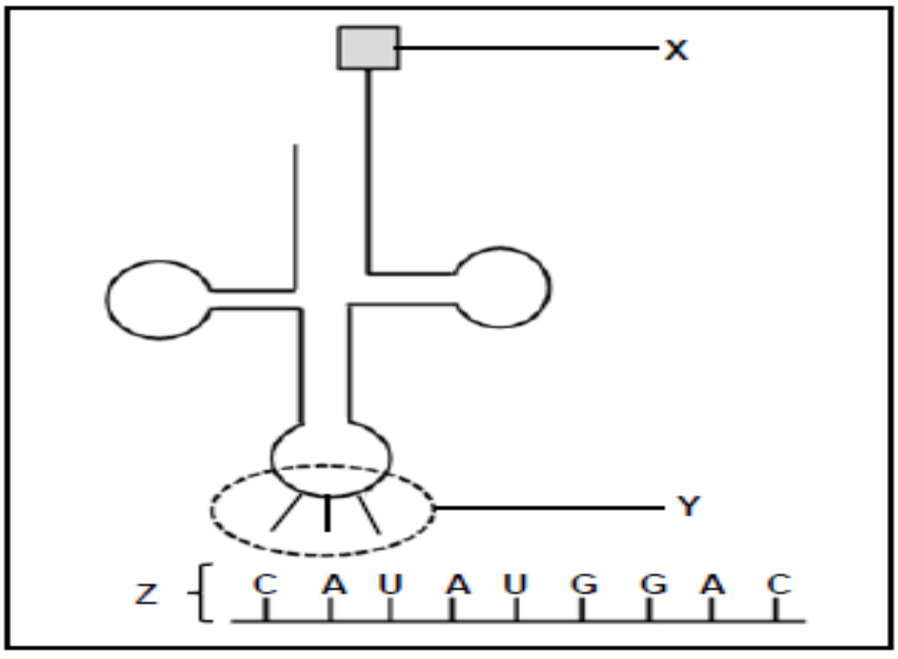
Question 13

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



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

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

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

(12)

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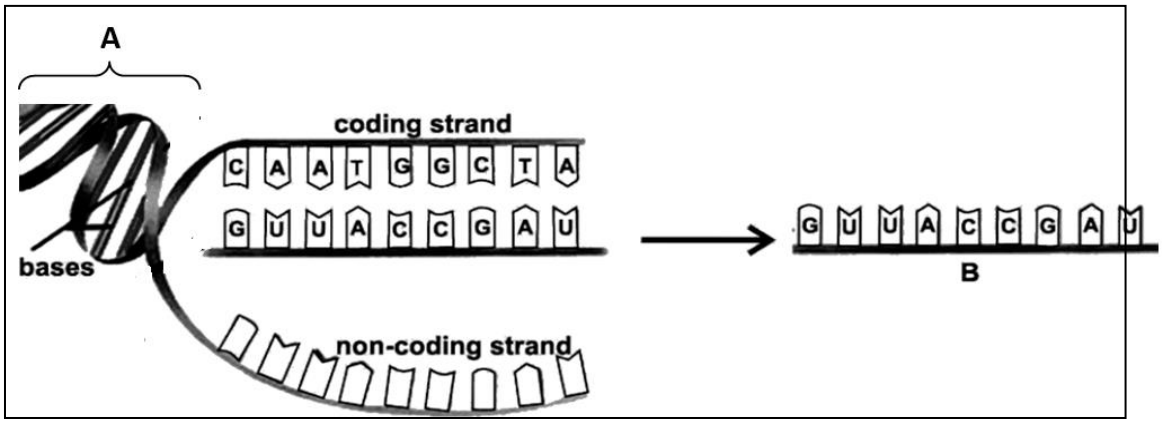
Question 14

The diagram below shows parts of Protein synthesis.



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

Question 15

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

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

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

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Question 16

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

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

16.1 Name the mutation that has occurred (1)

16.2 Give a reason for your answer to QUESTION 14.1 (1)

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

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

(a) State the number of different amino acids coded for by the original sequence of the mRNA molecule given above. (1)

(b) Give the anticodon on the tRNA molecule that carries the amino acid isoleucine. (1)

(c) Use information in the table to describe the effect of the mutation on the protein formed (4)

(8)

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Question 17

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

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

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

17.3 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)

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

(10)

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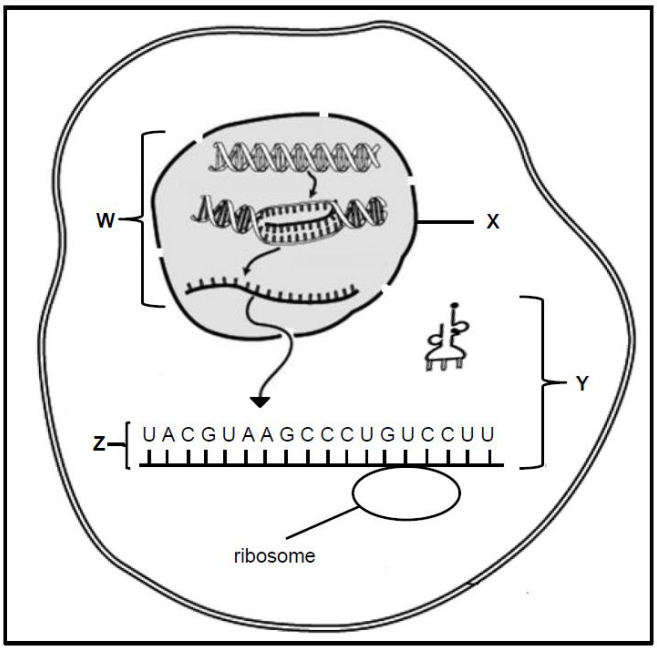
Question 18

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



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

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

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

18.4 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

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18.5 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)

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

18.7 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 19

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

C T T A C A

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

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

19.3 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

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

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

(8)

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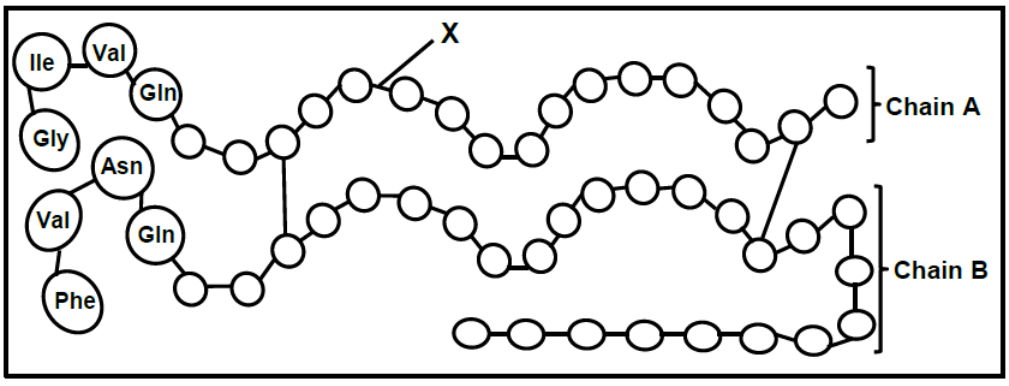
Question 20

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.



20.1 Name the process whereby insulin is produced in a normal human cell. (1)
20.2 Identify bond **X**. (1)
20.3 How many nitrogenous bases in DNA molecule code for the amino acids in chain **A**? (1)
20.4 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)

20.4.1 Name the nitrogenous base represented by **G** in the mRNA codon CAG. (1)
20.4.2 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)
20.4.3 Give the anticodon for Valine. (1)
(7)

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Question 21

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

Question 22

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

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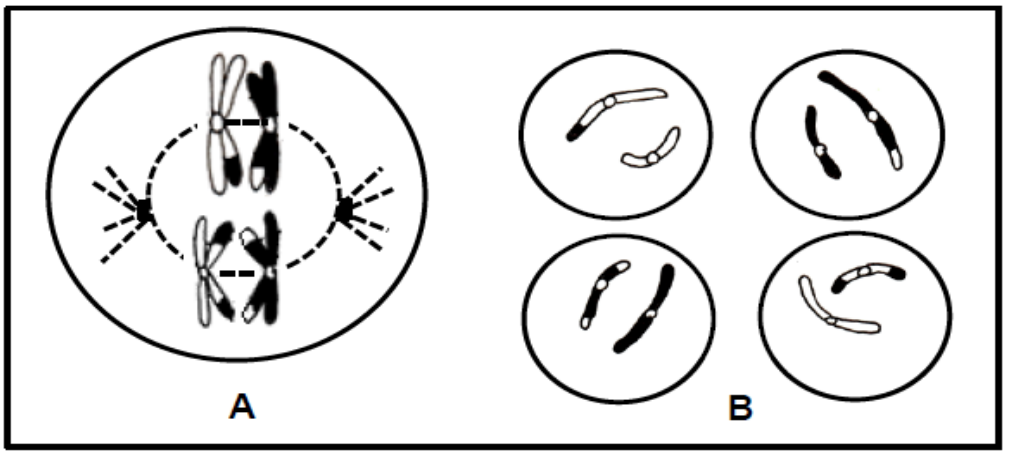
TOPIC: MEIOSIS

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 represents 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

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C Homologous chromosomes arranged at the equator
D Centrioles formed at the poles of the cell

1.4 During which phase of meiosis does the nuclear membrane disappear?

A Metaphase
B Telophase
C Prophase
D Anaphase

1.5 Below is a list of events that occur during cell division.

(i) Homologous chromosomes line up at the equator of the cell.
(ii) Chromatids are pulled to opposite poles of the cell.
(iii) Chromosome pairs arrange themselves randomly at the equator of the cell.
(iv) Individual chromosomes line up at the equator of the cell.

Which ONE of the following combinations occur in both meiosis and mitosis?

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

1.6 During Anaphase II of meiosis, the two chromatids of a chromosome are pulled apart, each moving towards opposite poles at a rate of 1 micrometer per second. The distance, in micrometers, between the chromatids after 20 seconds is ……

A 10.
B 20.
C 30.
D 40.

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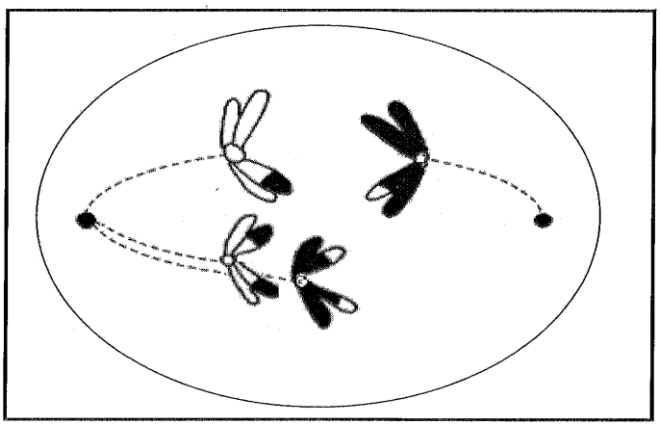
1.7 The diagram below shows a cell undergoing meiosis



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

(7X2) **(14)**

Question 2

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	

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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 carries the same set of genes.	
2.17	The structure that joins two chromatids of a chromosome	
2.18	The division of the cytoplasm of a cell during cell division	
2.19	The process during meiosis where there is an exchange of genetic material between chromatids	
2.20	The structures in animal cells that give rise to spindle fibres during cell division	
2.21	The phase in the cell cycle during which DNA replication takes place	
2.22	The point where adjacent chromatids overlap during meiosis	
2.23	The representation showing the arrangement of a diploid set of chromosomes	
	(23x1)	**(23)**

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)**

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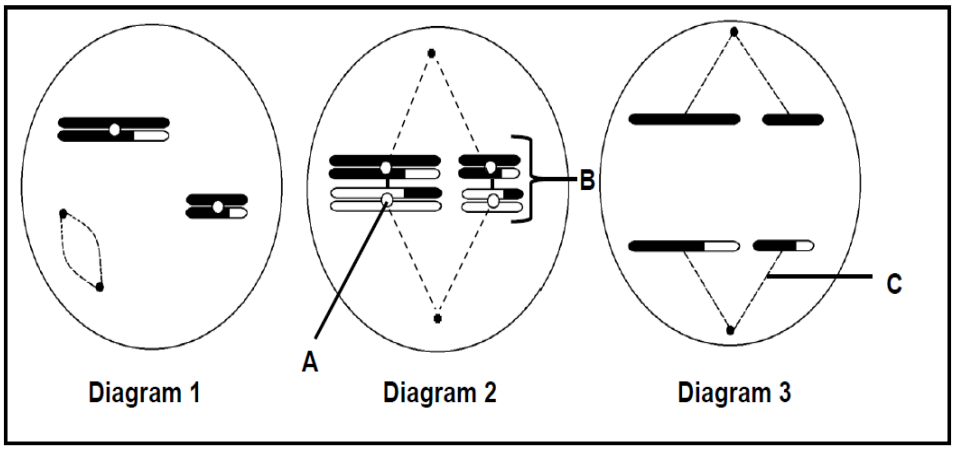
Question 4

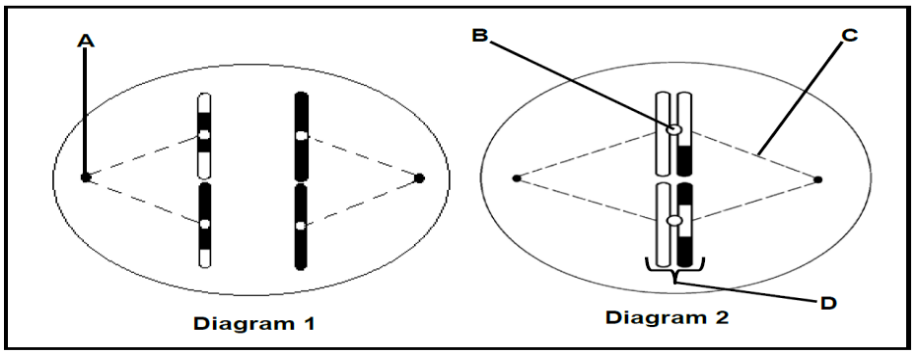
The diagram below represents different phases of meiosis in the diagram.



