KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

CURRICULUM DIRECTORATE GRADES 10-12

NCS CAPS

LEARNER SUPPORT DOCUMENT

GRADE 12

LIFE SCIENCES

FINAL PUSH REVISION

2025

PREAMBLE

This document has been prepared as support material for 2025 Grade 12 Life Sciences.

This document takes the following into account:

1. Focus on **core concepts and content** per topic as well as the relevant Life Sciences skills.
2. Activity based Revision sessions and constant feedback on assessments/activities given.
3. **Scaffolding of concepts** according to **cognitive levels and degrees difficulty** and a differentiated approach to cater for learners with different abilities.
4. Addressing the **common errors & misconceptions** in each topic as per **diagnostic report**.
5. Providing multiple opportunities for learners to master concepts through multiple exposure using different source stimuli.
6. A focus on **scientific investigations** for each topic.
7. Consolidating and supplementing topics through the use of previous examination question papers.

STRATEGIES FOR PLANNING AND CONDUCTING REVISION

1. Use the past papers (Start with the recent papers) and provincial revision documents
2. Start your revision with topics that have bigger weightings (reproduction, responding to environment, genetics and evolution).
3. **Scientific investigation skills** (variables, validity, reliability, aim, control, trend, conclusion, relationship, graphs, tables, planning steps).
4. **Calculation**: percentage, average and percentage increase/decrease
5. **Drawing** (structures and graphs): marking criteria
6. Explain (cause and effect / what happened and why it happened)
7. Describe (sequence of events)
8. Tabulate
9. Identify, name, state and label
10. Use of mnemonics and mind maps for consolidation

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TOPIC: DNA – CODE OF LIFE

Activity 1

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

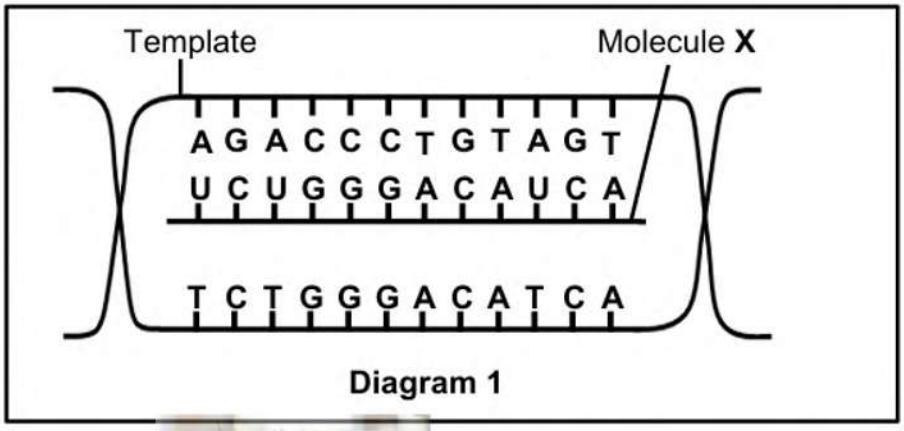


Diagram 1

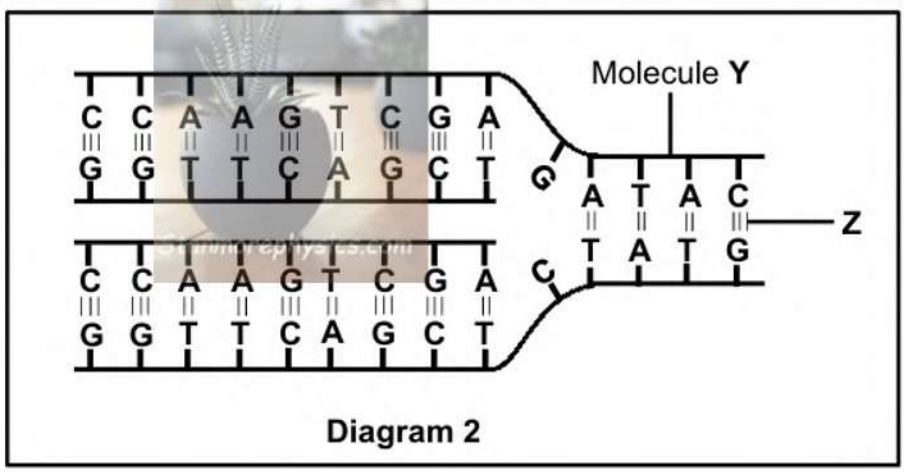


Diagram 2

1.1 Name the process represented by Diagram **2** (1)

1.2 Describe the process mentioned in QUESTION 1.1 (6)

1.3 State the number of codons on molecule **X** (1)

1.4 Give the:

(a) Natural shape of molecule **Y** (1)

(b) Phase of the cell cycle during which the process in Diagram **2** occurs (1)

(c) Full name of the nitrogenous base that is found in molecule **X**, but not in molecule **Y** (1)

1.5 Name the:

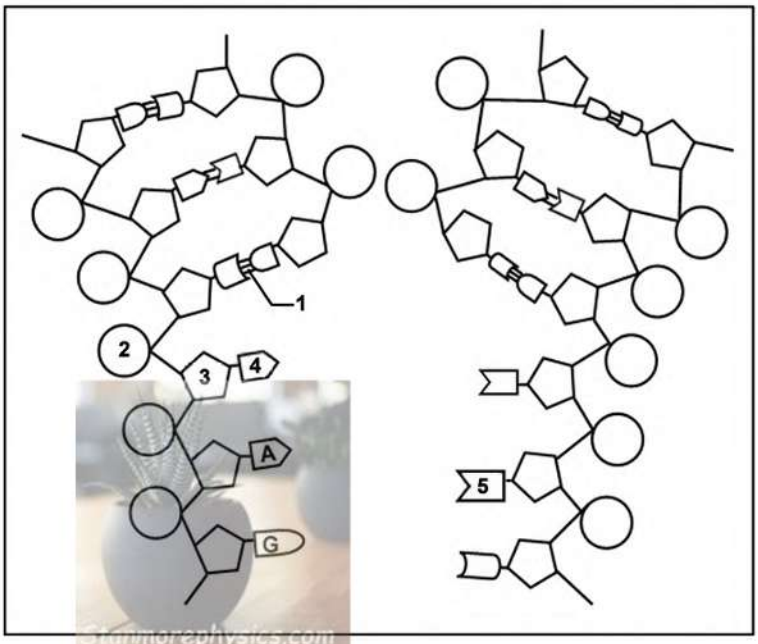
(a) Bond **Z** (1)

(b) Sugar found in molecule **X** (1)

(12)

Activity 2

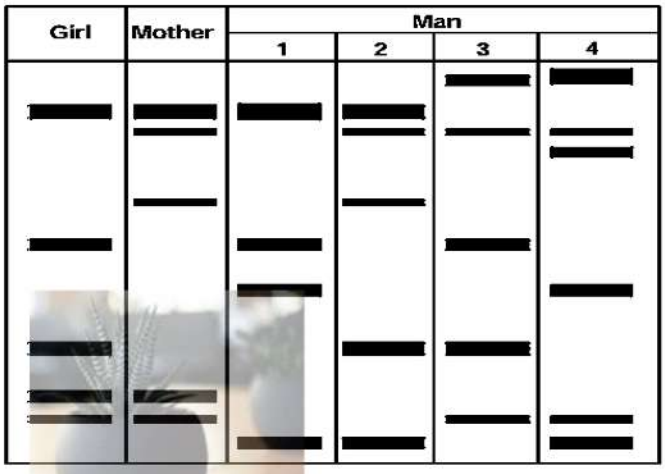
2. The diagram below represents a DNA molecule undergoing an important biological process.



2.1	During which phase of the cell cycle does this process take place	(1)
2.2	Where in the cell does this process occur	(1)
2.3	Name and describe the process where DNA makes an exact copy of itself.	(7)
2.4	Describe the significance of DNA replication.	(3)
		(12)

Activity 3

3 In a car accident, the biological father of a girl and three other men were killed. The men could not be identified due to their injuries. DNA profiling was used to identify the girl's father.
The diagram below shows the DNA profiles of the girl, her mother and the four men.

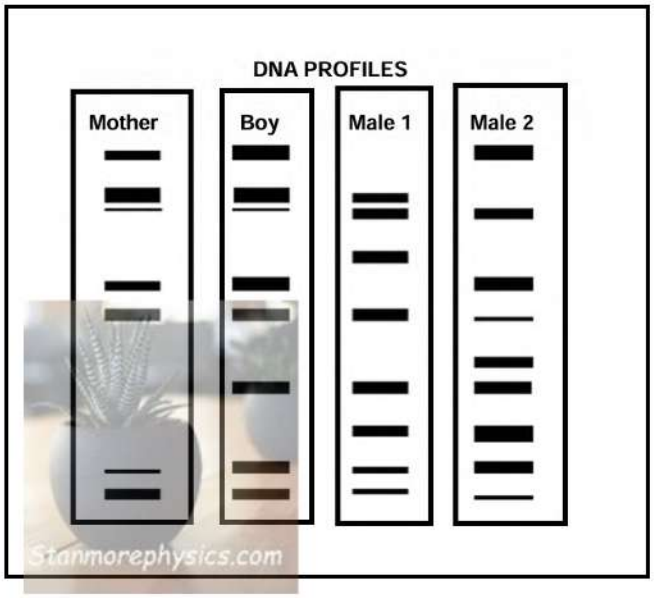


3.1 Which ONE of the men is most likely to have been the father of the girl? (1)
3.2 Explain your answer to QUESTION 4.1 (3)
3.3 State TWO other uses of DNA profiling (2)
(6)

Activity 4

4 A family wanted to identify the biological father of a boy. The mother of the boy is known. DNA profiles of the mother, the boy and two males were used to determine paternity.

The data below shows the results of the two procedures.



4.1 Who is the biological father of the boy according to the DNA profiles? (1)
4.2 Explain your answer to QUESTION 4.1 (3)
4.3 State ONE other use of DNA profiling (1)
(5)

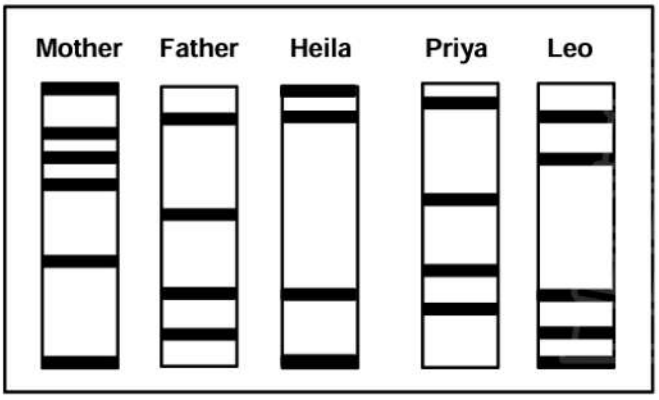
Activity 5

5 The police arrested two suspects accused of housebreaking. Their DNA profiles were analysed and compared to the profile of DNA evidence collected from the crime scene.

5.1 Which suspect is positively linked to the crime? (1)
5.2 Explain your answer to QUESTION 5.1 (2)
(3)

Activity 6

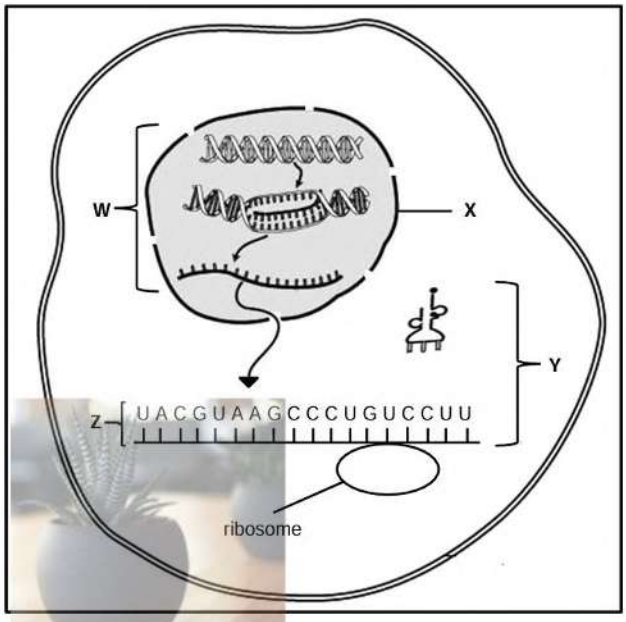
6 The diagram below represents the DNA profiles of three children and their parents. Only two of the children are their biological children and one is adopted.