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 occur. (2)
4.4. State ONE difference between metaphase II and metaphase II. (2)
(8)

Question 5

The diagram below represents 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)

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(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:

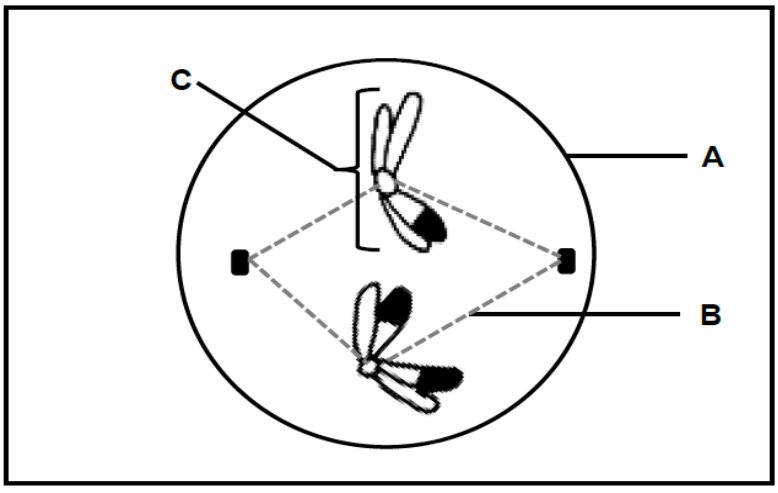
(a) The original parent cell in this organisms (1)

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

(9)

Question 6

The diagram below represents 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)

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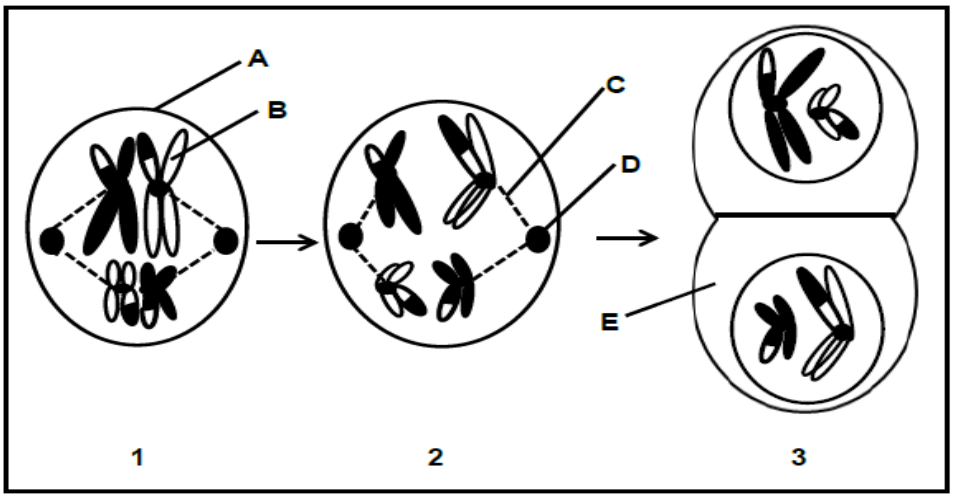
Question 7

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)**

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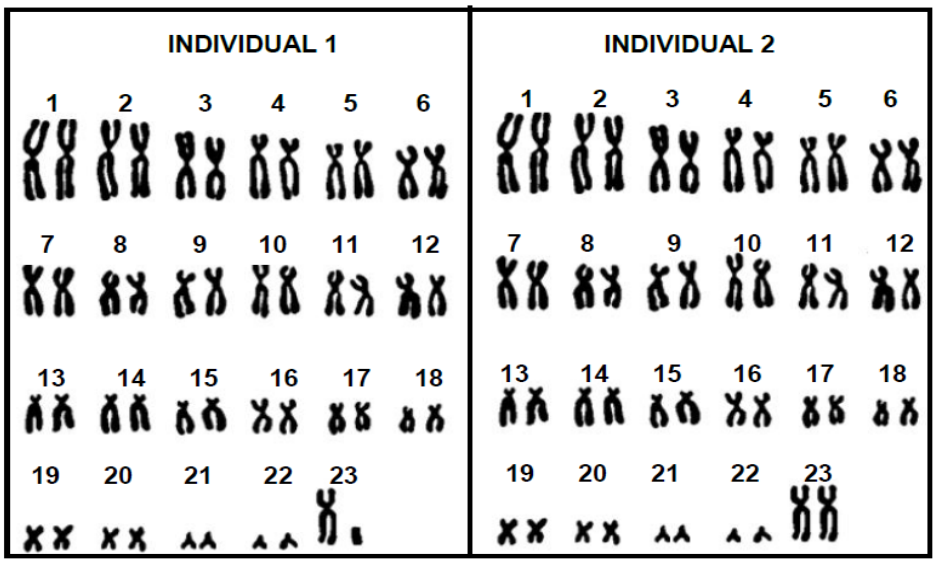
Question 9

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)

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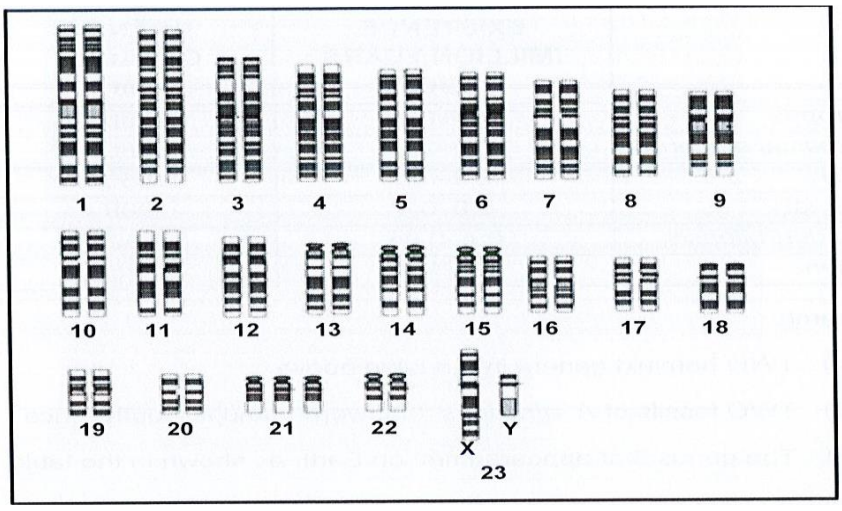
Question 10

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



10.1 Name:

(a) This disorder (1)

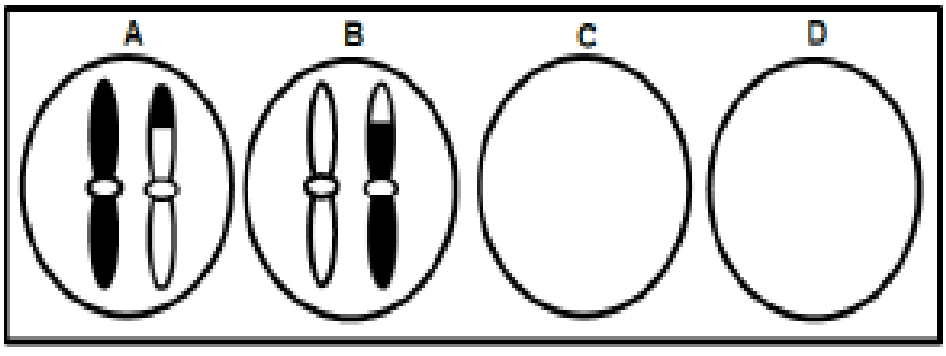
(b) The phase in meiosis when non-disjunction occurs (1)

(c) The type of mutation that is a result of non-disjunction (1)

(3)

Question 11

The diagram below represents 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**

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appear different to each other. (1)

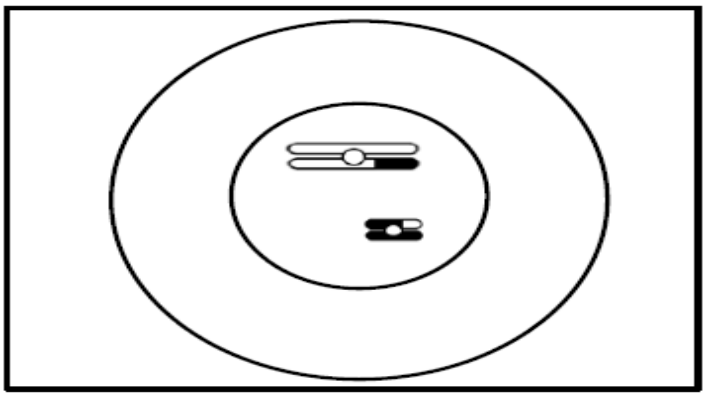
(a) Identify the phase of meiosis during which crossing over occurs. (1)

(b) Describe the events during crossing over. (1)

(9)

Question 12

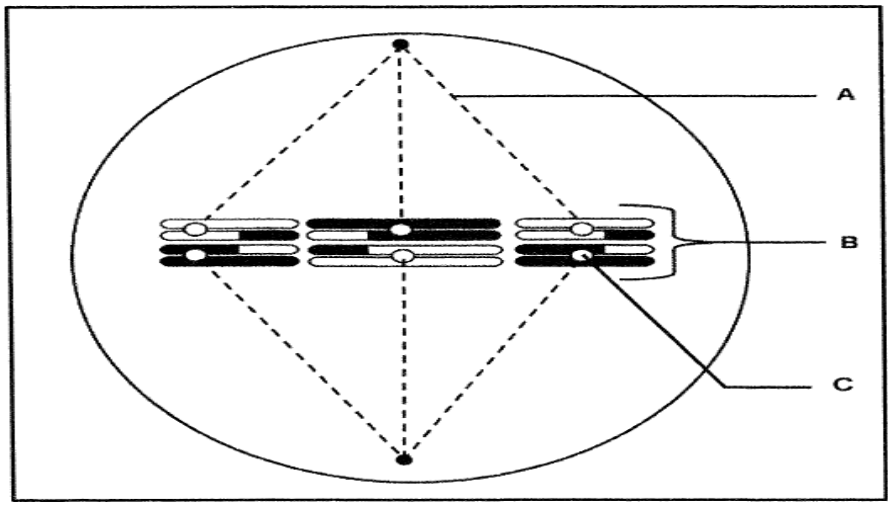
The diagram below represents one of the two cells that formed during Telophase I of meiosis in an organism.



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)

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13.4 Explain the appearance of chromosome in the diagram. (3)

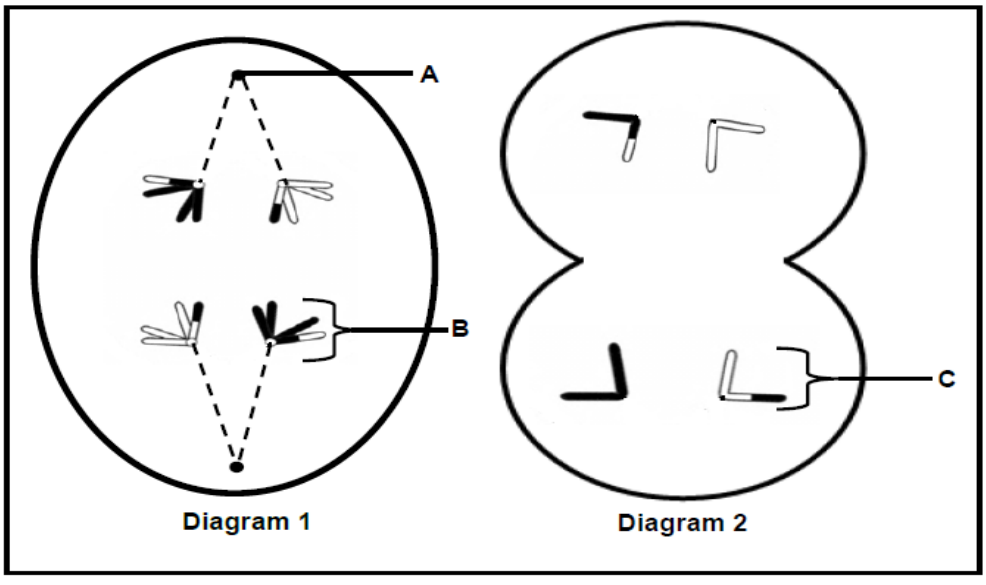
13.5 State the function of part A in the phase following the one represented in the diagram. (1)

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)

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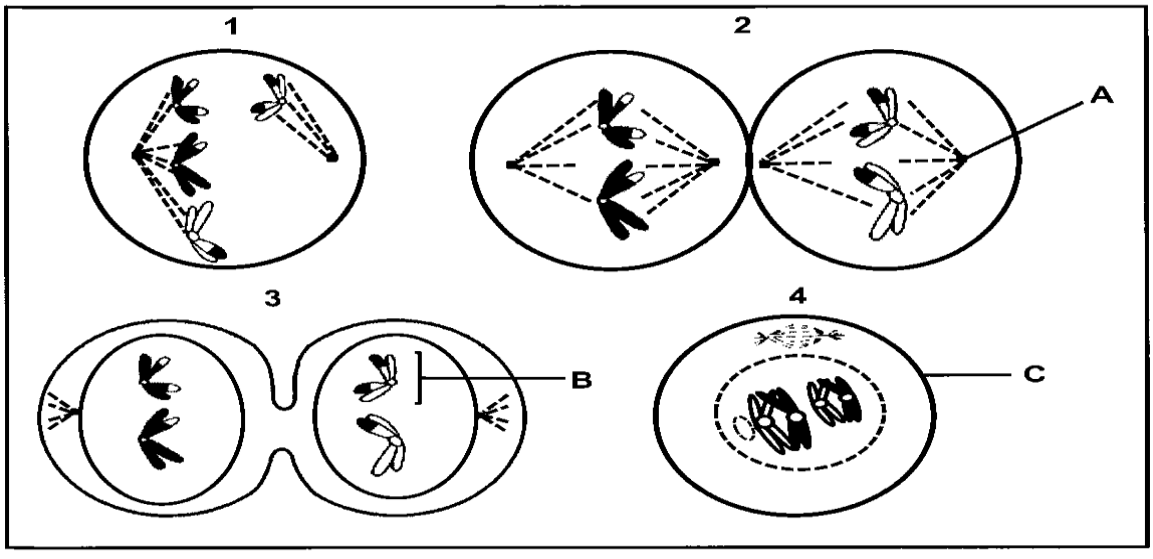
Question 15