6.1 Identify the TWO biological children (2)
6.2 Explain your answer to QUESTION 6.1 (2)
6.3 State THREE other uses of DNA profiling. (3)
(7)

Activity 7

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



7.1 Name the process which occurs at:

(a) **W** (1)

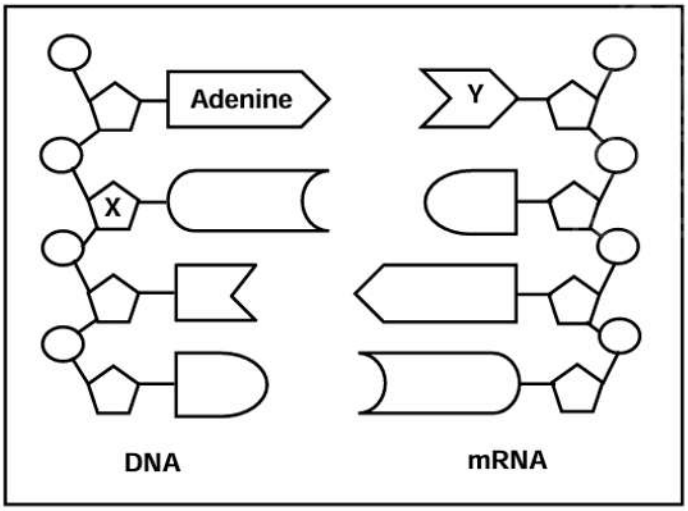
(b) **Y** (1)

7.2 Describe the process at mentioned in QUESTION 7.1(a). (7)

(9)

Activity 8

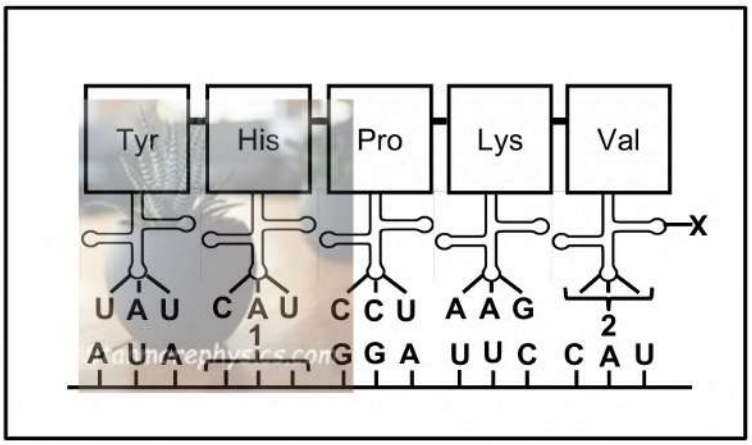
8 The diagram below represents transcription during protein synthesis.



8.1 Describe the process above (5)
8.2 Tabulate TWO differences between transcription and DNA replication. (5)
8.3 Describe the role of mRNA in protein synthesis (2)
(12)

Activity 9

9 The diagram below represents a stage of protein synthesis.



9.1 Describe the role of molecule **X** in protein synthesis. (2)
9.2 Identify the complementary bases (from left to right) representing the following:
(a) Anticodon **2** (1)
(b) The DNA triplet for codon **1** (1)
(4)

Activity 10

10 The table below represents the anticodons coding for different amino acids.

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

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

Use the table and explain how this mutation will affect the protein that is synthesised **(7)**

Activity 11

11 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

11.1 The codon GUC changed to GUA.

Explain the effect it would have on this particular protein molecule. **(3)**

Activity 12

12 A mutation has occurred on a section of an mRNA molecule as shown below.

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

12.1 Name the type of mutation that has occurred. (1)
12.2 Give a reason for your answer to QUESTION 12.1 (1)
12.3 The table below shows 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)

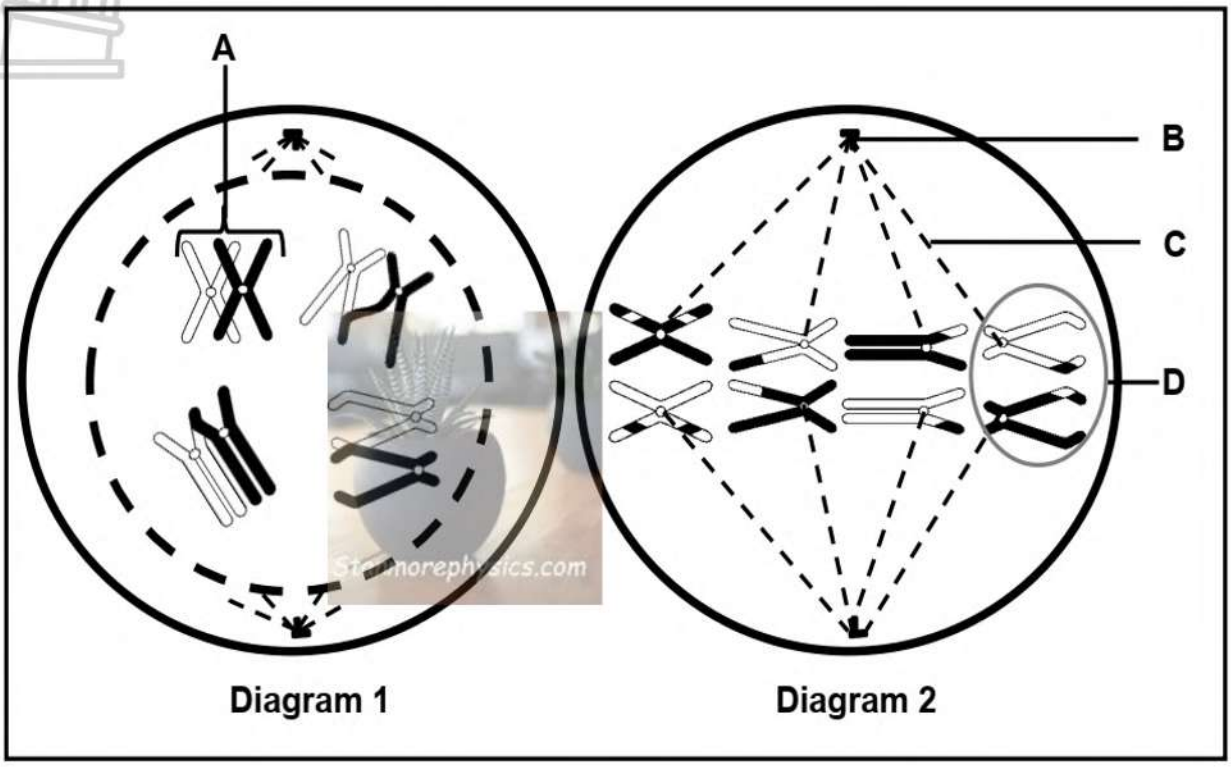
(c) Use information in the table to describe the effect of the mutation on the protein formed (4)

(8)

TOPIC: MEIOSIS

Activity 1

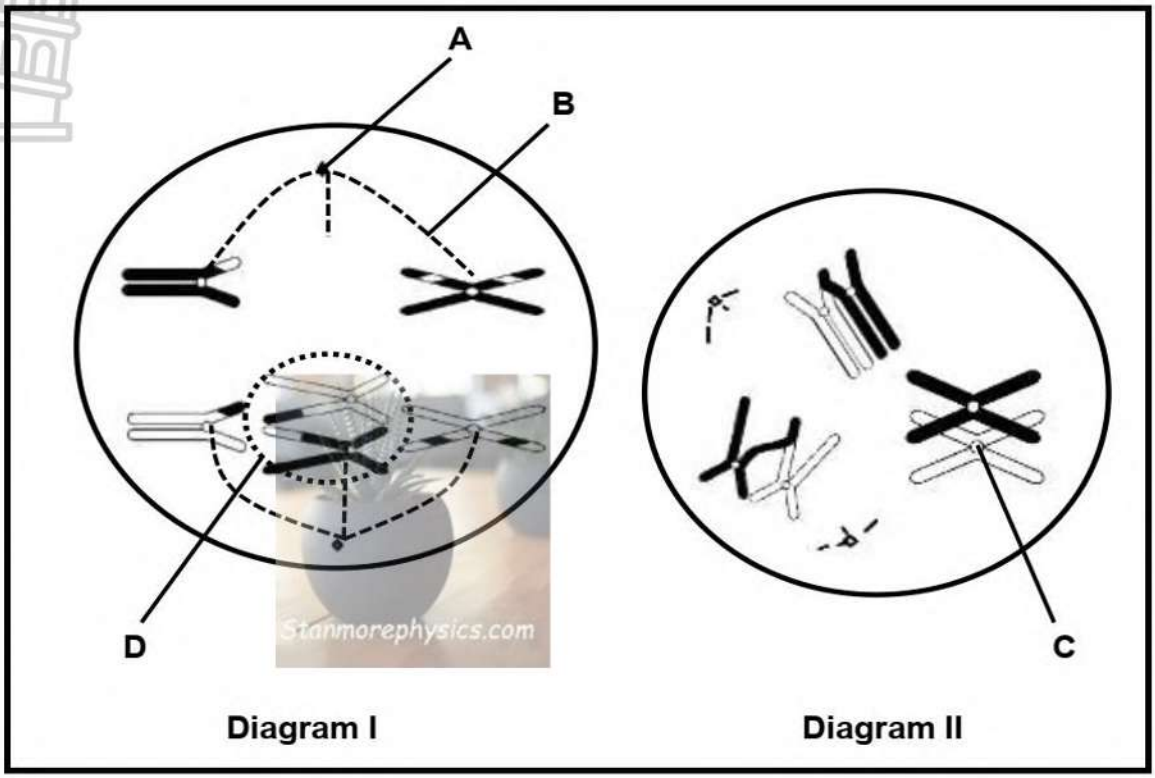
1 The diagrams below represent two stages of meiotic cell division



1.1 Describe the results at the end of meiosis if the chromosomes at **D** failed to separate. **(3)**

Activity 2

2 The diagrams below show the same cell at different phases of meiosis



2.1 Explain the effect of the abnormal process indicated by **D** if it occurred in chromosome pair number 21 in humans. **(4)**

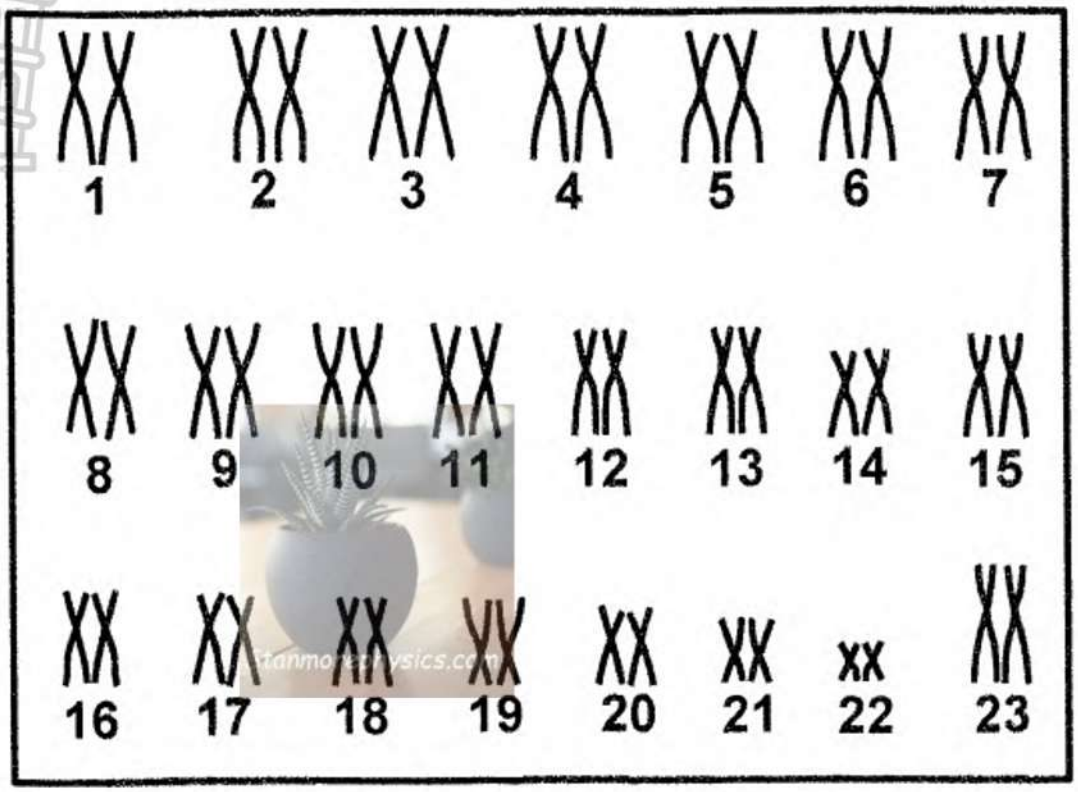
Activity 3

3 Describe how non-disjunction leads to Down's syndrome.

(5)

Activity 4

4 The karyotype below represents the chromosomes of a person.



4.1 Give the collective term for the chromosomes numbered 1 to 22 (1)

4.2 Describe how the karyotype of a person with Down's syndrome would differ from one above (2)

(3)

Activity 5

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

Age of mothers in years	Number of babies born with Down syndrome
25	1 in 1250
32	1 in 378
40	1 in 100
45	1 in 30

5.1 Identify the independent variable in this investigation. (1)
5.2 Give the age of mother when Down syndrome is most prevalent. (1)
5.3 State ONE reason why Down syndrome is most prevalent with the age mentioned in QUESTION 5.2 (1)
5.4 State the conclusion of this investigation that one can draw from the data in the table above. (2)
(5)

Activity 6

6 Down syndrome is the result of an individual having an extra copy of chromosome 21.

Two genetic variations that can cause Down syndrome are:

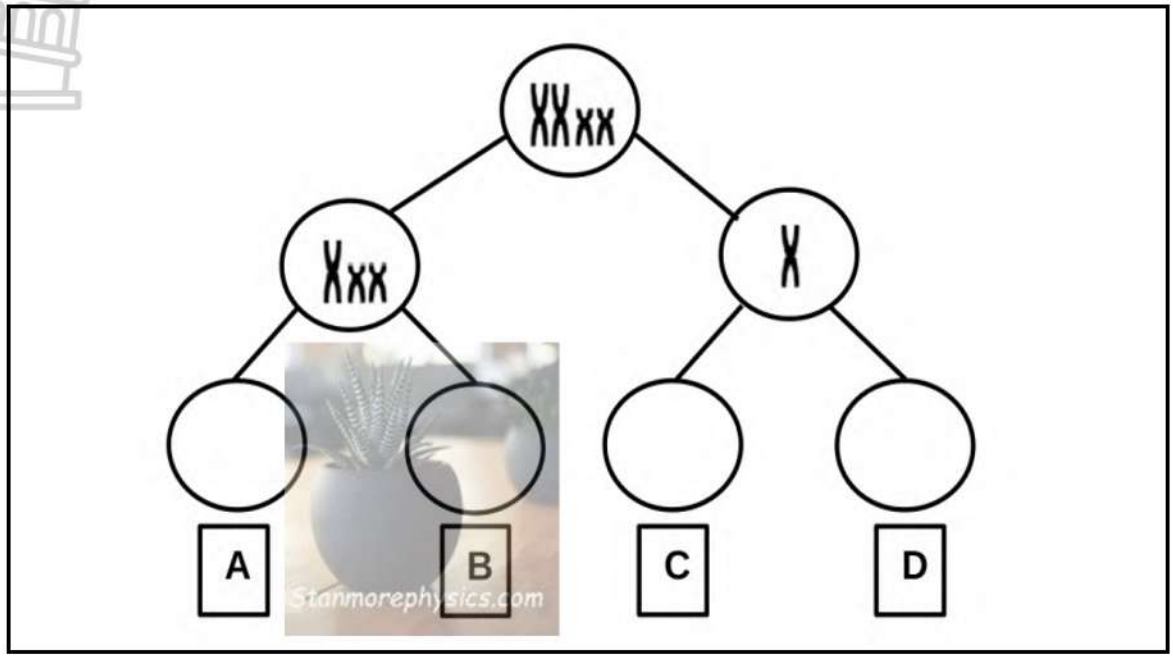
- **Trisomy 21**
  All the somatic cells in an individual have three copies of chromosome 21 due to an abnormal process that occurs during gamete production.

- **Mosaic Down syndrome**
  The individual has only some cells with an extra copy of chromosome 21 which is caused by an abnormal process during cell division after fertilisation.

6.1 Name the:
(a) Type of mutation that leads to Trisomy 21 (1)
(b) Abnormal process during gamete production that leads to three copies of chromosome 21 (1)
(c) Type of cell division that occurs after fertilisation (1)
6.2 Describe how the process in QUESTION 4.1(b) leads to Trisomy 21 (5)
6.3 Describe the TWO differences between **Trisomy 21** and **Mosaic Down syndrome**, according to the extract. (4)
(12)

Activity 7

7 The diagram below shows a cell which has undergone a non-disjunction of chromosomes during meiosis.



7.1 During which phase of meiosis did this non-disjunction chromosomes occur? (1)

7.2 Name the type of mutation that will result from non-disjunction of chromosomes. (1)

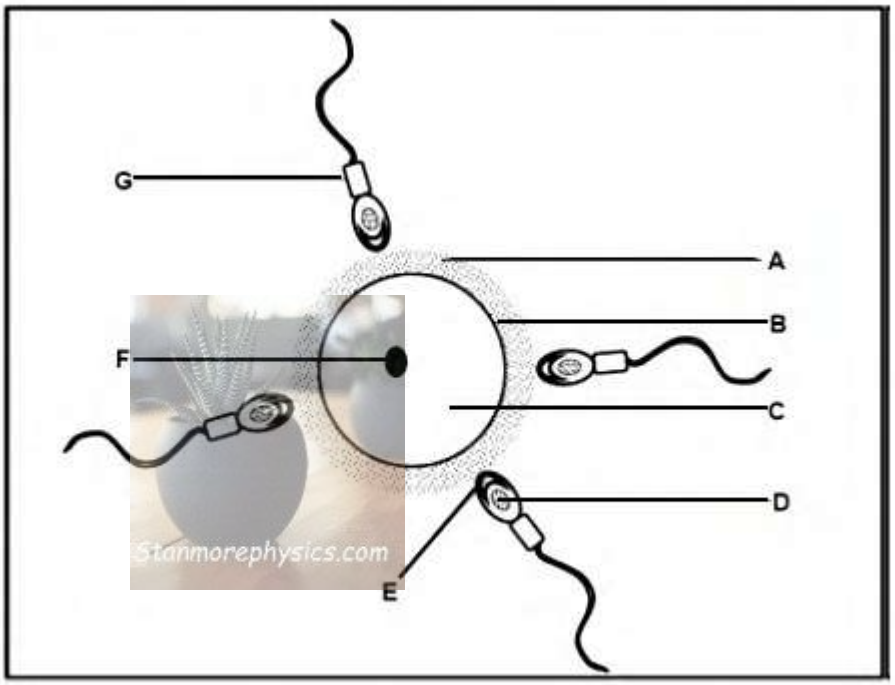
7.3 Draw cell A to show the chromosome composition after meiosis II of this cell division. (2)

(4)

TOPIC: REPRODUCTION

Activity 1

1 The schematic diagram below represents a human ovum that is about to be fertilised. The diagram is not drawn to scale.



1.1 Explain the role of the organelle found in part **G** in increasing the chances of fertilization. (2)

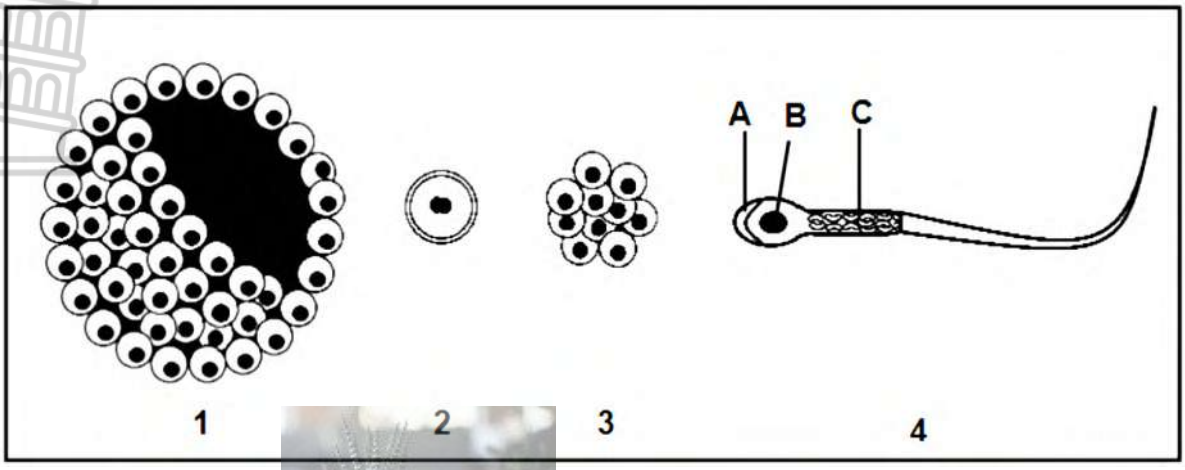
1.2 Describe the process that results in the formation of the zygote (3)

1.3 Explain the changes that the zygote undergoes until implantation (4)

(9)

Activity 2

2 The diagrams below show structures formed during human reproduction.



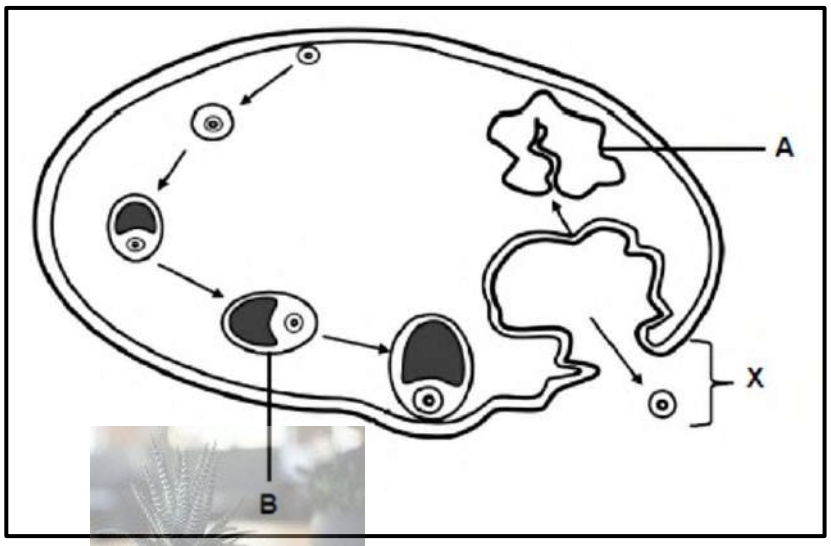
2.1 Name the type of cell division that occurs to produce the structure in diagram **3**. (1)

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

(7)

Activity 3

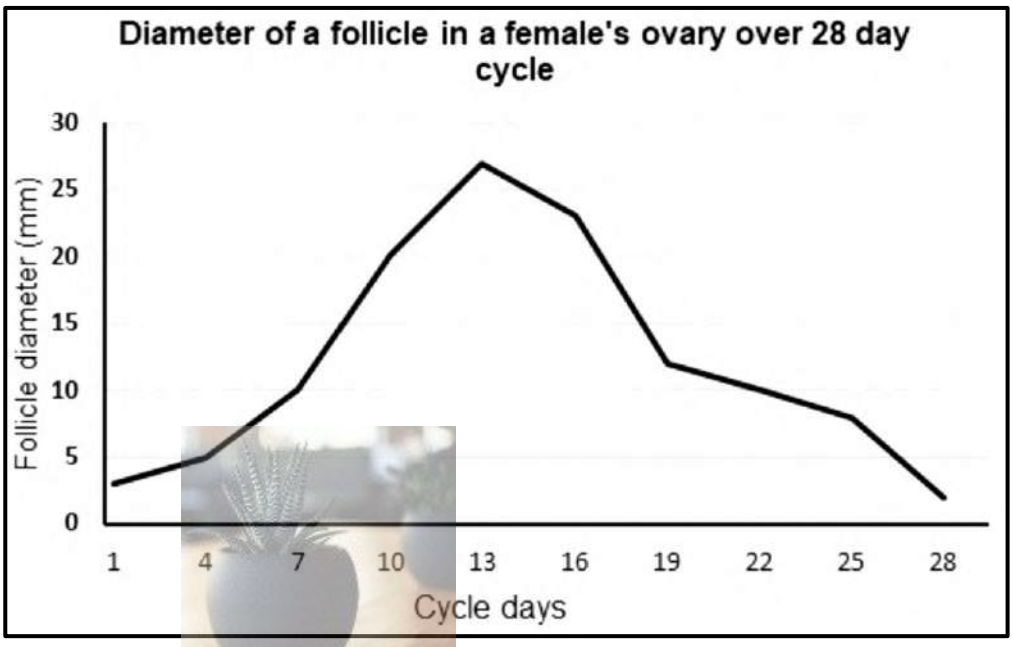
3 The diagram below shows events during the menstrual cycle of a human female