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)

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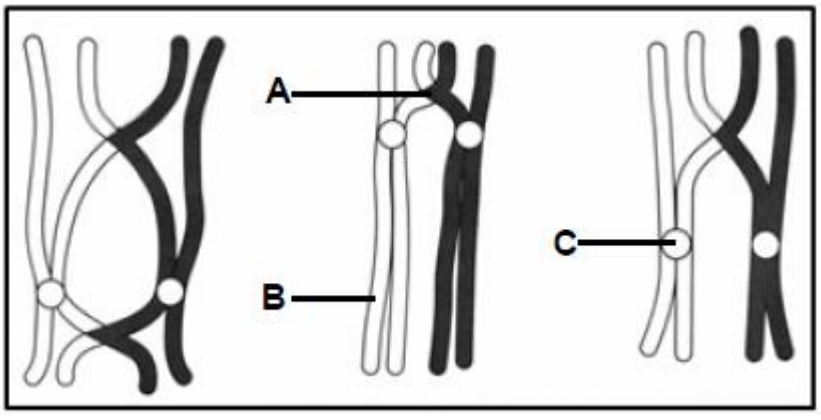
Question 16

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)

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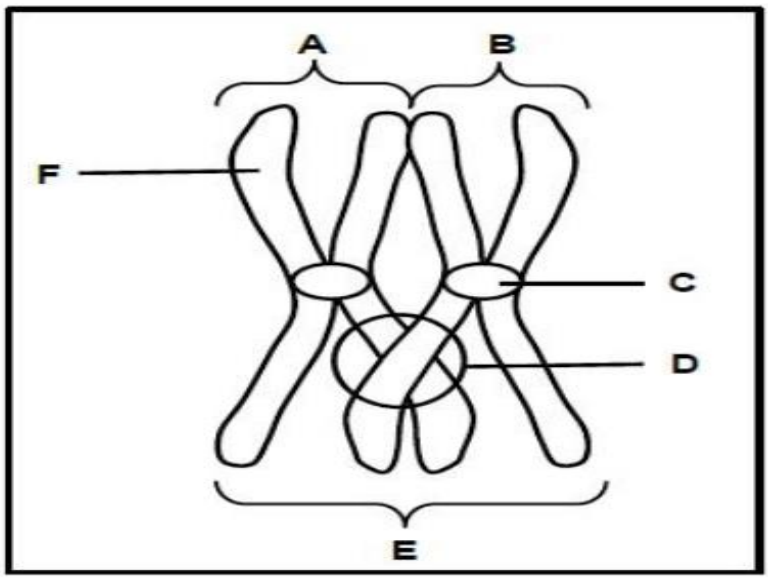
Question 17

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 all sperm (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)**

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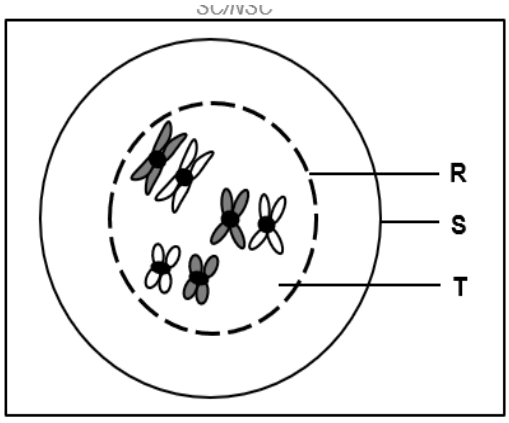
Question 19

The diagram below represents part of an abnormal human karyotype.



19.1 Give the
- (a) Phase of meiosis represented (1)
- (b) Number of chromatids shown (1)
- (c) Number of homologous chromosome pairs (1)

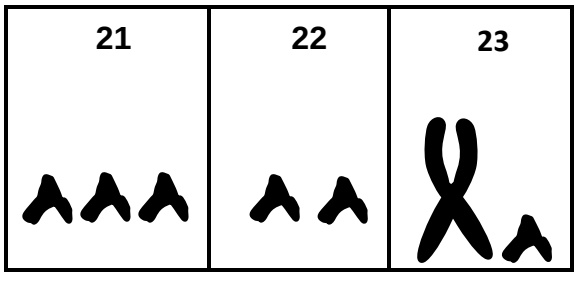
19.2 Identify the following
- (a) R (1)
- (b) S (1)
- (c) T (1)

19.3 Name TWO organs in an animal where meiosis occurs. (2)

(8)

Question 20

The diagram below represents part of an abnormal human karyotype.



20.1 How many autosomes are shown in the diagram? (1)

20.2 Name the type of chromosomes represented by pair 23. (1)

20.3 Name the:
- (a) Disorder represented in the diagram (1)
- (b) Process during anaphase of meiosis that resulted in the abnormal number of chromosomes in this karyotype (1)

20.4 State the gender of the person represented in this karyotype. (1)

(5)

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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 (1.1.1 to 1.1.3) in your ANSWER BOOK, for example 1.1.4 D.

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

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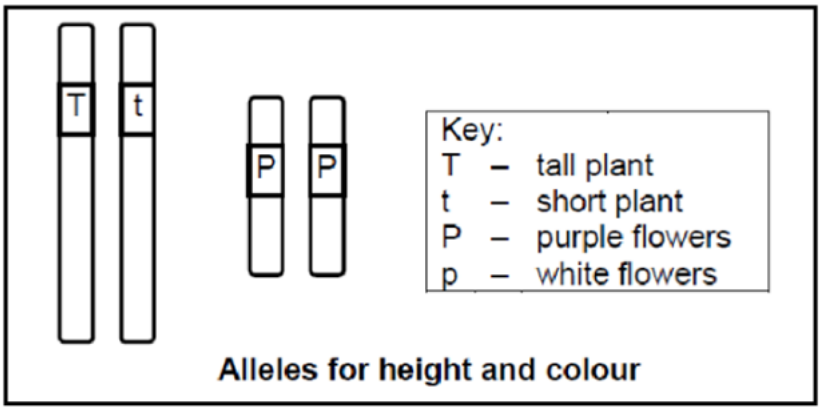
1.4 The diagram below shows the alleles for height and flower colour in a flowering plant.

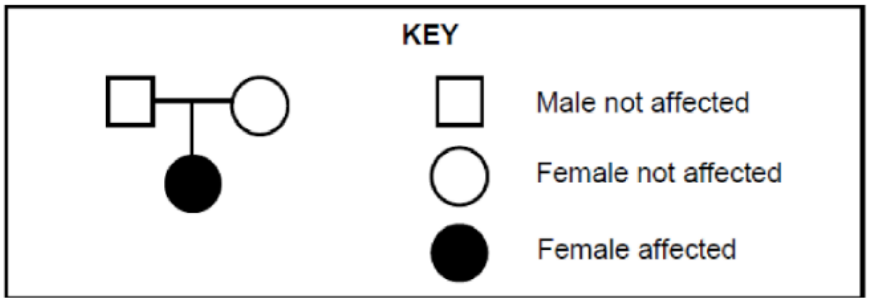
The diagram below shows the alleles for height and flower colour in a flowering plant.



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.

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1.6 The genotype for a specific characteristic …

A contains two chromosomes.
B is the physical appearance of an individual.
C is the composition of a gene pair.
D is represented by one allele.

1.7 The statements below describe the steps in the process of cloning an animal.

(i) The embryo is implanted into the uterus of an adult female for development.
(ii) The nucleus from a somatic cell of the donor is extracted.
(iii) The nucleus from the somatic cell is inserted into the ovum.
(iv) The nucleus from the ovum of another individual is removed.
(v) The ovum with the new nucleus is given an electric shock to stimulate cell division and the formation of the embryo.

Which combination shows the CORRECT order of the steps?

A (ii)→ (iv)→ (iii)→ (v)→ (i)
B (ii)→ (iii)→ (iv)→ (v)→ (i)
C (i)→ (ii)→ (iii)→ (iv)→ (v)
D (ii)→ (iv)→ (v)→ (iii)→ (i)

1.8 For a particular characteristic, the offspring inherits …

A one allele from the mother and one allele from the father. both alleles from the father.
B both alleles from the mother.
C the alleles from either the mother or the father randomly.
D one allele from the mother and one allele from the father. both alleles from the father.

(8 x 2) **(16)**

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Question 2

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	
2.24	The type of inheritance which produces an intermediate phenotype	
	(24 x1)	**(24)**

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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
3.6	An organism possesses two factors which separate so that each gamete contains only one of these factors	A: Law of dominance B: Principle of independent assortment
3.7	A plant with white flowers that is crossed with a plant with red flowers and produces offspring with pink flowers	A: Incomplete dominance B: Complete dominance
3.8	The separation of alleles during gamete formation	A: Law of Dominance B: Principle of Segregation
	(8x2)	**(16)**

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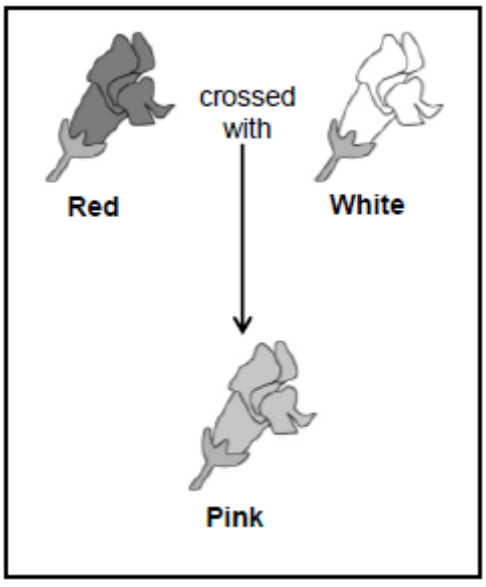
Question 4

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

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.

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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

6.1 State the dominant flower colour. (1)
6.2 Use cross 1 to explain your answer to QUESTION 7.1. (2)
6.3 State Mendel's Law of Segregation. (3)
6.4 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 7

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

7.1 State the genotype at **Z.** (1)
7.2 Give the:
(a) genotype of the parents (2)
(b) number of genotypes that could result in offspring with short fingers and a continuous hairline (2)
(c) allele for a continuous hairline (2)
(d) phenotype of a child who is homozygous recessive for both characteristics (2)
(9)

Question 8

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.

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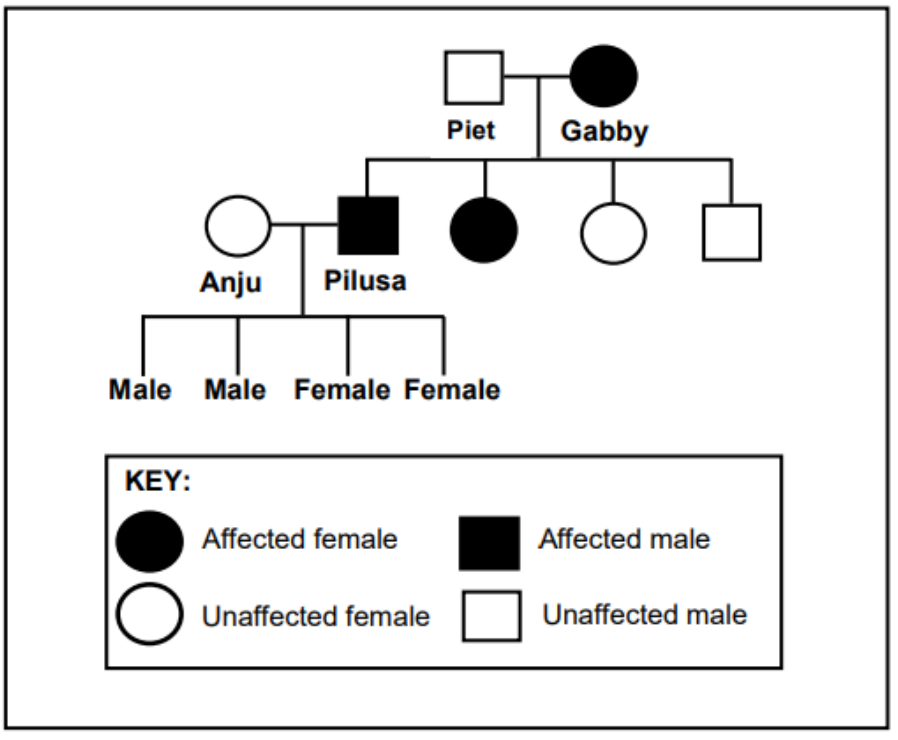
8.1 Name this type of genetic cross. (1)
8.2 Give the genotype of a homozygous tall, yellow tomato plant. (2)
8.3 List the genotypes of ALL the possible gametes for a plant that is heterozygous for both characteristics. (4)
(7)

Question 9

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 10

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.