3.1 Name the hormone secreted by structure B (1)
3.2 Where in the human body does the above process takes place. (1)
3.3 Name the part of the menstrual cycle represented in the diagram above. (1)
3.4 Describe the role of the hormone mentioned in QUESTION 3.1 in pregnancy (2)
3.5 If fertilisation occurs, explain the effect of an increase in progesterone on the development of a new follicle (3)
(8)

Activity 4

4 Study the graph below



4.1 According to this graph, on which day did ovulation take place? (1)

4.2 Name the ovarian hormone that increases in the blood between days **7** to 13. (1)

4.3 Describe the role of the hormone named in QUESTION 4.2 in the uterine cycle. (1)

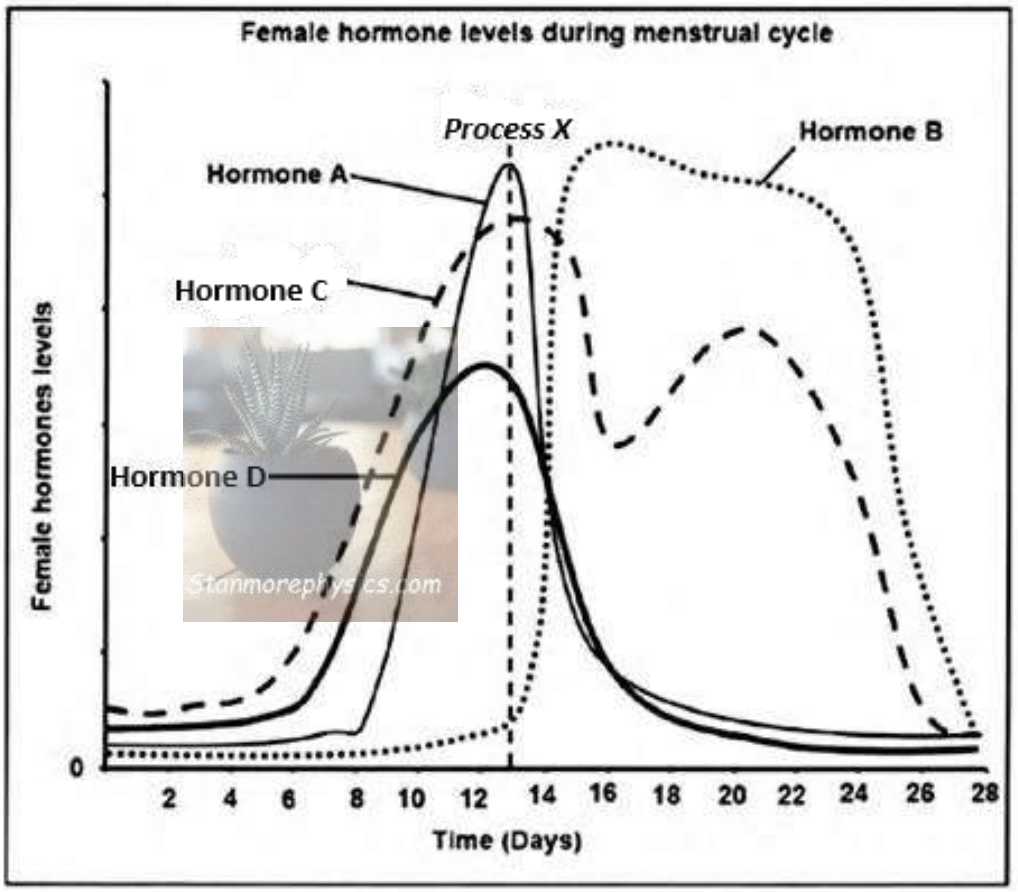
4.4 Did fertilisation take place during the 28-day cycle shown in the graph above? (1)

4.5 Explain your answer to QUESTION 4.4 using the evidence from the graph. (3)

(7)

Activity 5

5 The graph below shows the female hormone levels during the menstrual cycle.
Hormones A and D are produced in the pituitary gland.
Hormones B and C are produced in the ovary.



5.1 State TWO functions of hormone **A**. (2)

5.2 Describe the effect of hormone C on the endometrium from day 7 to 13 of the cycle. (2)

5.3 Suggest a possible reason for the maintenance of a high level of hormone **B** beyond the 28-days of the cycle. (2)

5.4 Describe the changes in the uterine lining between

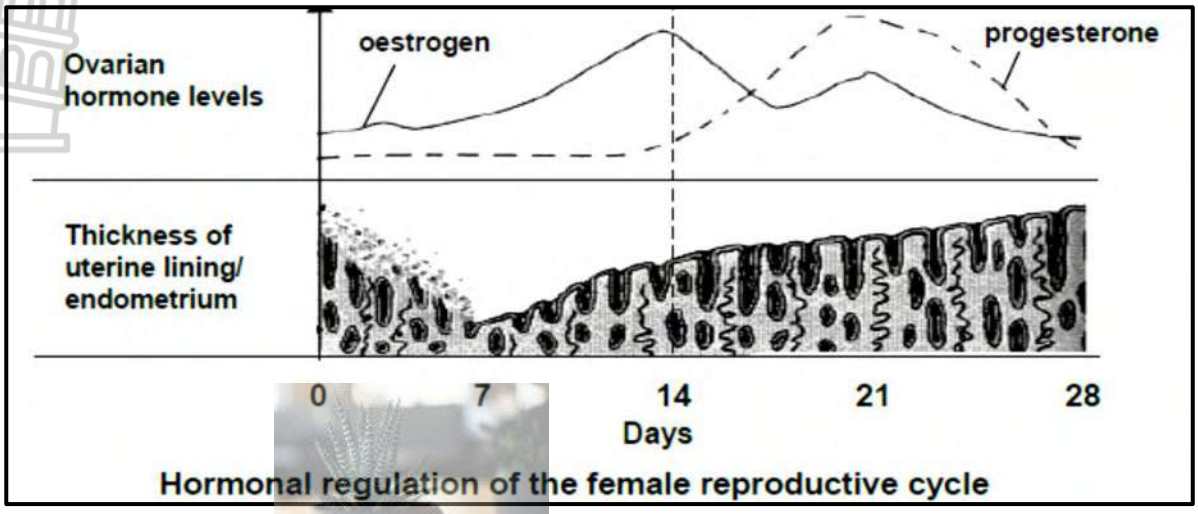
a) Days 0 to 7 (2)

b) Day 8 to 14 (2)

(10)

Activity 6

6 The diagram below shows some of the changes that take place during the menstrual cycle



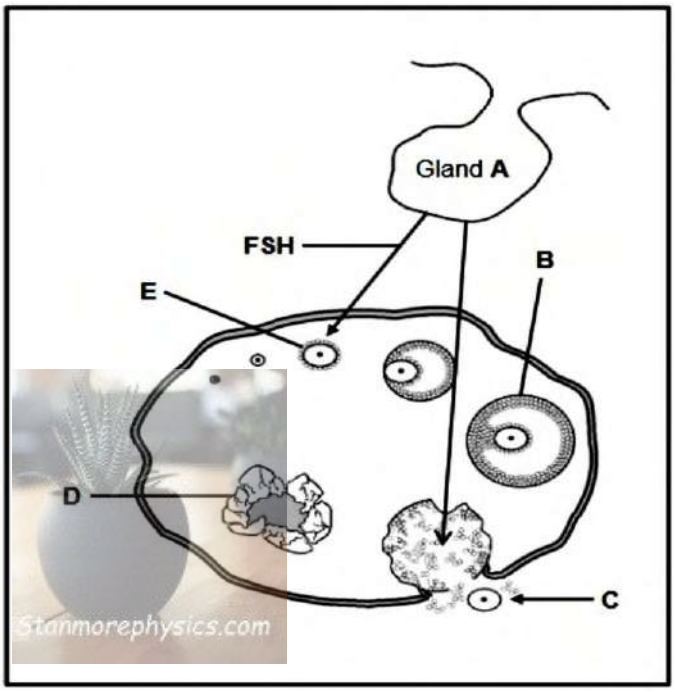
Hormonal regulation of the female reproductive cycle

6.1 Name the process taking place on Day 14. (1)
6.2 Name TWO hormones that increase in levels between Day 2 to 10 (2)
6.3 Give TWO observable reasons for your answer to QUESTION 6.3. (2)
6.4 Provide evidence from the diagram that fertilisation has taken place. (2)
6.5 Describe the effect of fertilisation on FSH and progesterone. (4)
6.6 Describe the structural changes that occur within the endometrium between days 14 – 21 that play a role in pregnancy (3)

(14)

Activity 7

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



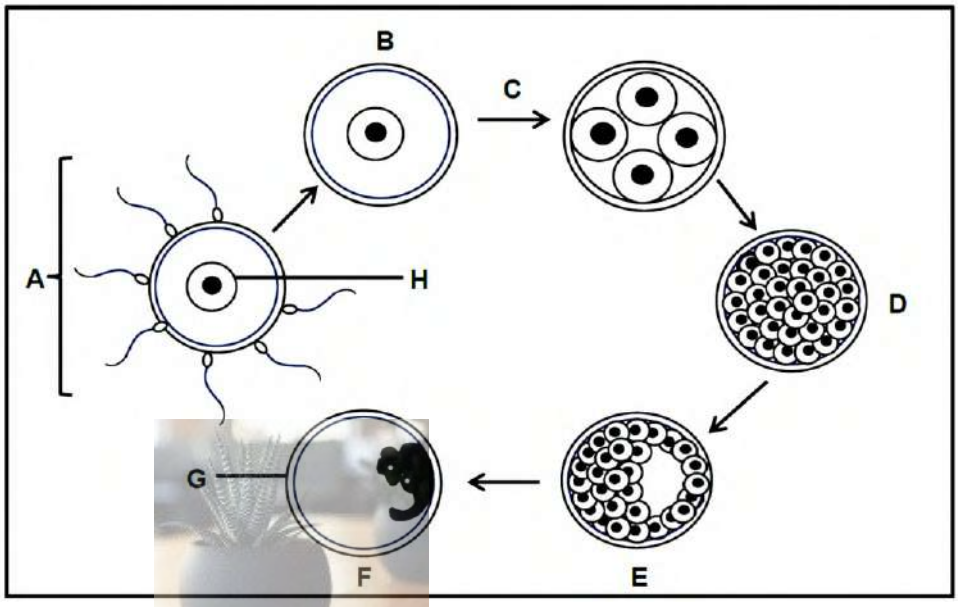
7.1 Describe the role of the hormone secreted by structure B in pregnancy. (2)

7.2 Describe the role of the hormone secreted by structure D in pregnancy. (2)

(4)

Activity 8

Study the diagram below

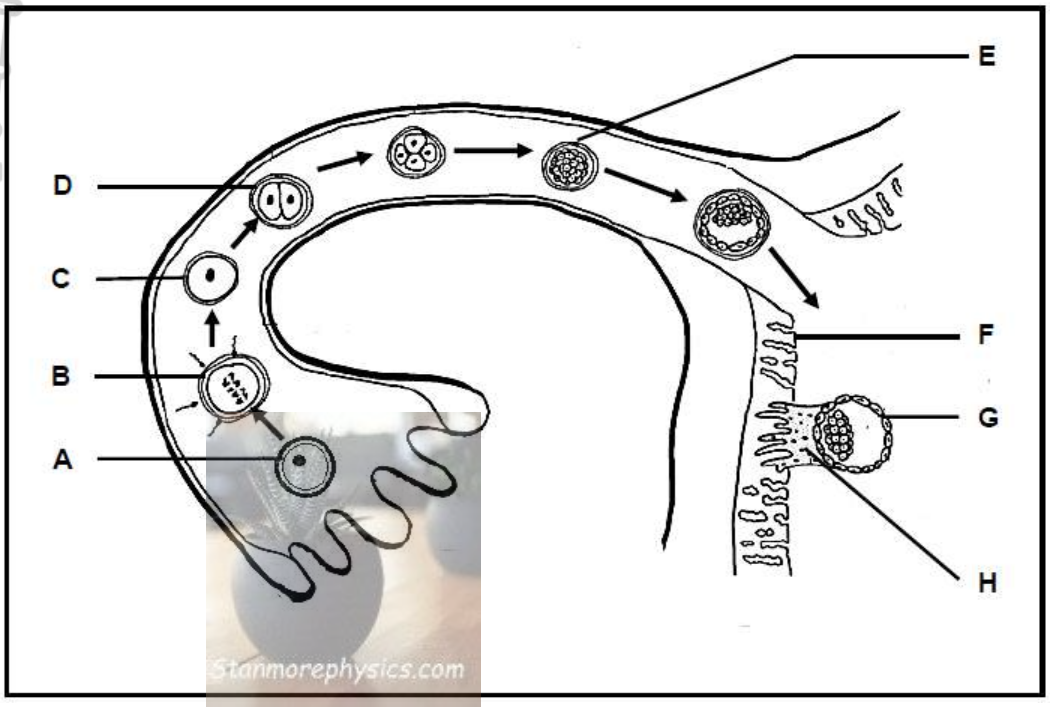


8.1 Describe the changes that take place from structure B to E. (4)

(4)

Activity 9

9 The diagram below shows a part of the female reproductive system.



9.1 Give ONE visible reason that indicates that structure F is prepared for the process of implantation (1)

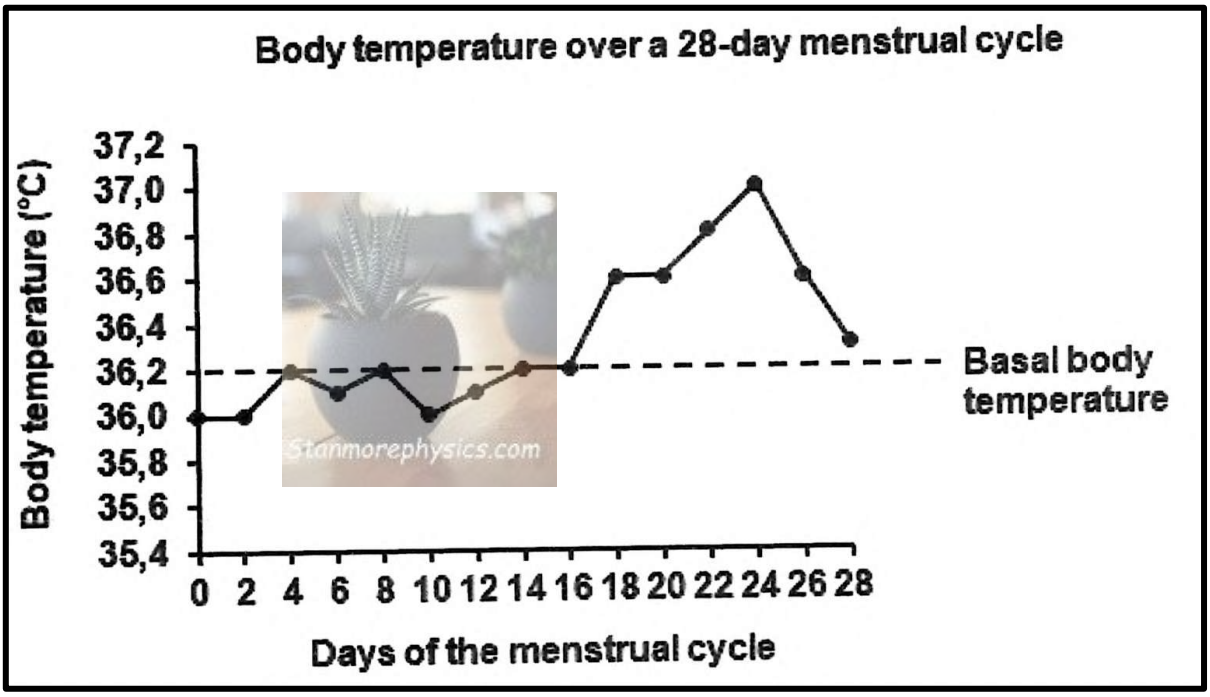
9.2 State TWO ways other than the one mentioned in QUESTION 9.1 that indicates that structure F is prepared for the process of implantation (2)

(3)

Activity 10

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

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



10.1 Progesterone is the hormone that causes an increase in basal body temperature.

Explain why the increase in basal body temperature occurs only after ovulation. (2)

10.2 Describe the changes that occur in the endometrium after the ovulation. (3)

(5)

TOPIC: GENETICS AND INHERITANCE

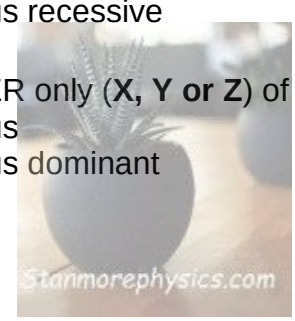
Activity 1

1 In rabbits, black fur is controlled by the allele **(B)** and white fur is controlled by the allele **(b).** The table below shows the genotypes of some rabbits

RABBIT	GENOTYPE
X	BB
Y	Bb
Z	bb

1.1 What is the phenotype of:
(a) Homozygous recessive (1)
(b) Rabbit **Y** (1)

1.2 Give the NUMBER only (**X, Y or Z**) of the rabbit that is/are:
(a) Homozygous (2)
(b) Homozygous dominant (1)
(5)



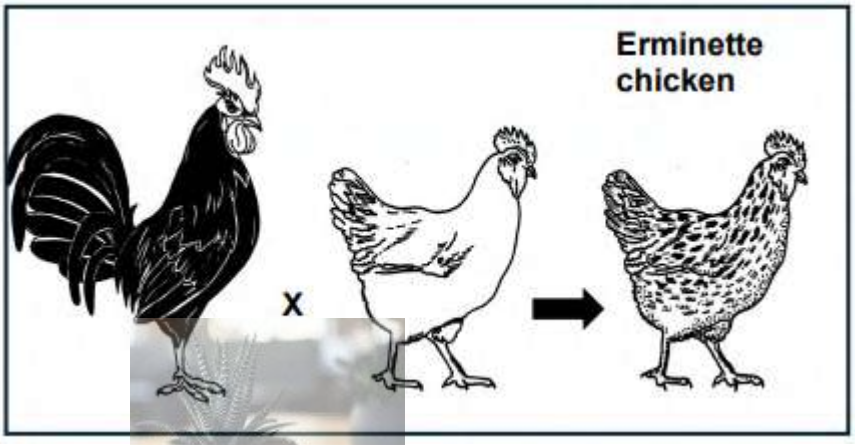
Activity 2

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

2.1. Name the type of dominance shown by these animals. (1)
2.2. Use a genetic cross to show the genotypes and phenotypes of F1 generation (6)
(7)

Activity 3

3 In some chickens, feather colour is controlled by two alleles, white feathers (**W**) and black feathers (**B**)**.** If a homozygous white chicken is crossed with a homozygous black chicken, the offspring have feathers that are both black and white, a phenotype that is known as erminette, as shown in the diagram below.



3.1 Explain why this inheritance is an example of co-dominance. (2)
3.2 The inheritance of which blood group in humans shows the same type of dominance as explained in QUESTION 3.1? (1)
3.3 A white chicken is crossed with an erminette chicken. Use a genetic cross to show ALL the possible phenotypes of the offspring (6)
(9)

Activity 4

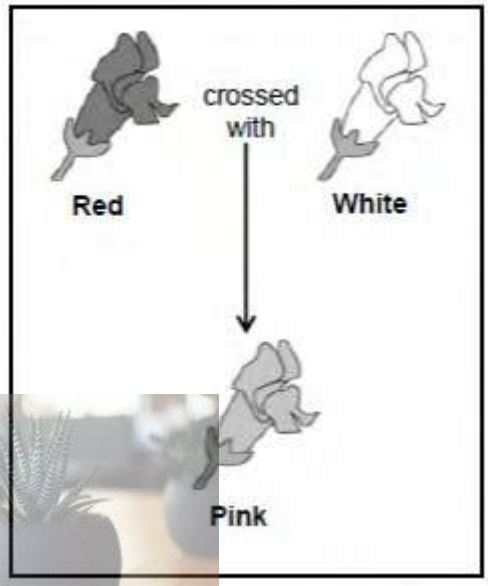
3 Flower colour (purple or white) in a particular plant species is controlled by two alleles, **D** and **d**. Four crosses were carried out to determine which allele is dominant. Forty (40) offspring were produced in each cross. The phenotypes of the parents and offspring in each cross were recorded. The results are shown in the table below

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

4.1 State the dominant flower colour. (1)
4.2 Use cross **1** to explain your answer to QUESTION 4.1. (2)
4.3 State Mendel's Law of Segregation (3)
4.4 Use a genetic cross to show how the crossing of two purple flowering plants can produce white offspring, as in cross **2**. (6)
(12)

Activity 5

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



5.1. State the type of dominance shown by the snapdragon plants. (1)
5.2 Give a reason for your answer to QUESTION 5.1. (2)
5.3 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)

Activity 6

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

Butterflies that are heterozygous for both genes were crossed.

6.1. Name the type of cross represented above (1)
6.2. Give the dominant characteristic of EACH gene. (2)
6.3. The table below shows the phenotypes and all the possible genotypes of the offspring.

PHENOTYPE	ALL POSSIBLE GENOTYPES
Rep spots, brown eyes	**(X)**
(Y)	RrEe
Grey spots, brown eyes	rree

(a) ALL the possible genotypes at **X** (4)
(b) The phenotype at **Y** (1)

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

(9)

Activity 7

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 (1)

(c) Allele for a continuous hairline (1)

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

(7)

Activity 8

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.

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)

Activity 9

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

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

(11)

Activity 10

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

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

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

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

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

(16)

Activity 11

11 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

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

11.2 The population size is 1 800 000.
Calculate the value of **X**. Show ALL working. (3)

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

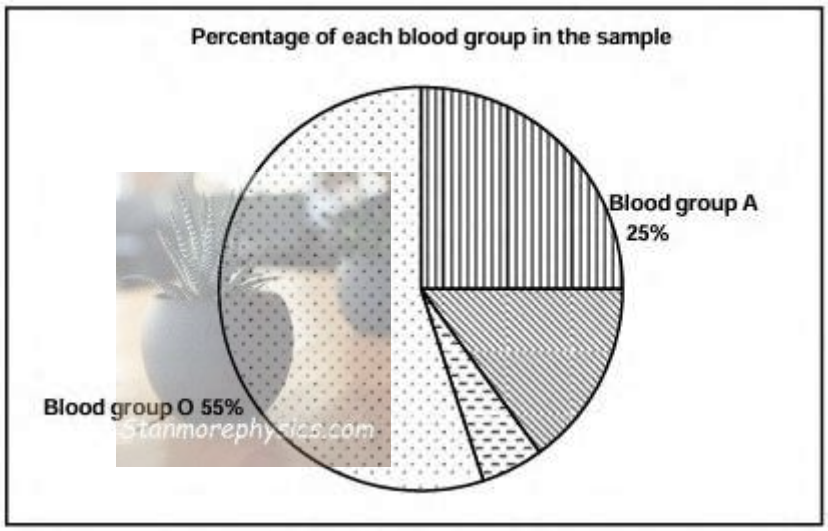
(7)

Activity 12

12 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.