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

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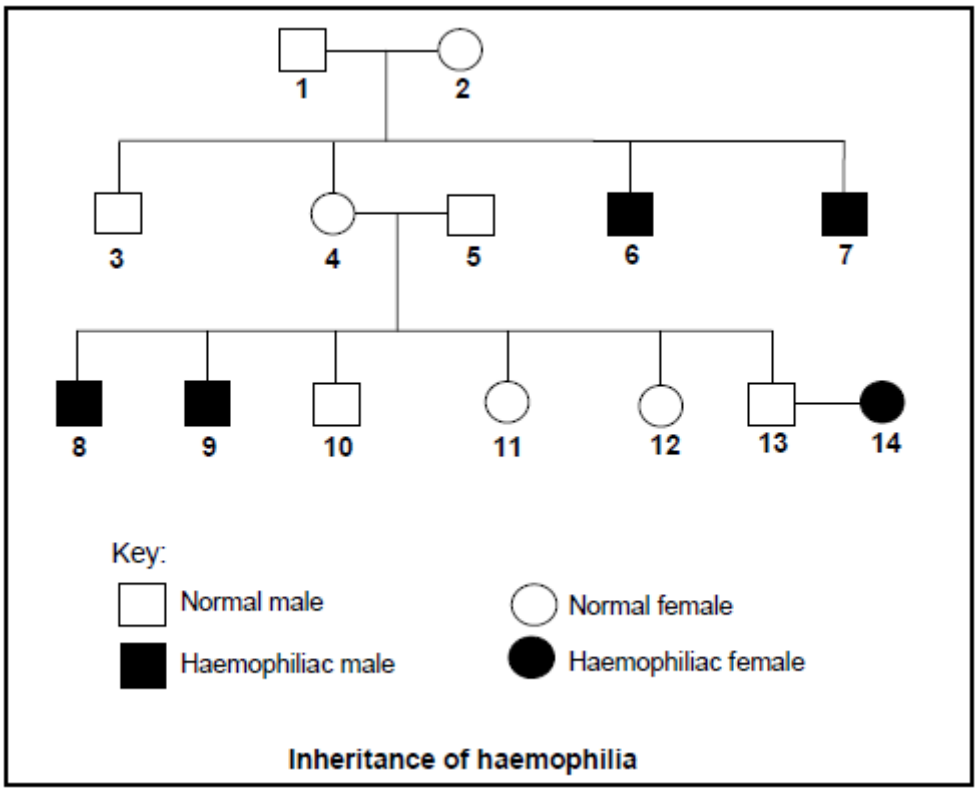
Question 11

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



Inheritance of haemophilia

11.1 Determine the:
(a) phenotype of individual **4.** (1)
(b) genotype of individual **2.** (2)

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

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

(13)

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Question 12

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**

12.1 What is a gene mutation? (2)

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

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

12.4 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)

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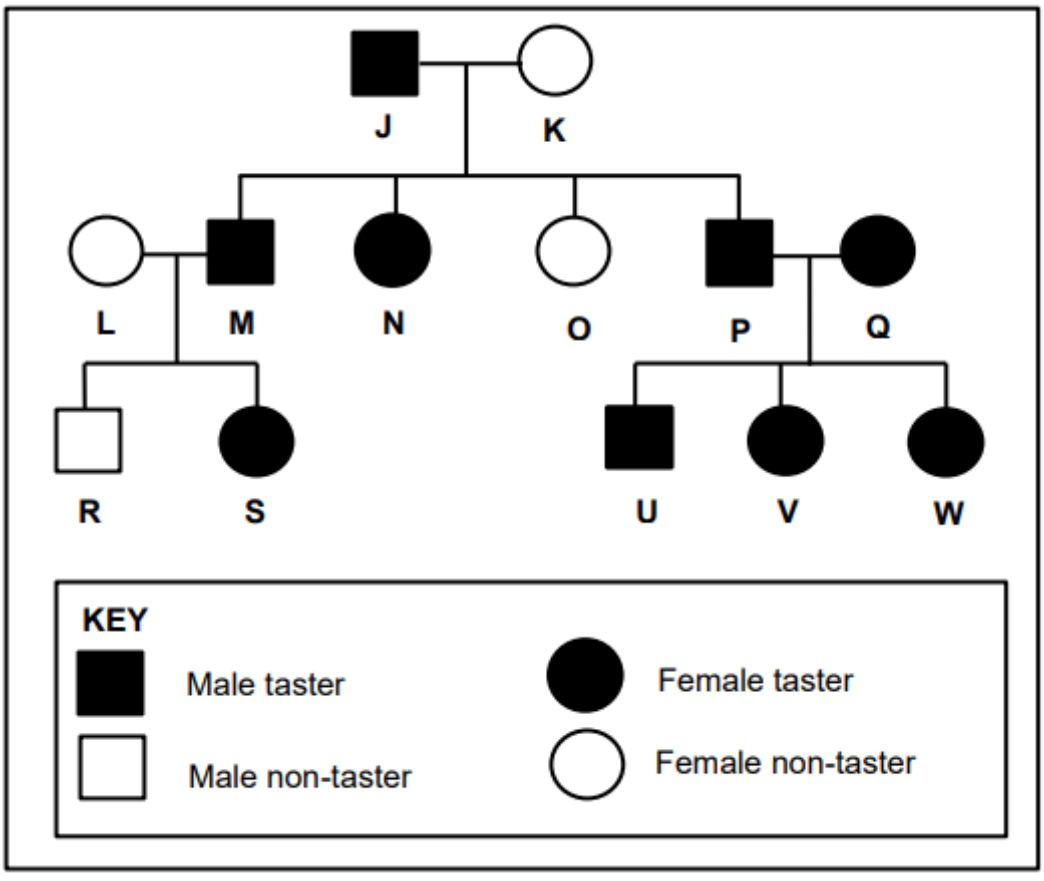
Question 13

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.



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

13.2 Give the:

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

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

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

(8)

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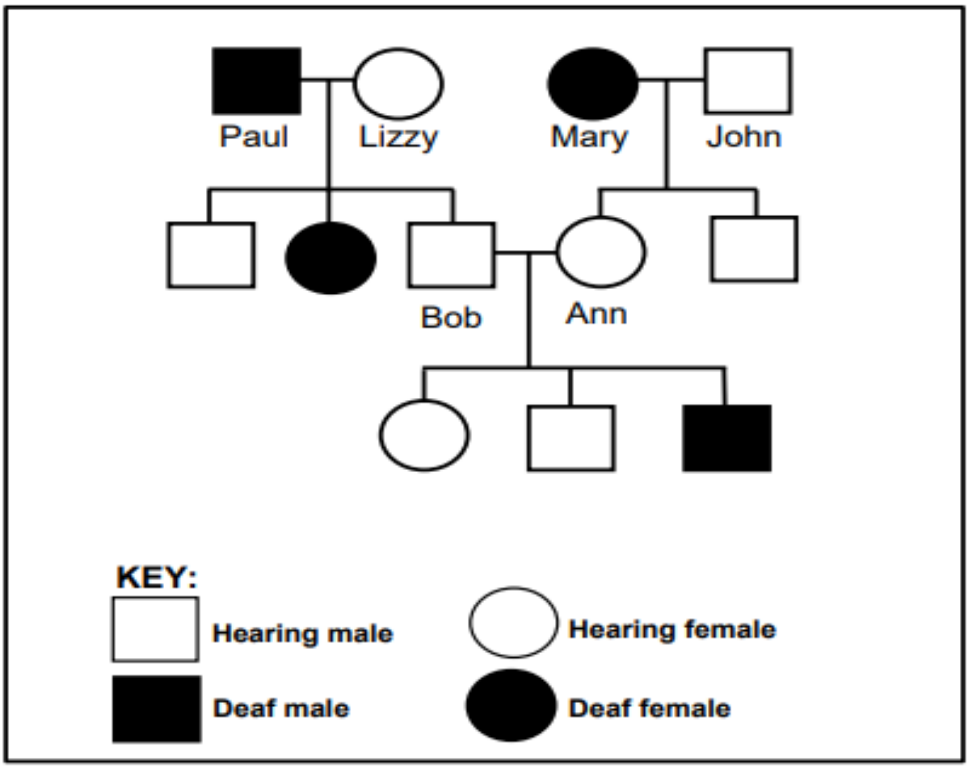
Question 14

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



14.1 How many:
(a) generations are represented in this pedigree diagram? (1)
(b) children of Paul and Lizzy are able to hear? (1)
14.2 Which phenotype is dominant? (1)
14.3 Use the offspring of Bob and Ann to explain your answer to QUESTION 15.2. (4)
14.4 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 15

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.

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15.1 From the extract, identify TWO areas in the body where bone density can mainly be measured. (2)
15.2 Describe what a gene mutation is. (2)
15.3 Explain why it was necessary for the researchers to collect DNA samples. (2)
16.4 State the effect of this mutation. (1)
15.5 Calculate the percentage of the family members who had normal bone density. Show ALL your workings. (3)
(10)

Question 16

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

16.1 How many:
(a) different phenotypes for blood group appear in this family? (1)
(b) possible genotypes are there for blood group AB? (1)
16.2 Give the genotype of the father. (2)
16.3 Which member of the family:
(a) has the genotype ii? (1)
(b) has co-dominant alleles? (1)
(c) is adopted? (1)
(7)

Question 17

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**).

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

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17.2 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)

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

17.4 State TWO benefits of cloning. (2)

(8)

Question 18

Human blood groups are controlled by multiple alleles.

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

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

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

18.4 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 19

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**.

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

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

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

(8)

Question 20

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

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

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

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

(10)

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Question 21

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

Question 22

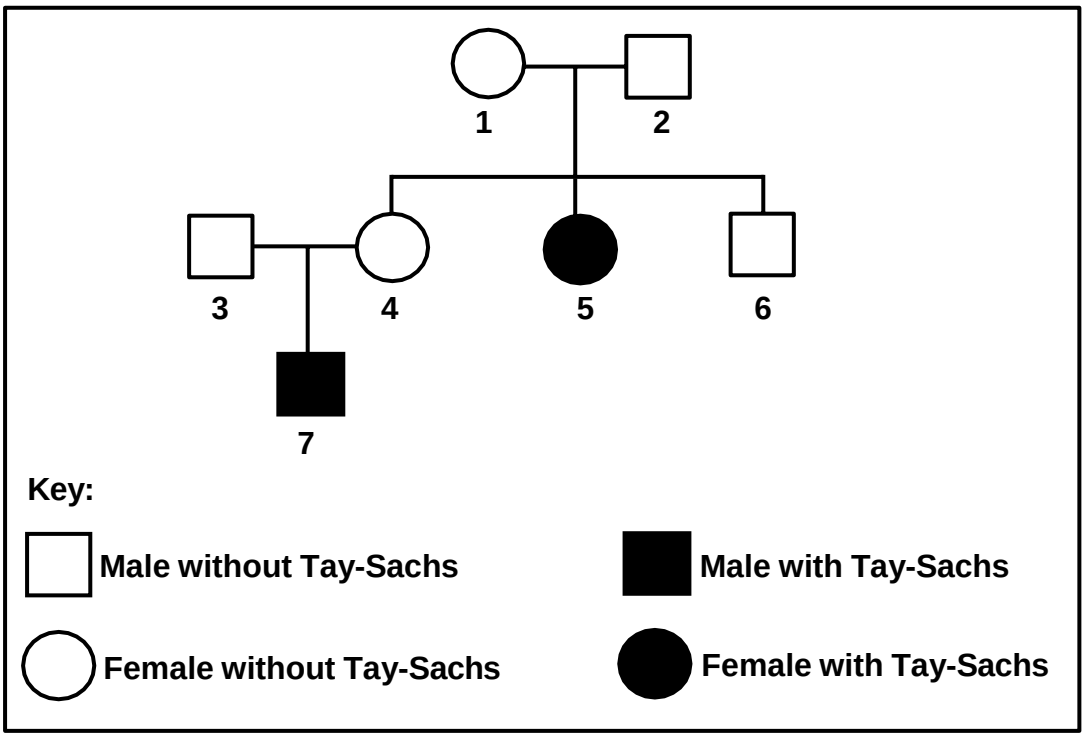
The brinjal plant carries edible fruit. Scientists have been studying the inheritance of two genes, one for stem texture and the other for fruit shape.

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

22.1 Name the type of cross that studies two characteristics. (1)
22.2 State the:
(a) Dominant characteristic for stem texture (1)
(b) Recessive characteristic for fruit shape (1)
22.3 Give the:
(a) Genotype of a plant with a prickly stem and elongated fruit (2)
(b) Phenotype of a plant with the genotype NnRR (2)
(7)

Question 23

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



23.1 Describe what is meant by an *autosomal disorder*. (2)
23.2 How many sons do individuals **1** and **2** have? (1)

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

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

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

(10)

Question 24

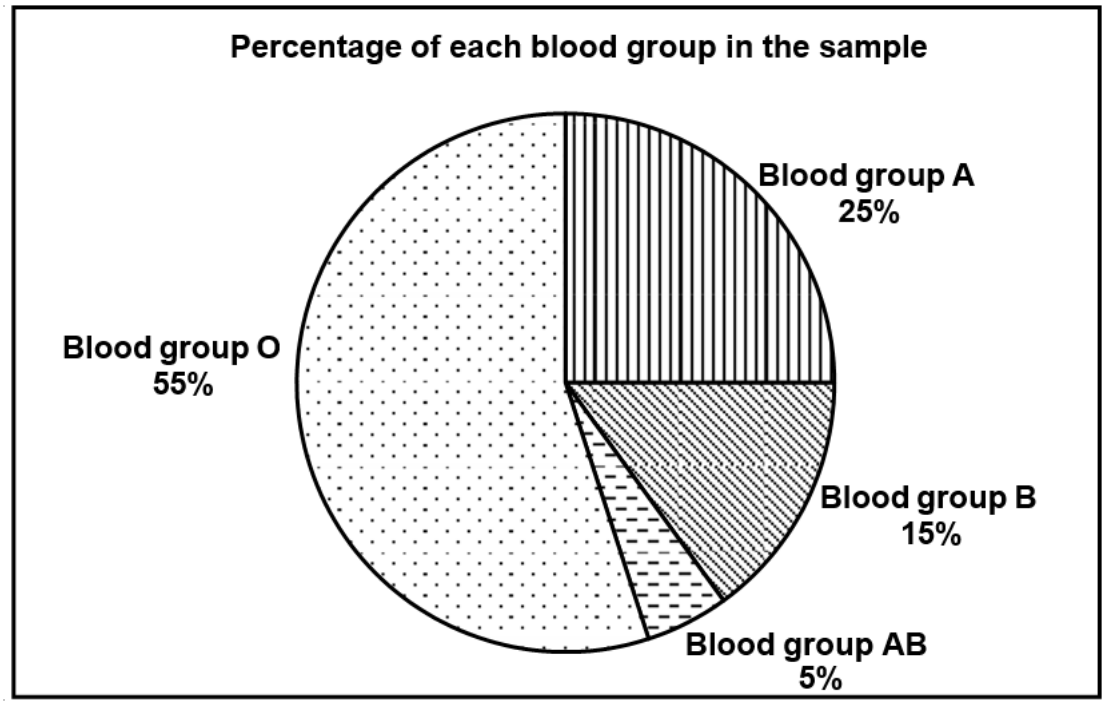
In humans, haemophilia is caused by a recessive allele on the X-chromosome (**X^h**). A woman, who is heterozygous for haemophilia, marries a man with haemophilia.

Use a genetic cross to show the percentage chance of the couple having a *daughter* who is homozygous for normal blood clotting. **(7)**

Question 25

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

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



25.1 State the aim of the investigation. (2)

25.2 Answer the following questions:

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

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investigation. (3)

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

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

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

25.4 Name the blood group which:

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

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

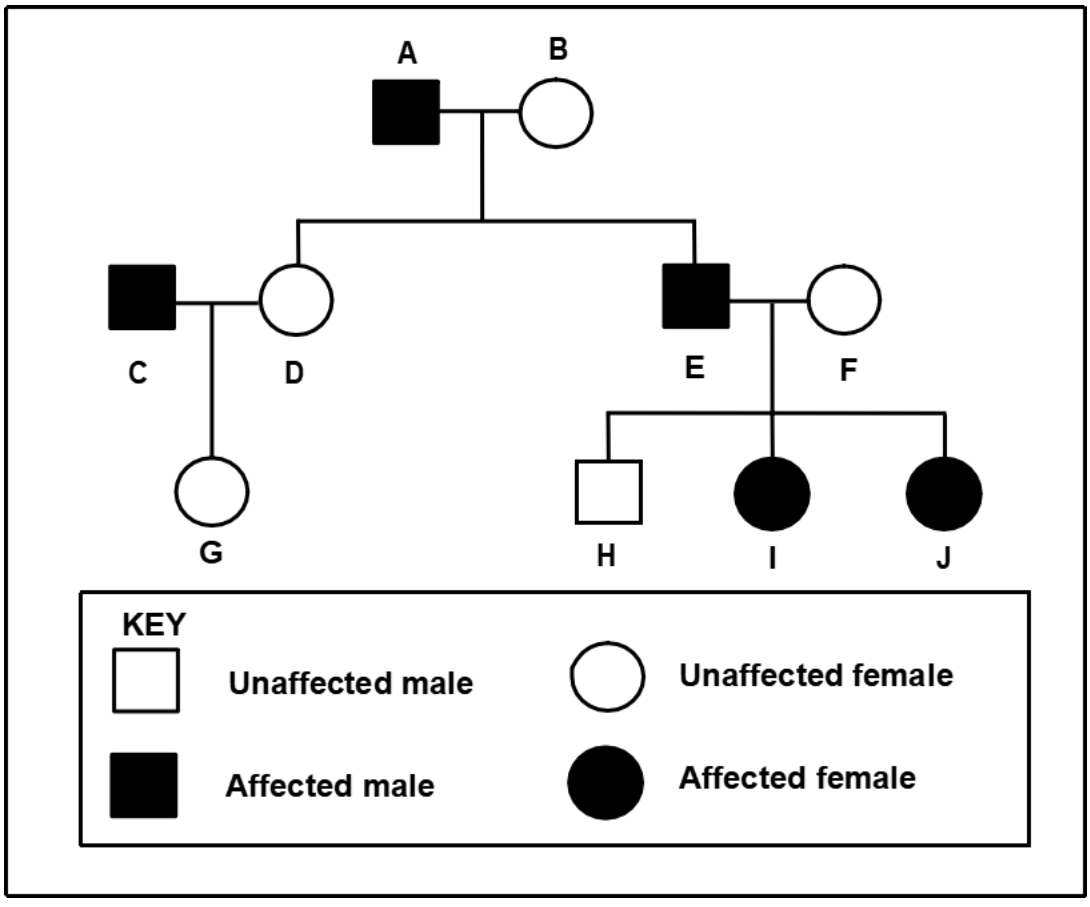
25.5 Give ALL the possible genotypes of the blood group represented by 25% of the donors. (2)

(14)

Question 26

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

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



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

26.2 Give the:

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

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

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(c) LETTER(S) of individuals not biologically related to **A** and **B** (2)
(5)

Question 27

In rabbits, brown fur (**B**) is dominant to white fur (**b**) and long ears (**E**) is dominant to short ears (**e**).

A rabbit, that is heterozygous for both characteristics, is crossed with a white rabbit with short ears.

27.1 Name the type of cross represented. (1)
27.2 Give the:
(a) Phenotype of a rabbit that is dominant for both characteristics (2)
(b) Genotype of the white rabbit with short ears (2)
(c) Genotype of the gametes of a heterozygous brown rabbit with short ears (2)
(7)

Question 28

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

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

28.1 How many people have the genotype ii? (1)
28.2 The population size is 1 800 000.
Calculate the value of **X**. Show ALL working. (3)
28.3 Describe how a child inherits the blood group represented by 3 per cent of this population. (3)
(7)

Question 29

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

29.1 Explain why more males than females have white teeth. (4)
29.2 A man with brown teeth married a woman with white teeth.

Use a genetic cross to show the possible phenotypic ratios of their children. Use $\mathbf{X^B}$ for brown teeth and $\mathbf{X^b}$ for white teeth. (6)
(10)

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Question 30

Read the extract below.

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

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

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

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

(6)

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TOPIC: EVOLUTION (GENERAL)

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

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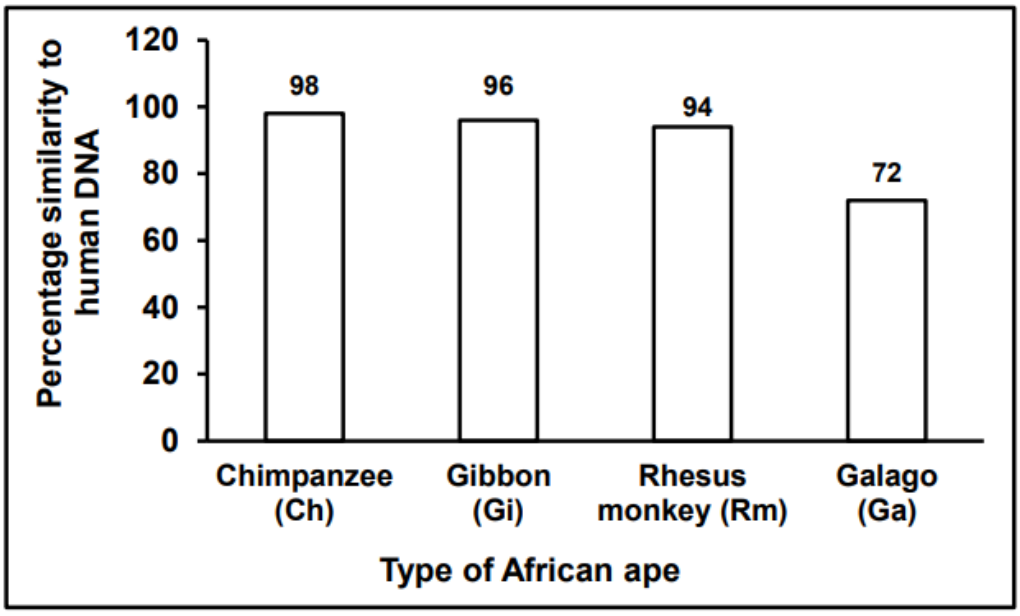
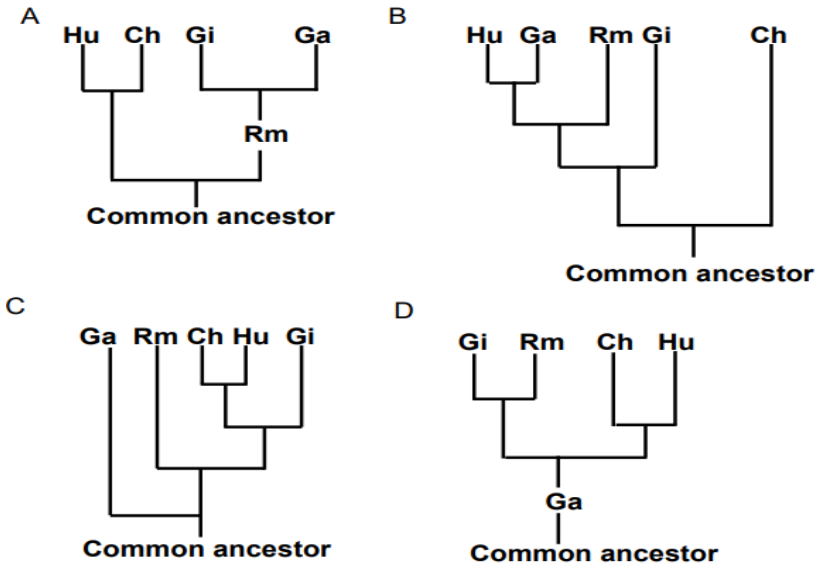
1.3 The graph below shows the percentage similarity between human (Hu) DNA and the DNA of some species of African apes.



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



1.4 Who formulated the law of use and disuse?

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

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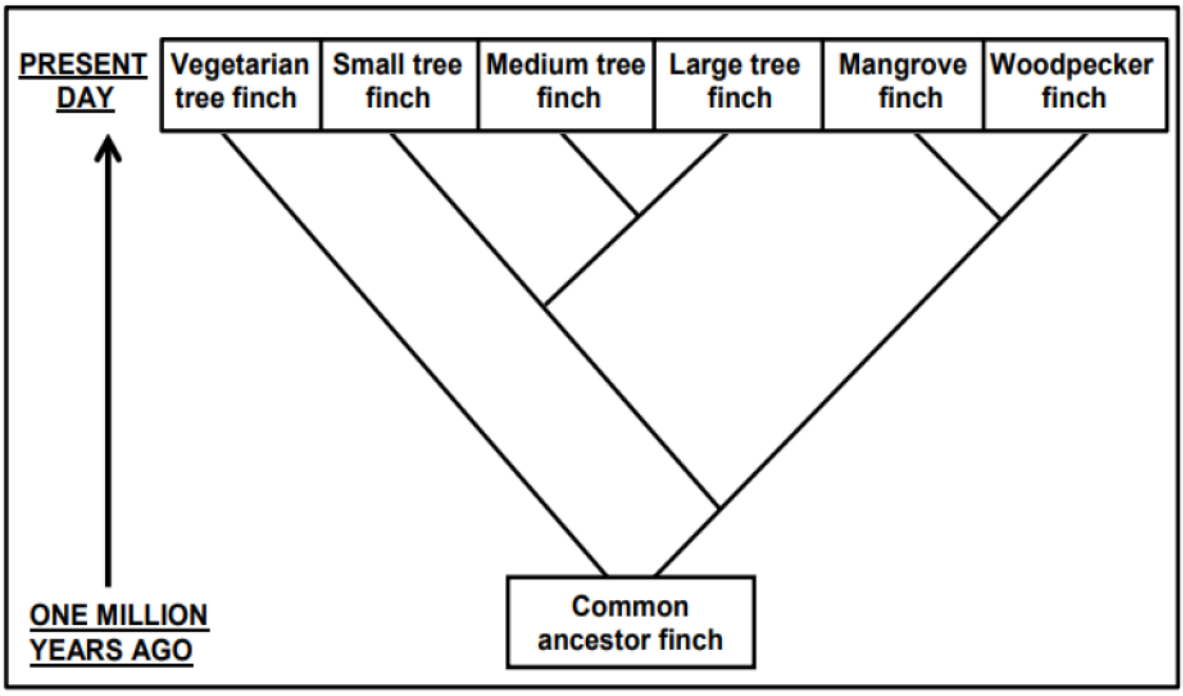
1.5 Study the diagram below



Which present day finch is LEAST related to all others?

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

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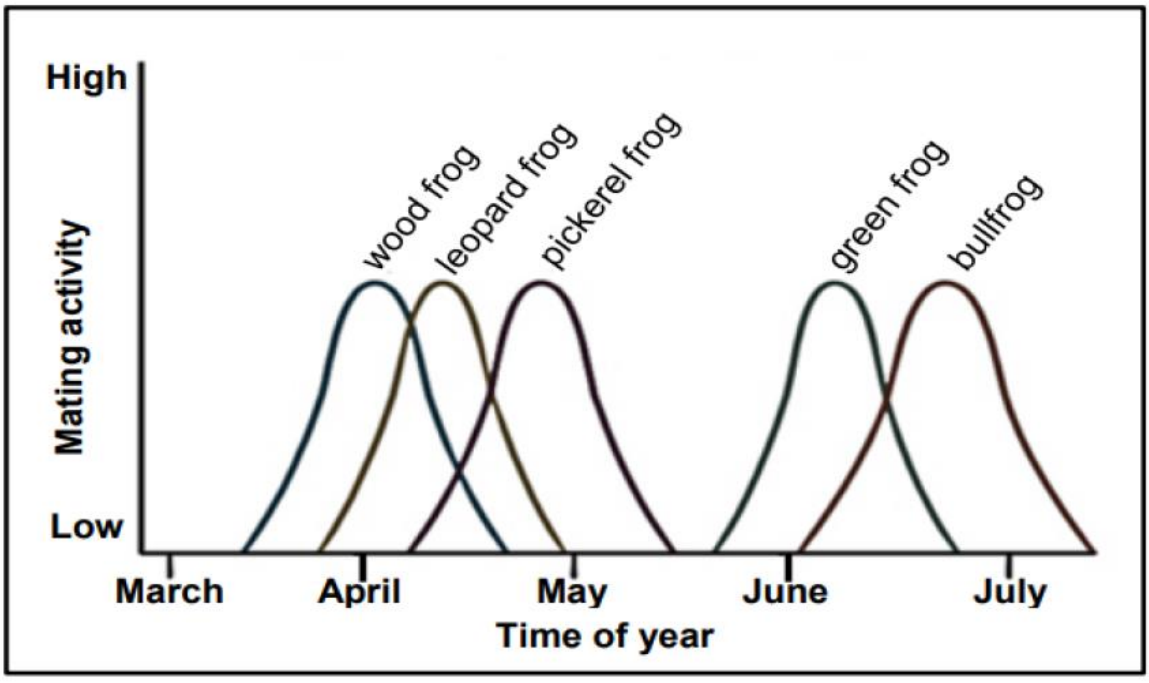
1.6 Different frogs, which all belong to the genus *Lithobates*, are found in the same forest. The graph below shows their mating activity



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

1.7 According to Lamarck's theory for evolution, …

A acquired characteristics are not inherited.
B organisms evolve because they adapt to their environment.
C there is variation amongst offspring.
D environmental changes have no influence on species diversity

1.8 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

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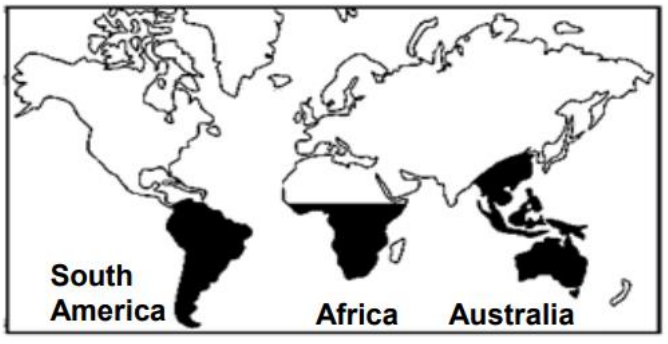
1.9 Which ONE of the following is CORRECT for speciation through geographic Isolation

A The populations undergo phenotypic changes only.
B Each population undergoes natural selection independently.
C The conditions on each side of the geographic barrier are the same.
D The new species formed are genotypically the same as the original species

1.10 Shrubs of the family Proteaceae (e.g. Waratahs and proteas) can be found in Australia, South America, Indo-China and parts of Africa as shown on the map below.