12.1 State the aim of the investigation. (2)

12.2 Answer the following questions:

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

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

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

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

12.4 Name the blood group which:

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

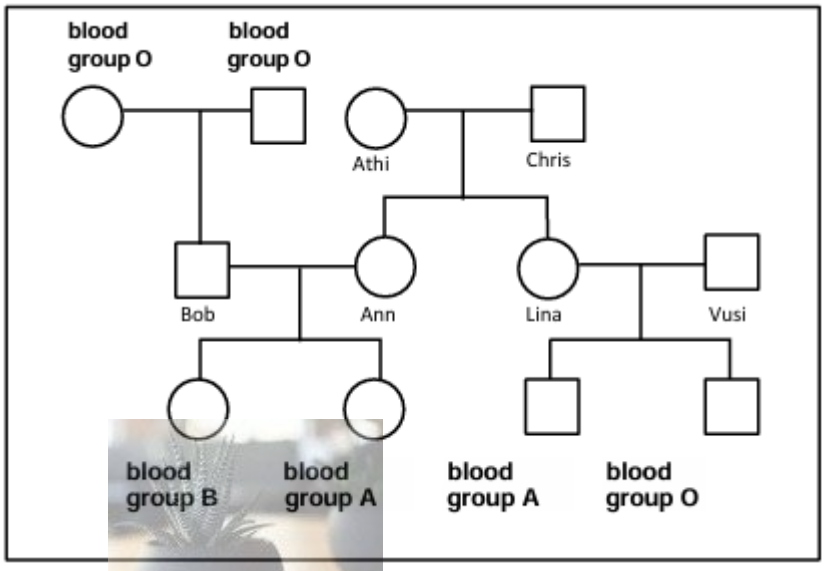
(b) Is a result of co-dominance (1)

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

(14)

Activity 13

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



13.1 Name the type of diagram shown. (1)

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

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

13.4 Lina's genotype is I^A i. (2)
State ALL the possible genotypes of Vusi.

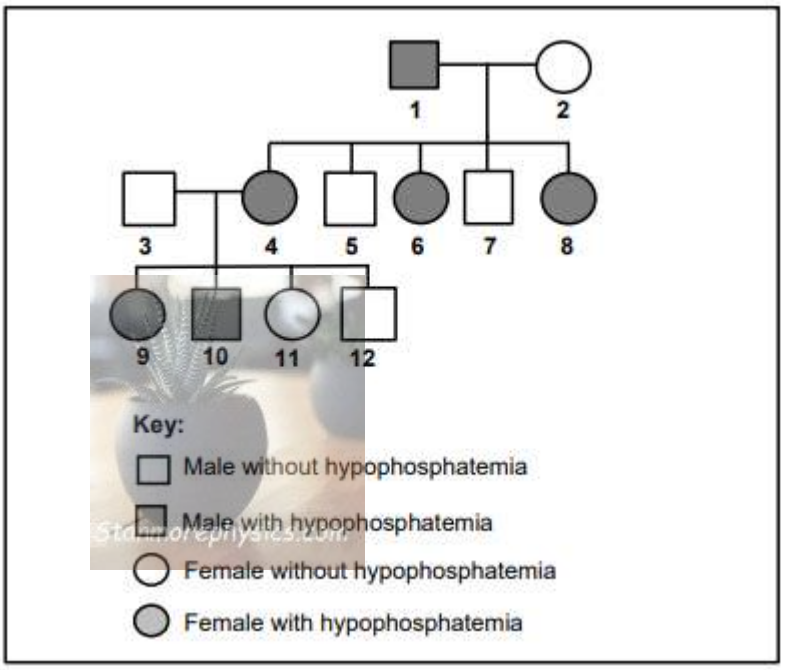
13.5 Give the genotype of Bob. (1)

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

(8)

Activity 14

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



14.1 Name the type of:
(a) Diagram shown (1)
(b) Gonosome found only in males (1)

14.2 State TWO effects of hypophosphatemia in humans (2)

14.3 How many individuals in the F1-generation have hypophosphatemia? (1)

14.4 Give ALL possible genotypes of individual:
(a) **3** (1)
(b) **4** (1)

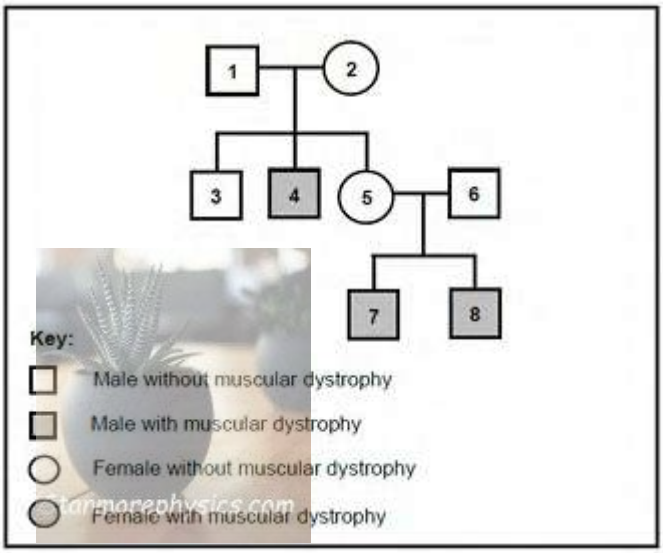
14.5 Explain why ALL the daughters of individuals **1** and **2** will have hypophosphatemia (6)

(13)

Activity 15

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

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



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

15.2 Give the:

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

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

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

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

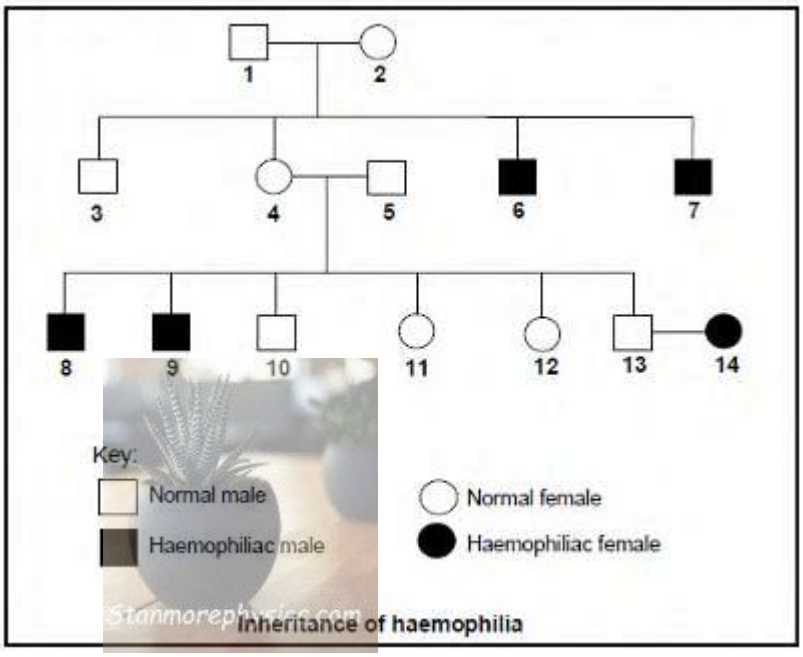
Use a genetic cross to show the percentage chance of having a child with muscular dystrophy.

(6)

(14)

Activity 16

16 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



16.1 Determine the:
(a) Phenotype of individual **4.** (1)
(b) Genotype of individual **2.** (2)
16.2 Explain why females have a smaller chance of suffering from haemophilia. (3)
16.3 Represent a genetic cross to show the percentage chance of individuals **13** and **14** having a haemophiliac son. (7)
(13)

Activity 17

17.1 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)
17.2 Haemophilia is caused by a recessive allele carried on the **X** chromosome (X^h). A heterozygous female for haemophilia is married to a haemophiliac male. Use a genetic cross to show the phenotypic ratio of their offspring. (6)
(10)

Activity 18

18 Bt corn is a crop that has been genetically modified to be insect-resistant.

The table below shows the percentage of land used to grow Bt corn and the amount of insecticide used in a certain country between 1995 and 2010.

YEAR	LAND USED TO GROW Bt CORN (%)	AMOUNT OF INSETICIDE USED (kg per hectare)
1995	0	0.2
2000	20	0.13
2005	40	0.05
2010	60	0.01

18.1 Describe how genetic engineering of Bt corn was done. (2)

18.2 Describe the relationship between the land used to grow Bt corn and the amount of insecticide used. (2)

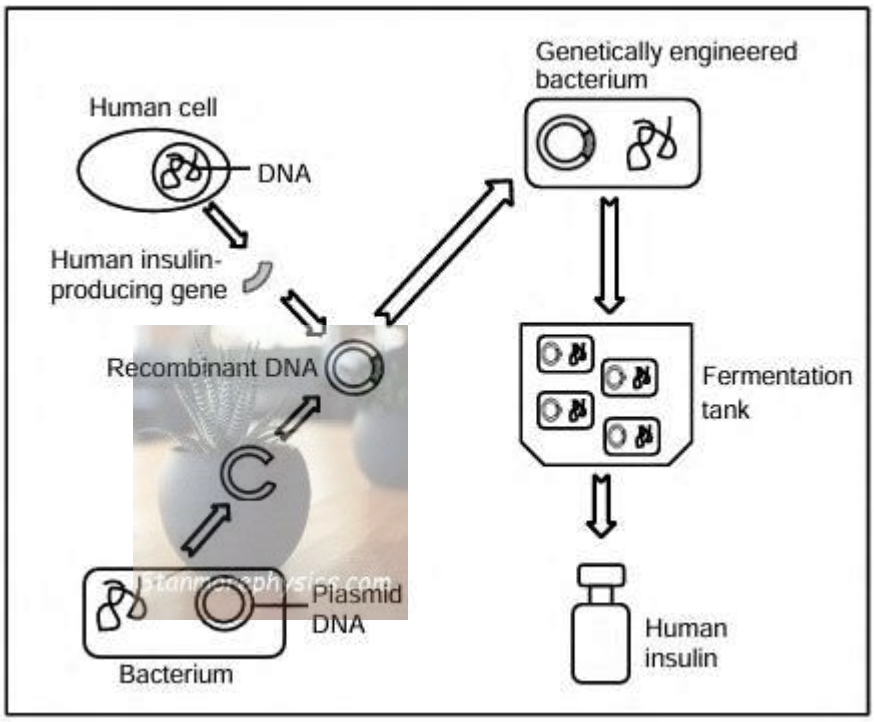
18.3 State TWO other plant characteristics that are genetically engineered to increase food security. (2)

18.4 Draw a bar graph to represent the percentage of land used to grow Bt corn from 1995 to 2010. (6)
(12)

Activity 19

19 Synthetic insulin is used to treat diabetes and is produced by genetic engineering technology.

The diagram below represents the process.



19.1 Define genetic engineering. (2)

19.2 Describe the steps involved in producing the recombinant DNA. (4)

19.3 Explain why bacteria are most suitable for genetic engineering. (2)

19.4 Suggest THREE objections that some people might have to genetic engineering. (3)

(11)

Activity 20

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

20.1 Describe the process of cloning. (5)

20.2 List THREE benefits of cloning animals. (3)

(8)

Activity 21

21 Read the following passage and answer the questions that follow.

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.

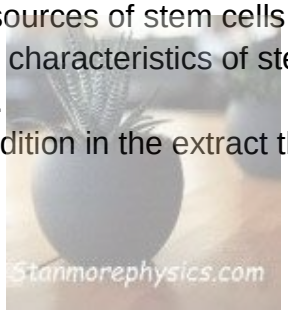
Recently, stem cells have also been obtained from bone marrow. These stem cells are used to treat conditions such as heart disease and spinal injuries.

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

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

21.3 Name ONE condition in the extract that can be treated with stem cells. (1)

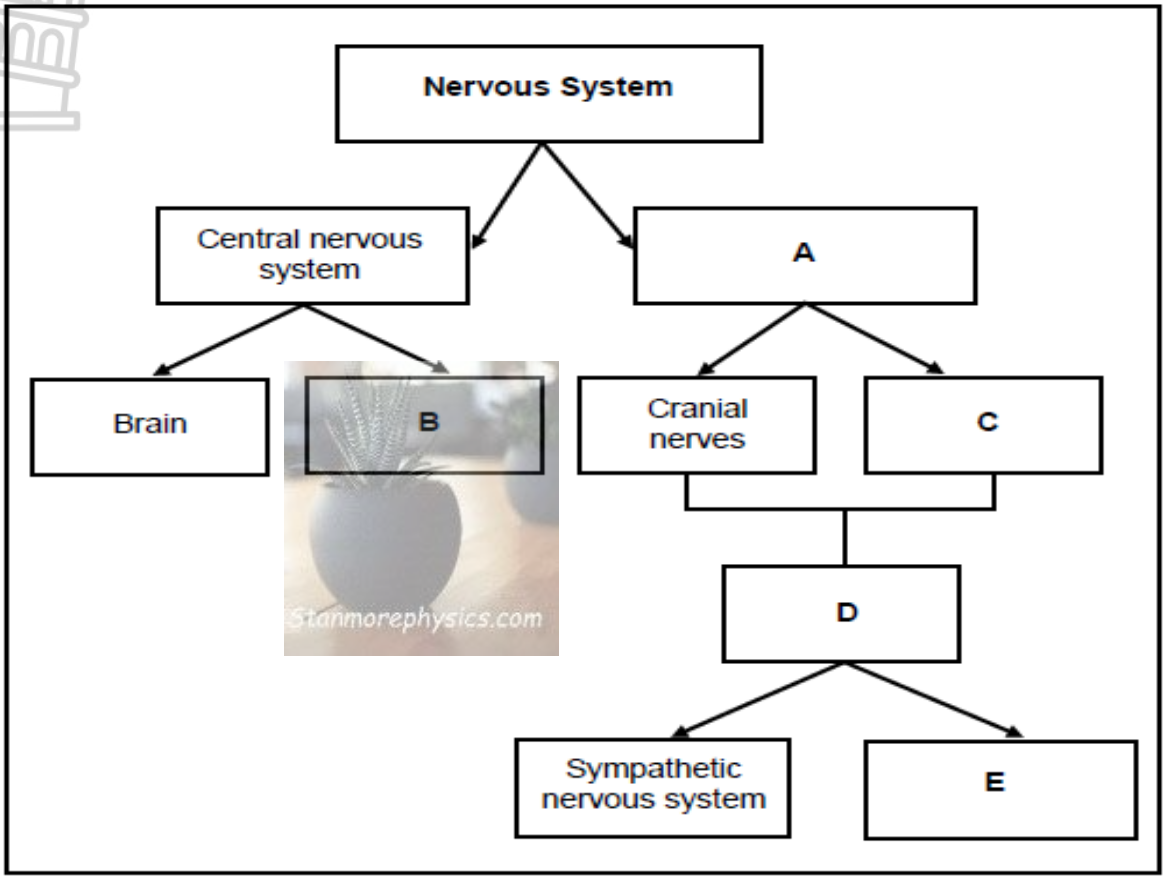
(6)