It is hypothesised that all continents were once one large continent called Pangaea and that they separated due to continental drift.

This is evidence that the family Proteaceae …

A all belong to the same species.
B are equally distributed on all continents
C became extinct when Pangaea separated.
D arose from a common ancestor when Pangaea separated.

(10 x 2) **(20)**

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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	
2.27	Similar structures that are inherited from a common ancestor and are modified for different functions	
2.28	The formation of new species	
	(28 X 1)	**(28)**

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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: *Austrolopithecus africanus*
3.7	Type of evolution characterised by long periods of little or no change alternating with short periods of rapid change	A: Artificial selection B: Punctuated equilibrium
	(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**

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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

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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)

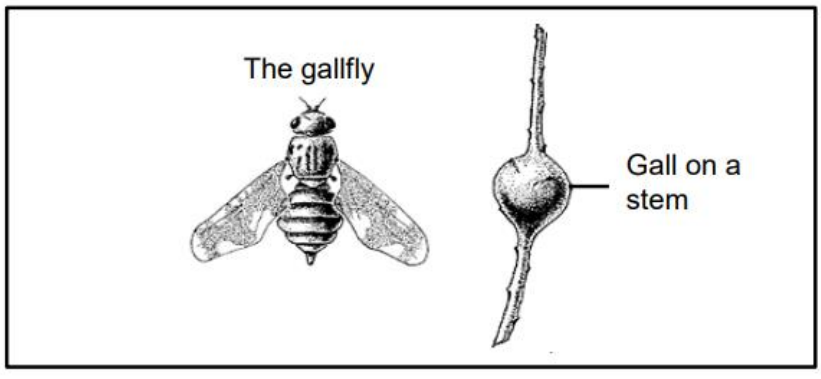
6.4 Describe how Lamarck would have explained the survival of Tibetans at high altitudes (5)

(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.



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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)**

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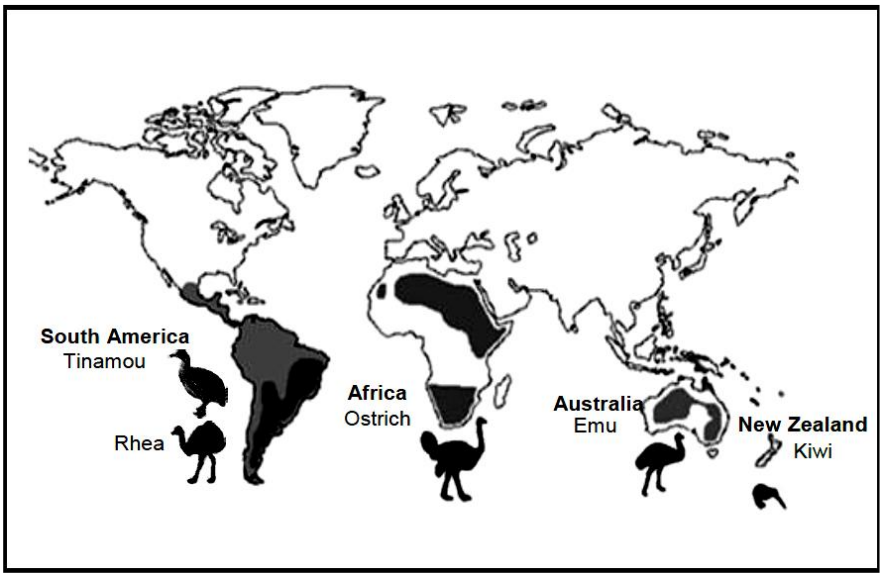
Question 11

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.

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- 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

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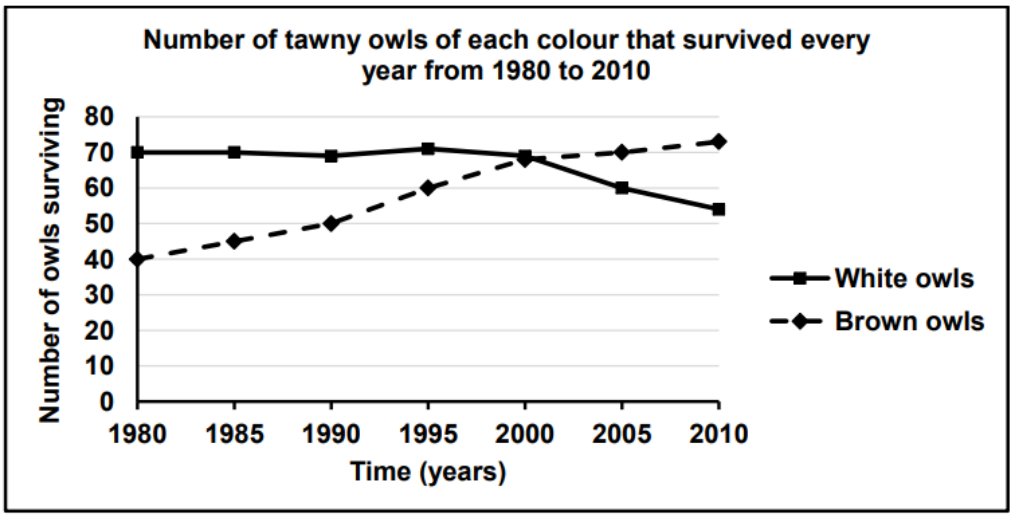
13.1 Explain the advantages of a louder mating calls. (2)
13.2 State why these results may be considered to be reliable. (1)
13.3 State a conclusion for this investigation. (2)
13.4 Give TWO variables that should be kept constant in this investigation (2)
13.5 Draw line graphs on the same set of axes 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)

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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.

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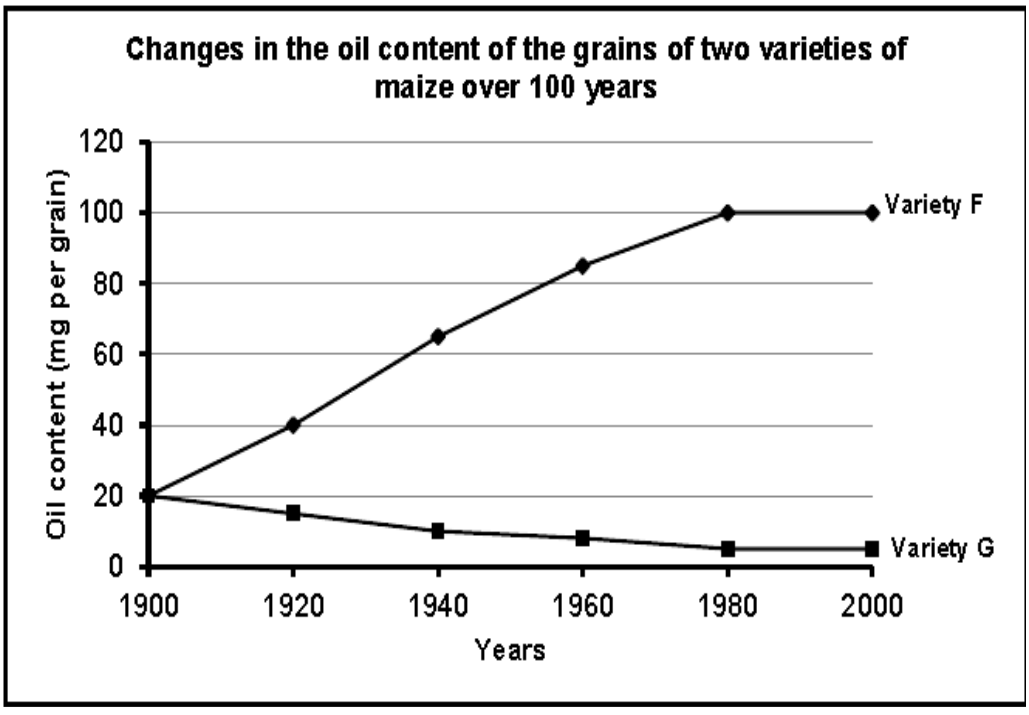

16.1 In which year did the two maize varieties have the same oil content? (1)

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)

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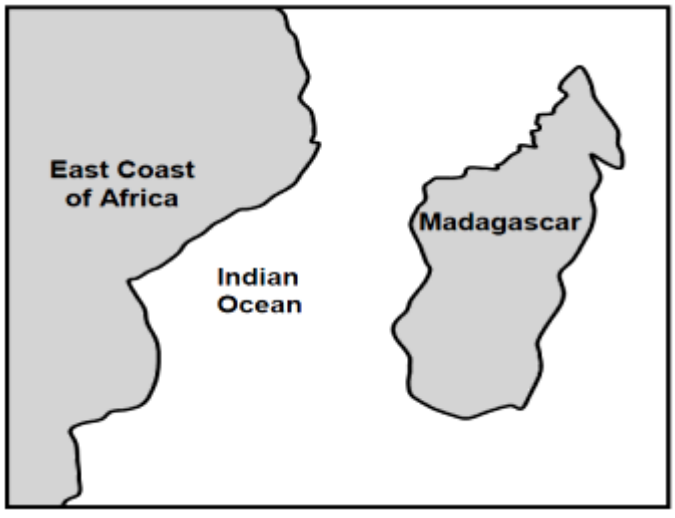
Question 18

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.

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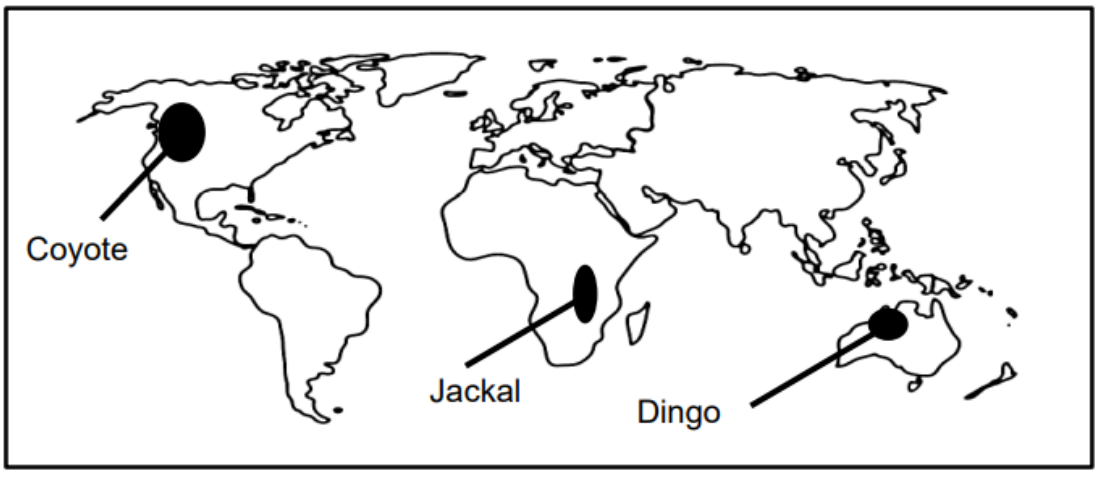


20.1 What type of evidence for evolution is represented here? (1)
20.2 What is a biological species? (3)
20.3 Describe how these three species could have evolved from a common ancestor (7)
(11)

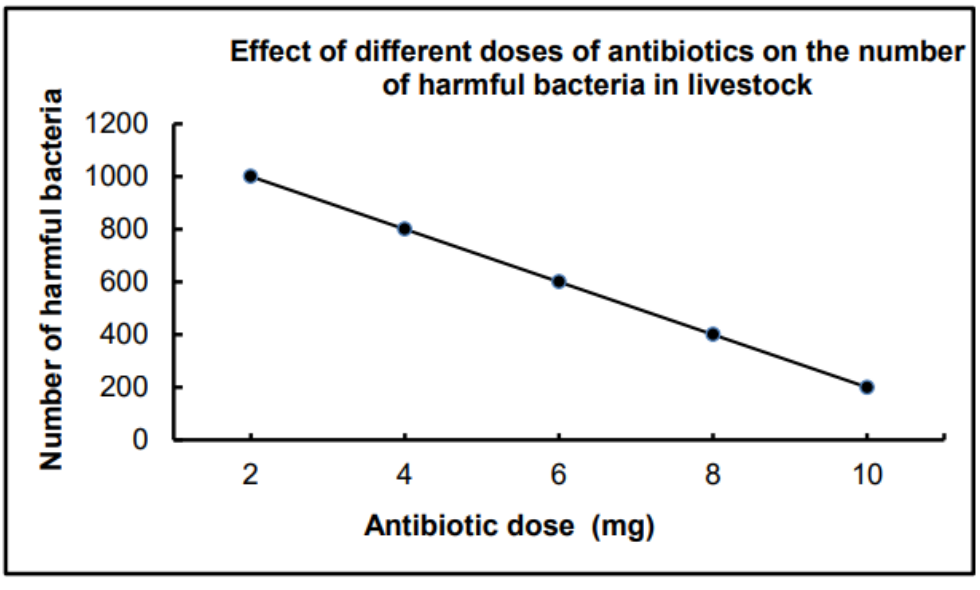
Question 21

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.



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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

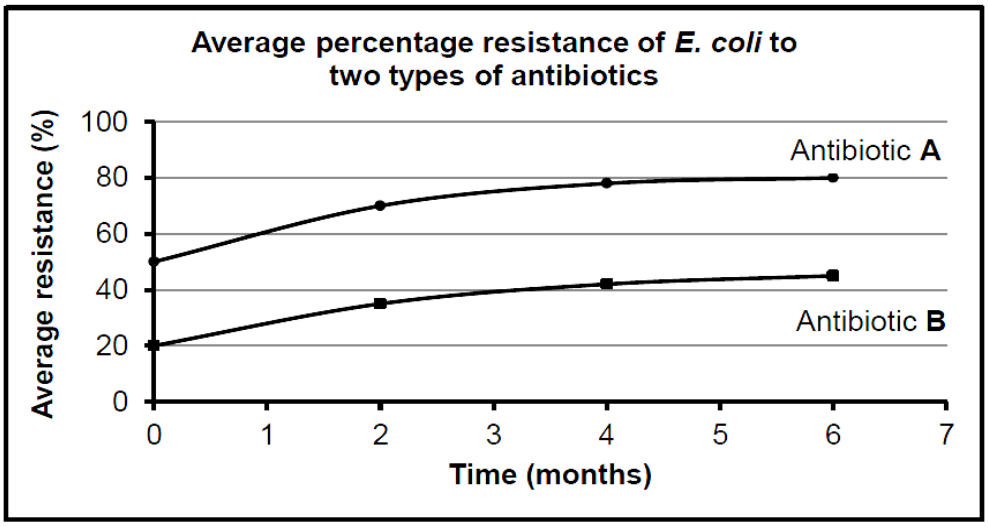
The E. coli bacterium lives in the intestines of pigs where they reproduce rapidly. Certain strains of E coli cause diarrhoea in young pigs (piglets)

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)

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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)

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Question 25

Modern-day whales are aquatic mammals, spending their entire lives in the ocean. They are thought to have evolved from four-legged ancestors, as represented below.

SPECIES	EXISTENCE ON EARTH	CHARACTERISTICS
Pakicetus	50 mya	Quadrupedal carnivore
Ambulocetus	48 mya	Flipper-like large feet and tail for swimming
Dorudon	40 mya	Large flippers in front and very small hind limbs
***Balaena* (Blue whale)**	Present day	Non-functioning pelvis and large flippers in front

25.1 Which ancestor of whales most likely lived both in water and on land? (1)

25.2 Give ONE reason for your answer to QUESTION 5.1. (2)

25.3 Explain why Ambulocetus and Dorudon may be considered as transitional species in the evolution of whales. (2)

25.4 Explain, according to Lamarck, why modern-day whales do not have legs. (3)

(8)

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Question 26

Read the extract below

> Samango and vervet are two species of monkeys that occupy the same habitat. Researchers have recently discovered that a population of samango monkeys were able to interbreed with vervet monkeys to produce offspring. These offspring were infertile.

26.1 Define the term population. (3)

26.2 Give ONE reason why samango and vervet monkeys are considered to be two different species. (1)

26.3 List THREE mechanisms of reproductive isolation that are NOT mentioned above. (3)

(7)

Question 27

Dogs have been selected and bred over many years to produce approximately 340 different dog breeds. They have been bred for certain characteristics desirable to humans.
An analysis of 736 base pairs of the cytochrome-b gene showed that grey wolves are the only direct ancestor to present-day dog breeds. All dog breeds belong to the species Canis familiaris.
The table below shows some dog breeds and their desirable characteristics.

Grey wolf	Dog breeds	Characteristics
	Poodle	Intelligent
	Pug	Loving, affectionate and playful
	Saint Bernard	Outgoing and adventurous
	Rhodesian ridgeback	Strong, athletic and fast

27.1 Name the process whereby the different breeds of dogs were produced. (1)

27.2 Describe how humans carried out the process named in QUESTION 7.1. (3)

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27.3 Explain how it can be confirmed that all these dog breeds belong to the same species. (2)
27.4 Explain which of the dog breeds shown would best be used for hunting. (2)
27.5 Explain how present-day dog breeds may be disadvantaged in relation to their common ancestor (3)
(11)

Question 28

Describe the process of speciation through geographic isolation. **(7)**

Question 29

A population of lizards on an island, Island A, were well suited to feed mainly on insects. Scientists moved five adult 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.

29.1 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)
29.2 Explain how the larger jaws of the lizards on Island B would be structurally suited to eat tough fibrous leaves. (3)
29.3 How did the scientists determine that the two populations of lizards on both islands still belong to the same species? (2)
29.4 Explain the possible effect that the evolution of the lizards has on biodiversity (2)
29.5 Use Darwin's theory of natural selection to explain the evolution of lizards with larger jaws. (7)
(17)

Question 30

Patients infected with the HI virus (HIV) are treated with antiretroviral drugs.
When they miss their treatment, it can increase the chances (probability) of the virus developing resistance to the drug.

Scientists conducted an investigation to determine the effect of the number of missed treatments on the probability of the HI virus developing resistance to antiretroviral drugs.

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The results are shown in the table below.

Number of missed treatments (in days)	Probability of the HI virus developing resistance to antiretroviral drugs (%)
2	0
7	20
14	35
21	40
37	60

30.1 State the following for this investigation:
(a) The dependent variable (1)
(b) The independent variable (1)
30.2 Based on the results, state ONE precaution for patients receiving antiretroviral treatment. (1)
30.3 State a conclusion for this investigation. (2)
30.4 Describe the evolution of resistance to antiretroviral medication in the HI virus. (5)
(10)

Question 31

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

31.1 Name ONE characteristics of the hand that African apes share with humans. (1)
31.2 Tabulate THREE differences between the skulls of African apes and humans. (7)
31.3 Give TWO characteristics of the pelvis of a bipedal organism. (2)
(10)

Question 32

Humans are bipedal organisms.

32.1 What is meant by bipedalism? (2)
32.2 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)

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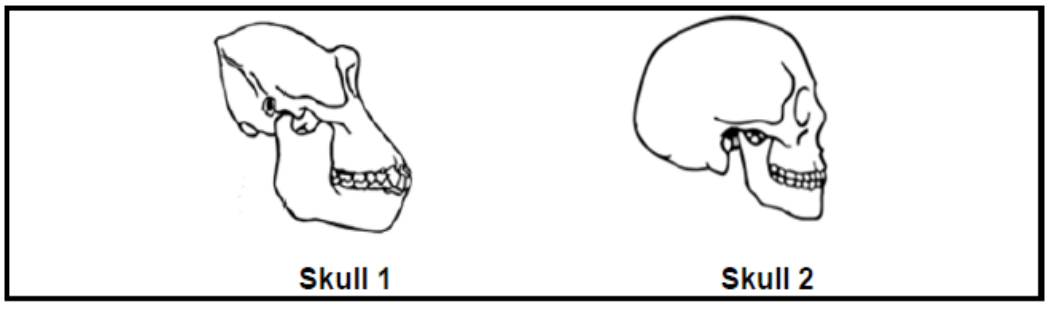
Question 33

Scientists find evidence for human evolution by comparing humans to other hominids. The upper limbs of humans and African apes show similar characteristics, whereas there are differences between the dentition (teeth) of the two.

33.1 Why do scientists look for similarities between humans and African apes? (1)
33.2 Explain the importance of the positioning of the thumbs for humans and African apes. (2)
33.3 State ONE difference between the teeth of humans and African apes. (2)
(5)

Question 34

The diagrams below show the skulls of two species of primates.



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

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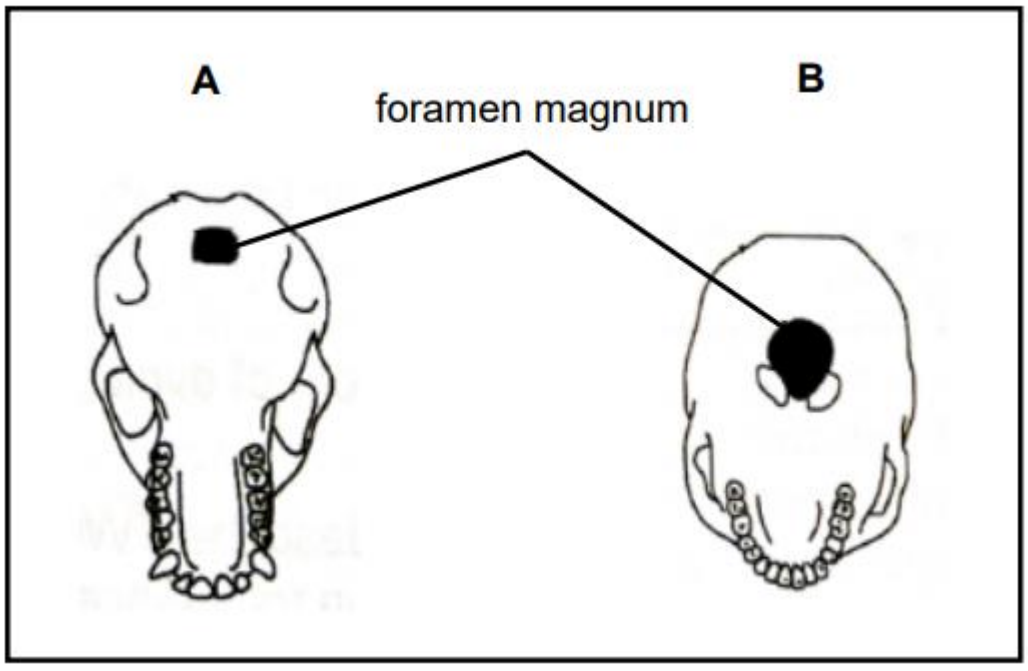
Question 35

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



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

35.2 Give ONE visible reason for your answer to QUESTION 35.1. (2)

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

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

(10)

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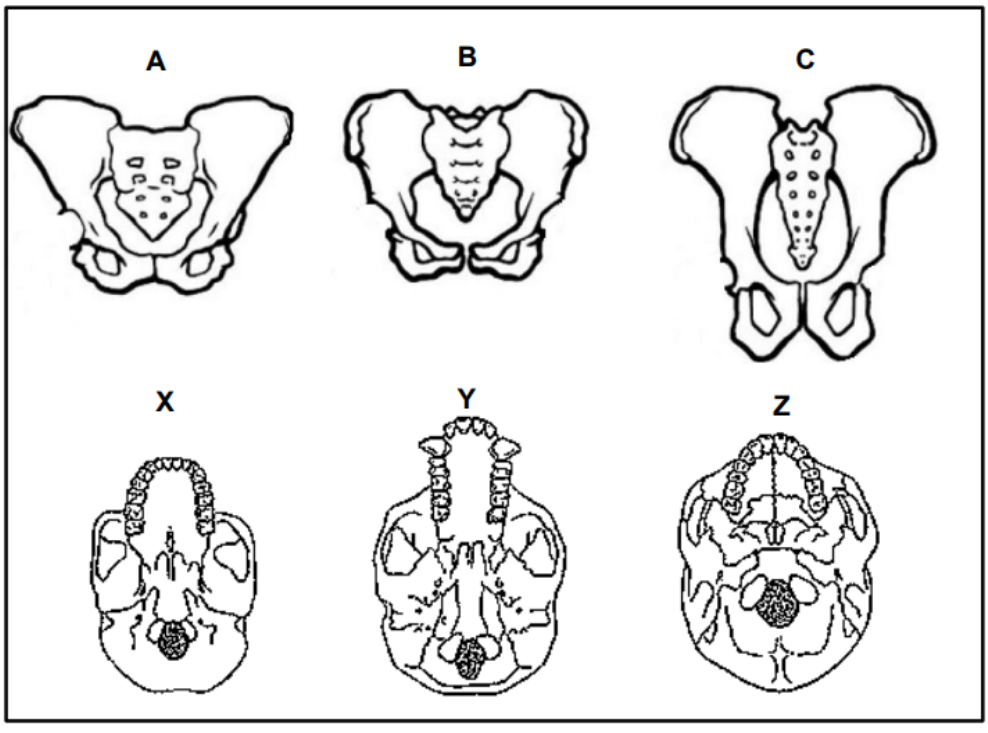
Question 36

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



36.1 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)

36.2 Give a reason for your answer to QUESTION 36.1(b). (2)

36.3 Describe ONE other structural difference between a bipedal and a quadrupedal organism. (3)

(8)

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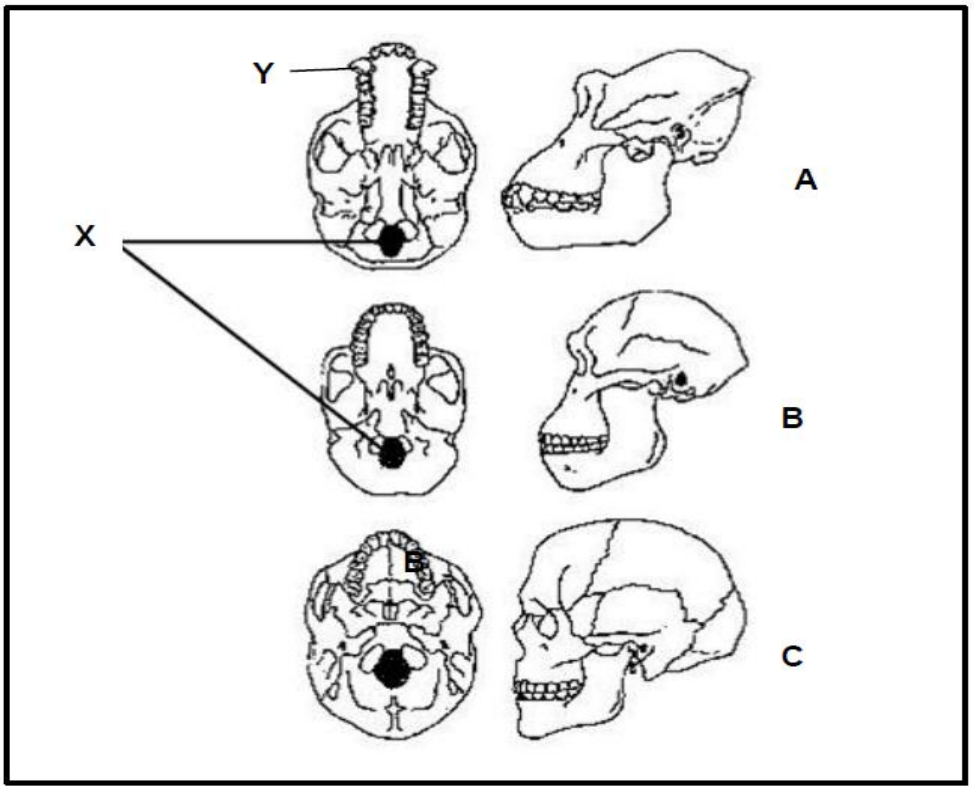
Question 37

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).