TOPIC: RESPONDING TO ENVIRONMENT BY HUMANS

Activity 1

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



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

1.2 Name the type of nervous system found at A. (1)

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

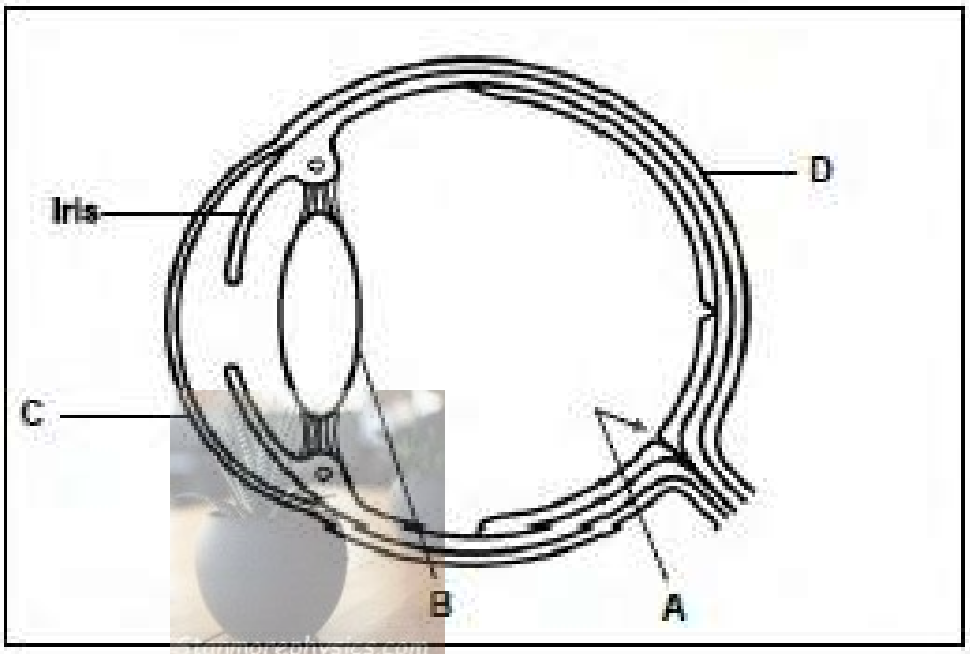
1.4 Describe the role of sympathetic nervous system when a person is chased by a dog (5)

1.5 Describe the structure and the functioning of autonomic nervous system. (4)

(14)

Activity 2

2 The diagram below represents the structure of the human eye



2.1 Describe the pupillary mechanism when a person enters a dimly lit room (4)

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

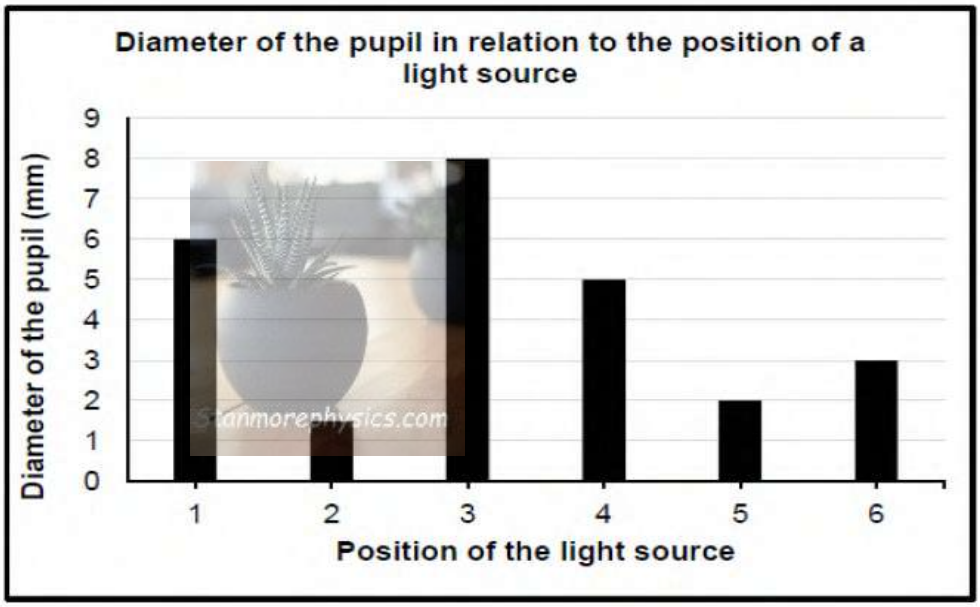
2.3 Explain ONE way in which part B is structurally suited for accommodation (2)

(9)

Activity 3

3 An experiment was set up to investigate the diameter of the pupil under different light conditions. A person sat in a dark room and electric light bulb was switched on at different distances from a person. The diameter of the pupil was measured 1 minutes after each time the light bulb was switched on.

The results are illustrated in the graph below.



3.1 Identify the :

(a) Independent variable (1)

(b) Dependent variable (1)

Give the :

3.2 (a) Diameter of the pupil at position 4 of the light source (1)

(b) Position where light the light source was the furthest from the person (1)

3.3 State TWO reasons why the results of this investigation are not reliable (2)

3.4 Calculate the percentage decrease in the pupil diameter, when the light bulb was moved from position 3 to position 4.Show all your workings. (3)

3.5 Name and describe the mechanism that caused the change in diameter of the pupil from position 2 to position 3 (5)

(14)

Activity 4

4 The data below represents the results of the investigation used the determine the thicknesss of the lense changed as a pencil was moved away from the eye.

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

4.1 State a conclusion for the above investigation. (2)

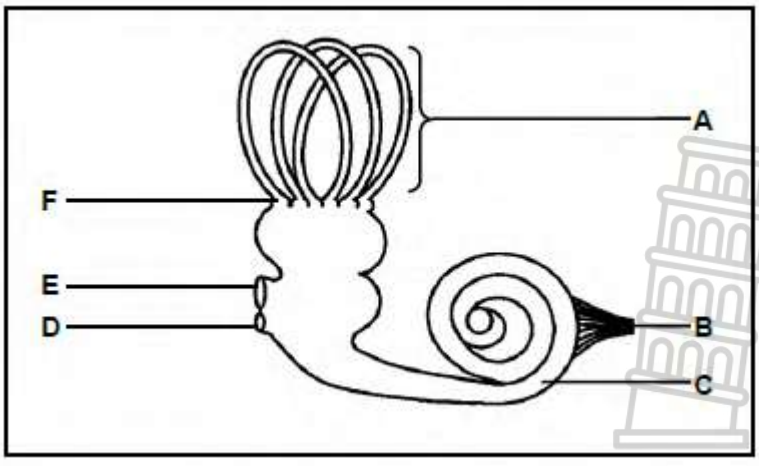
4.2 Name TWO structures in the eye that are responsible for changes in the curvature of the lens. (2)

4.3 Describe accommodation of the eye when a person focuses on an object that is moving away. (4)

(8)

Activity 5

5 The diagram below represents a part of a human ear



5.1 Describe the role of part A in maintaining balance (3)

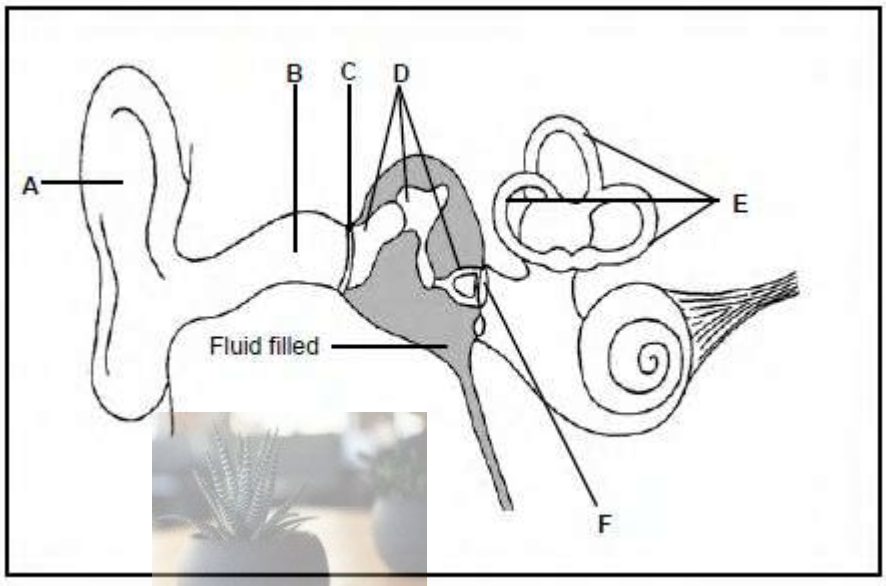
5.2 Name and describe the role of receptor found in part F to maintain balance (5)

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

(13)

Activity 6

6 The diagram below shows the part of the human ear with middle ear infection



6.1 State ONE function of part A (1)

6.2 Explain why a person will suffer from hearing loss if the bones at D are fused (5)

6.3 Describe the role of Eustachian tube (2)

6.4 Describe the role of hearing receptor when they are stimulated by pressure wave (2)

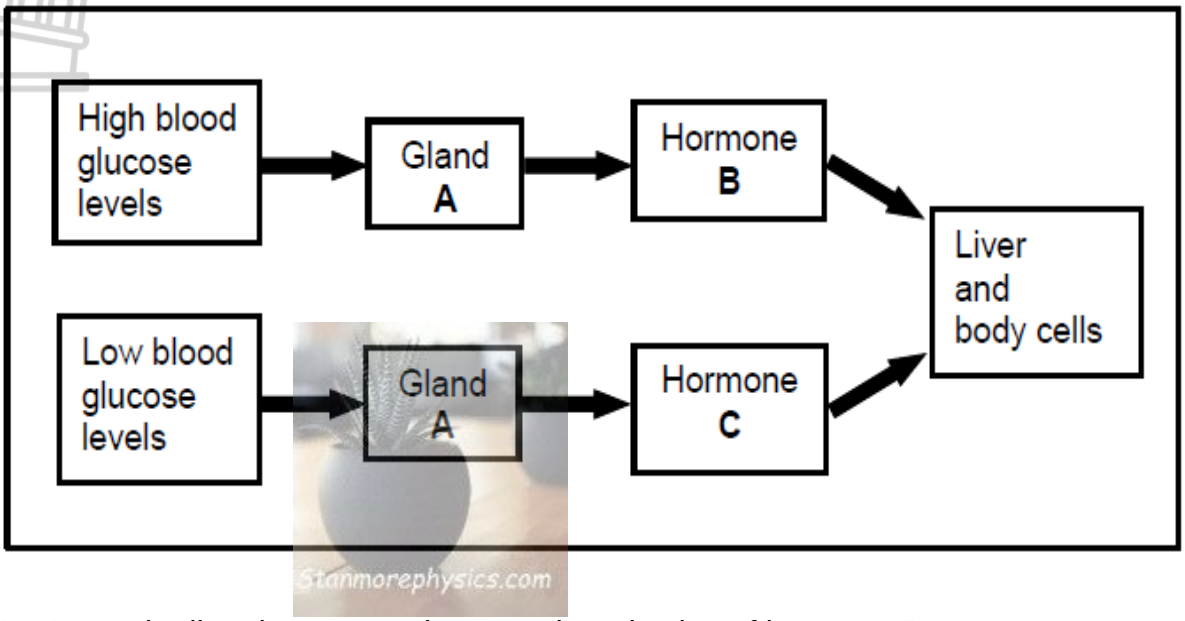
6.5 Explain how middle-ear infection could affect hearing (4)