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

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

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

(a) An *Australopithecine* (1)

(b) A quadrupedal primate (1)

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

(10)

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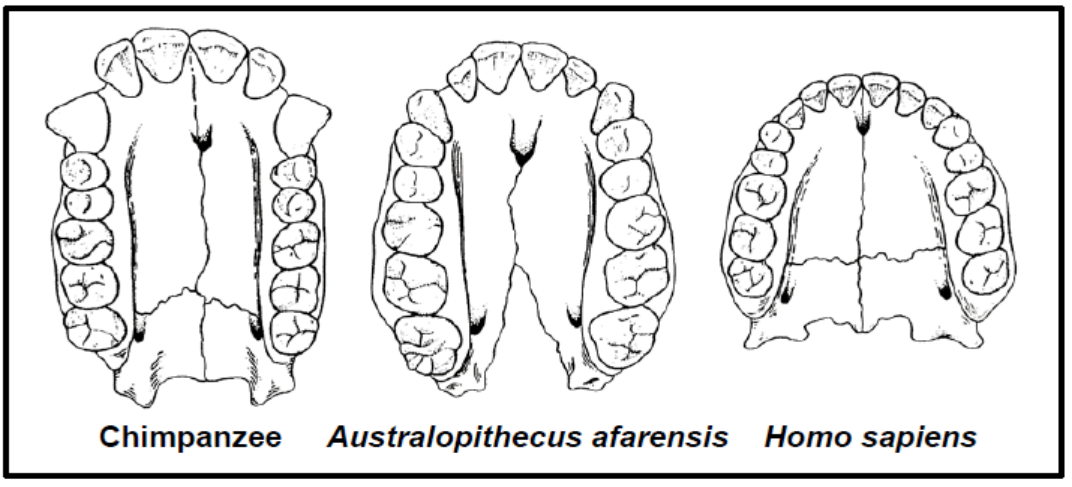
Question 38

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



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

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

38.3 *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 39

39.1 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)

39.2 Explain the significance of the structural changes to the parts mentioned in QUESTION 39.1 above. (4)

(8)

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Question 40

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

40.1 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)
40.2 Which hominid had a cranial capacity closest to that of *Homo sapiens?* (1)
40.3 Give the smallest cranial capacity (in cm3) of a Homo species. (1)
40.4 When did *Australopithecus africanus* become extinct? (1)
40.5 Fossils are used as evidence of hominid evolution.
Name TWO other lines of evidence. (2)
(10)

Question 41

The table below shows information on selected hominid fossils.

Common name of the fossil	Species	Fossil site	Scientist responsible for discovery
P	Australopithecus sediba	Malapa Cave in the Cradle of Humankind	**Q**
Taung Child	**R**	Sterkfontein Caves	**S**

41.1 Name fossil **P**. (1)
41.2 Identify the species at **R**. (1)
41.3 Give the name of the scientist at:
(a) **Q** (1)
(b) **S** (1)
(4)

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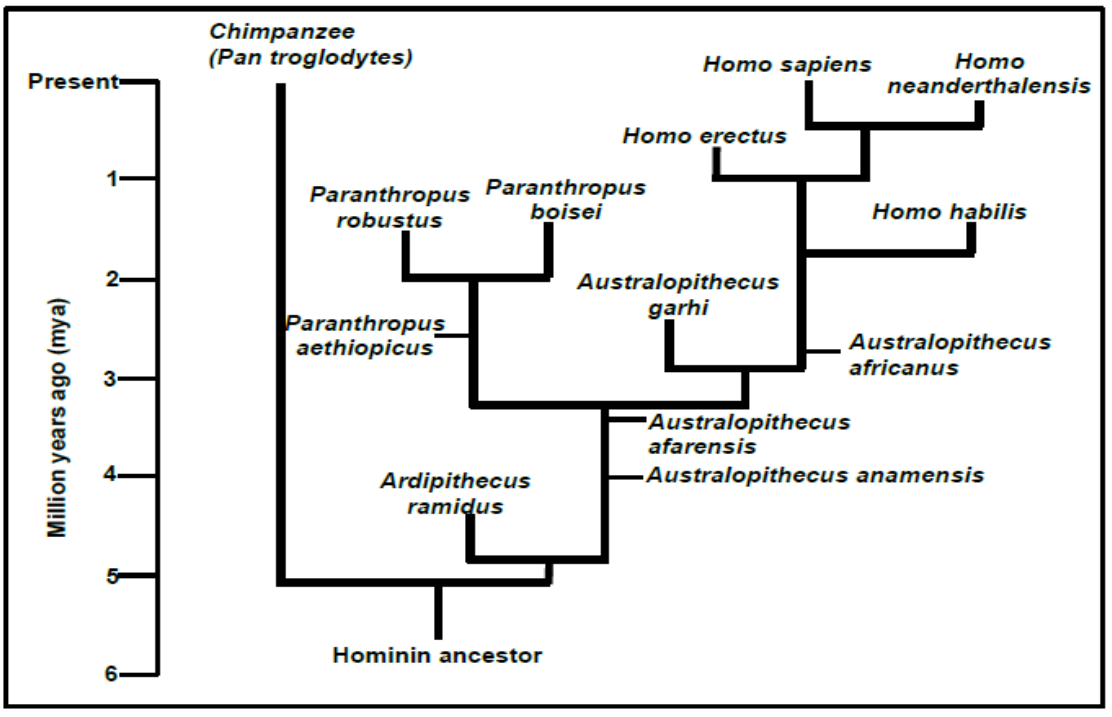
Question 42

The diagram below shows possible evolutionary relationships among some hominids.



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

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

(a) Genera (1)

(b) Homo species (1)

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

42.4 When did:

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

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

42.5 Name the:

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

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

(9)

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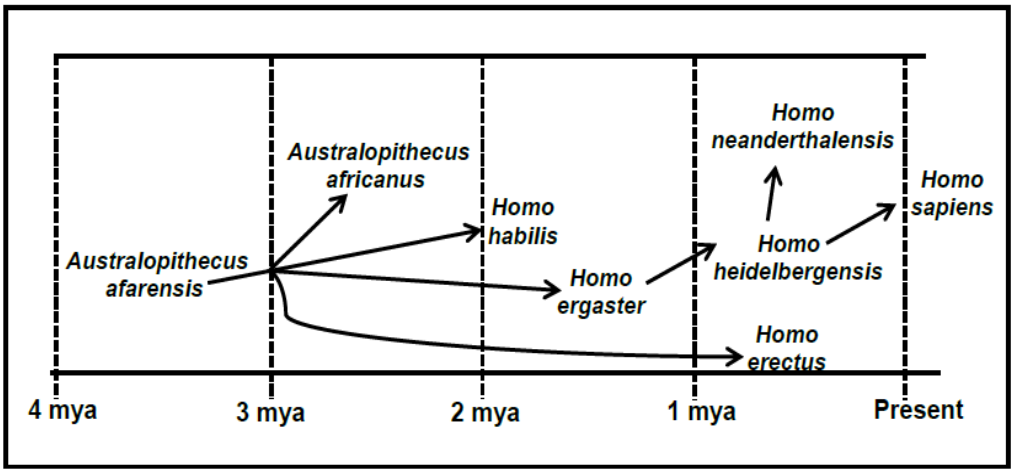
Question 43

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



43.1 Name the family to which all of the represented organisms belong. (1)

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

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

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

(6)

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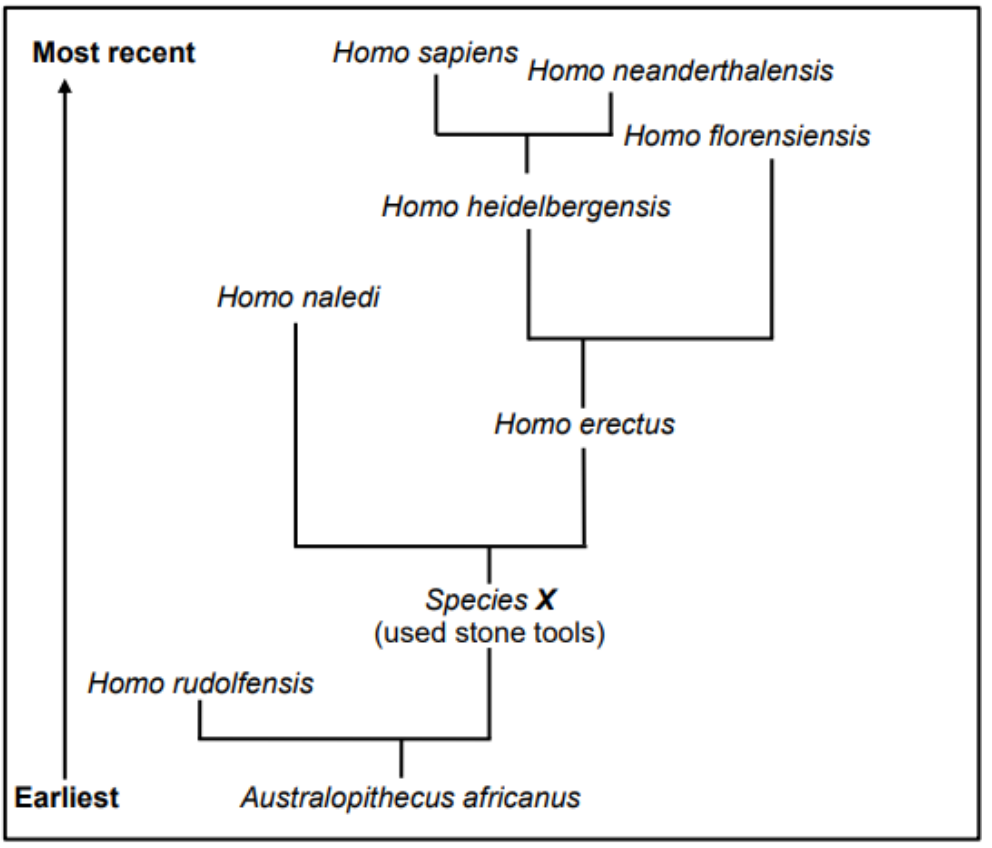
Question 44

The diagram below represents one model of the evolution of some hominids.



44.1 Identity the type of the diagram shown. (1)

44.2 How many genera are represented by the diagram? (1)

44.3 Name the speciaces:

(a) Represented by **X** on the diagram (1)

(b) That shares a common ancestor with Homo erectus (1)

44.4 Which species of the genus Homo is the only one in existence today? (1)

44.5 Name TWO forms of evidence that would have been used to support the information in the diagram . (2)

44.6 The average cranial capacity of Homo sapiens is 1500 cm^3 compared to 520 cm^3 in Australopithecus africanus.
Explain the significance of the difference in cranial capacity. (3)

44.7 Explain how the fossils of Australopithecus africanus, Species **X** and Homo erectus are used to support the 'Out of Africa' hypothesis. (4)

(14)

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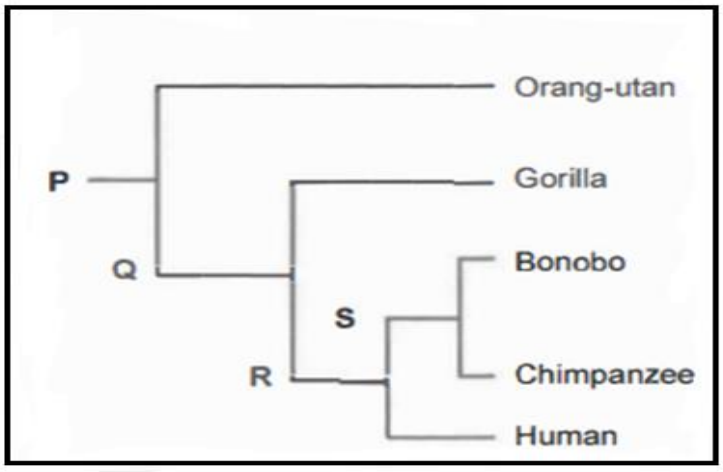
Question 45

The diagram below represent the evolution of the family Hominidae.



45.1 Name the type of diagram represented above (1)

45.2 Give the LETTER of the organism which:

(a) Is the common ancestor of all hominids (1)

(b) Shares the most recent common ancestor with the gorilla (1)

45.3 Name TWO organisms that:

(a) Have S as a common ancestor (2)

(b) Are quadrupedal (2)

45.4 Describe THREE anatomical features of the skeleton of a quadrupedal hominid. (3)

(10)

Question 46

46.1 State the 'Out of Africa' hypothesis. (2)

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

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

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

(8)

Question 47

Fossil evidence is used to support the 'Out-of-Africa' hypothesis.

47.1 State the 'Out-of-Africa' hypothesis. (2)

47.2 Describe how fossil evidence is used to support 'Out-of-Africa' hypothesis. (6)

(8)

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