(14)

TOPIC: HUMAN ENDOCRINE GLANDS AND HOMEOSTASIS

Activity 1

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



1.1 A certain disorder causes decreased production of hormone **B**
Explain how this will affect the blood glucose levels (3)

1.2 Scientist have been investigating the use of adrenalin as a treatment for people who cannot produce hormone **C**
Explain why this treatment may work. (3)
(6)

Activity 2

2

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 the 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:

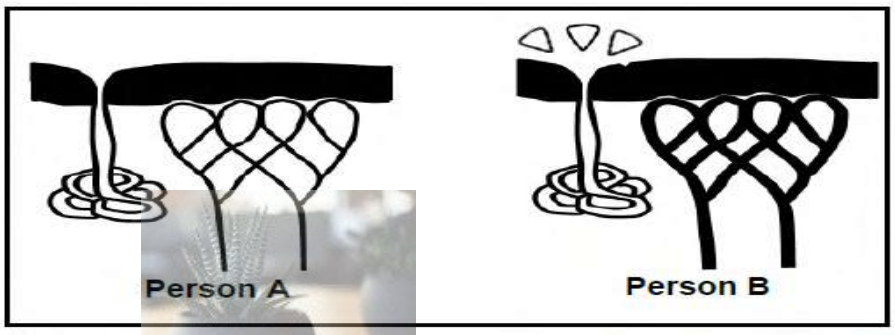
- Sit still for 10 minutes without wearing a face mask
- Sit still for 10 minutes while wearing a face mask
- Exercise for 10 minutes without wearing a face mask
- Exercise for 10 minutes while wearing a face mask
- Allowed a 15-minute interval between each 10-minute phase
- Recorded the carbon dioxide levels at the end of each 10-minute phase
- Ensured that the face mask covered the nose and mouth

2.1 Explain why scientists allowed a 15-minute interval between each phase (2)
2.2 Give a reason why the carbon dioxide levels were measured while participants were sitting still. (1)
2.3 Describe the *homeostatic control* of carbon dioxide when it is high in blood. (7)
(10)

Question 3

3 3.1 Describe how the human body maintains the temperature in the blood when it rises above normal limits. (7)

3.2 The diagrams below represent structures in the skin of two people. Both people were in the same room at the same time, but one person was exercising while the other person was sitting still. The skin surface temperature of both people was measured after 10 minutes.



After 10 minutes the surface skin temperature of each person was measured. The results were as follows:

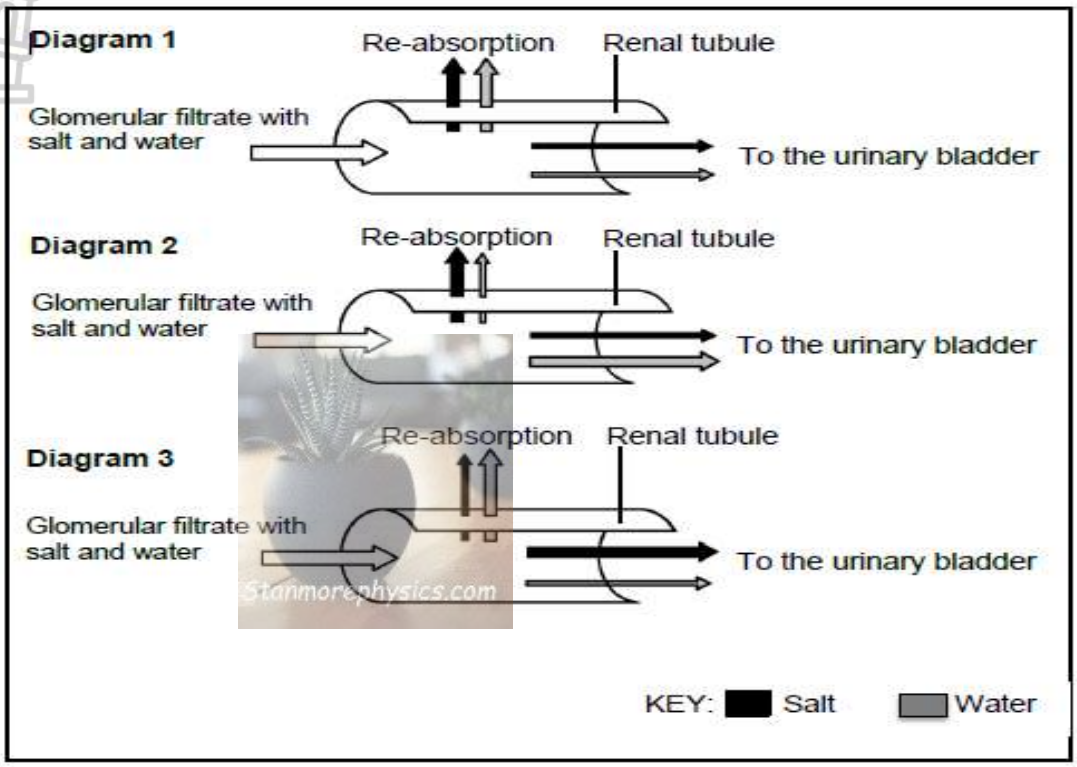
- Person **A**: 37,2 °C
- Person **B**: 36,6 °C

3.2.1 Explain why the skin temperature of person A was higher after 10 minutes. (3)

(10)

Activity 4

4 The diagrams below show the re-absorption of salt and water through the tubules of a nephron in the kidney under three different conditions. The width of the arrows represents the amounts of salt and water.



4.1 Which diagram (**1**, **2** or **3**) would represent a person who had eaten salty chips on a hot day without any intake of water? (1)

4.2 Explain your answer to QUESTION 4.1 (5)

(6)

Activity 5

5

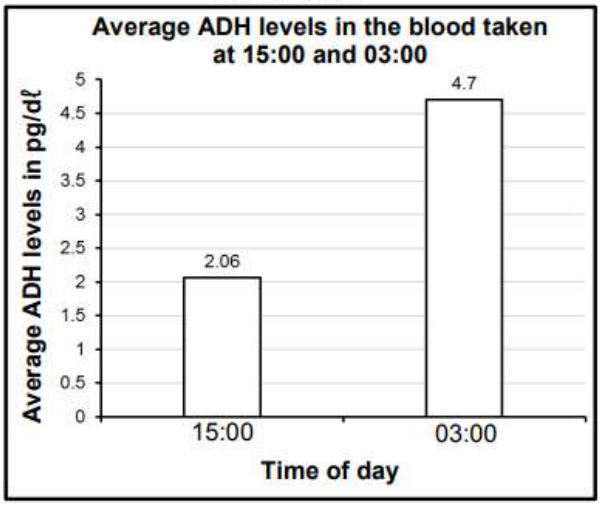
An investigation was conducted to determine the change in the ADH levels in the blood and the volume of urine produced over a 24-hour period.

The procedure was as follows:

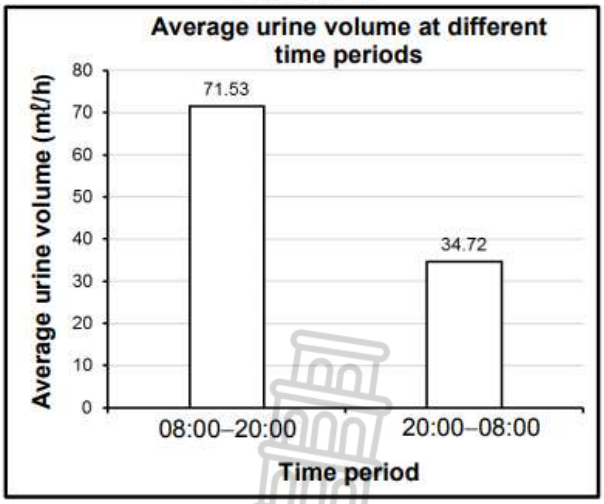
- One healthy adult participated in the investigation.
- The intake of food and liquids of this person was controlled for the duration of the investigation.
- The ADH levels in the blood were measured at 15:00 and 03:00 for 5 days and the average was calculated.
- The volume of urine produced from 08:00 to 20:00 was measured for 5 days and the average was calculated.
- The volume of urine produced from 20:00 to 08:00 was measured for 5 days and the average was calculated.

The results are shown in the graphs below.

GRAPH A



GRAPH B



5.1 Calculate the difference between the average volume of urine (mℓ/h) produced during the 2 time periods. Show ALL workings. (2)

5.2 Explain how the ADH levels in the blood at 03:00 affects the volume of urine produced between 20:00 and 08:00. (4)

5.4 A patient whose renal tubules are impermeable to water, underwent the same investigation.
Explain why the ADH levels are expected to remain high all the time. (3)
(9)

TOPIC: PLANT RESPONSE TO THE ENVIRONMENT

Activity 1

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

1.1 Describe the role of auxins in roots. (3)

1.2 When a plant is placed horizontally, with light coming from all directions, the auxins will accumulate on the lower side of both the stem and the roots.

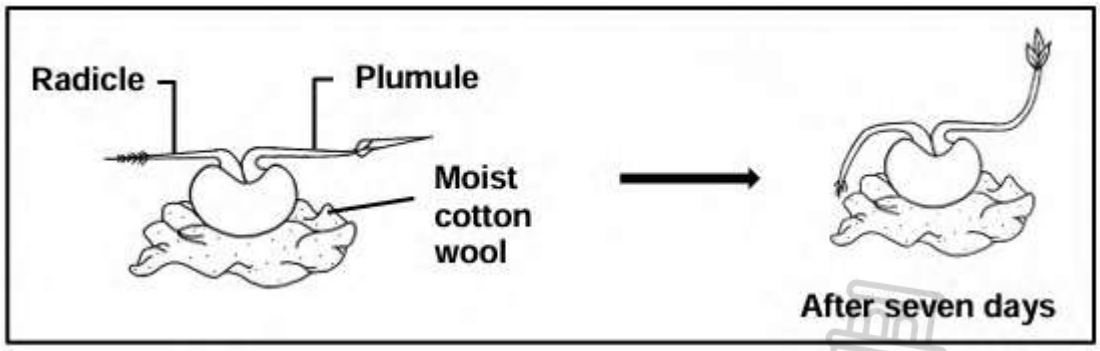
Explain the difference in the response of the stem and the roots after a few days. (4)

(7)

Activity 2

2 An experiment was set up to investigate a plant growth response to a stimulus. A seedling has a radicle (young root) and a plumule (young stem).

This seedling was placed horizontally in a dark place and a growth response was observed after seven days, as shown in the diagram below.



2.1 Name the:

(a) Growth response observed after seven days (1)

(b) Plant hormone responsible for the growth response named in QUESTION 2.1(a) (1)

2.2 Explain the growth response observed in the root of the seedling. (5)

2.3 Explain how a control set-up will be different from the above set-up. (2)

(9)

Activity 3

3 Explain the growth response of a plant when the stem is exposed to light coming from one side only. **(4)**

Activity 4

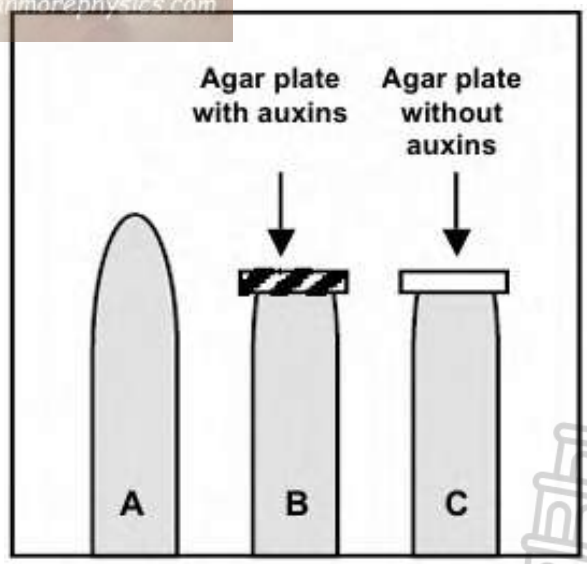
4 Thobeka investigated the effect of auxins on the growth of three plant shoots (**A**, **B** and **C**). The plant shoots were treated as follows:

- Shoot **A** – Not treated in any way
- Shoot **B** – Tip removed and agar plate with auxins placed on top
- Shoot **C** – Tip removed and agar plate without auxins placed on top

All shoots were exposed to the same light conditions.

NOTE: Agar is a jelly-like substance that allows auxins to diffuse through it.

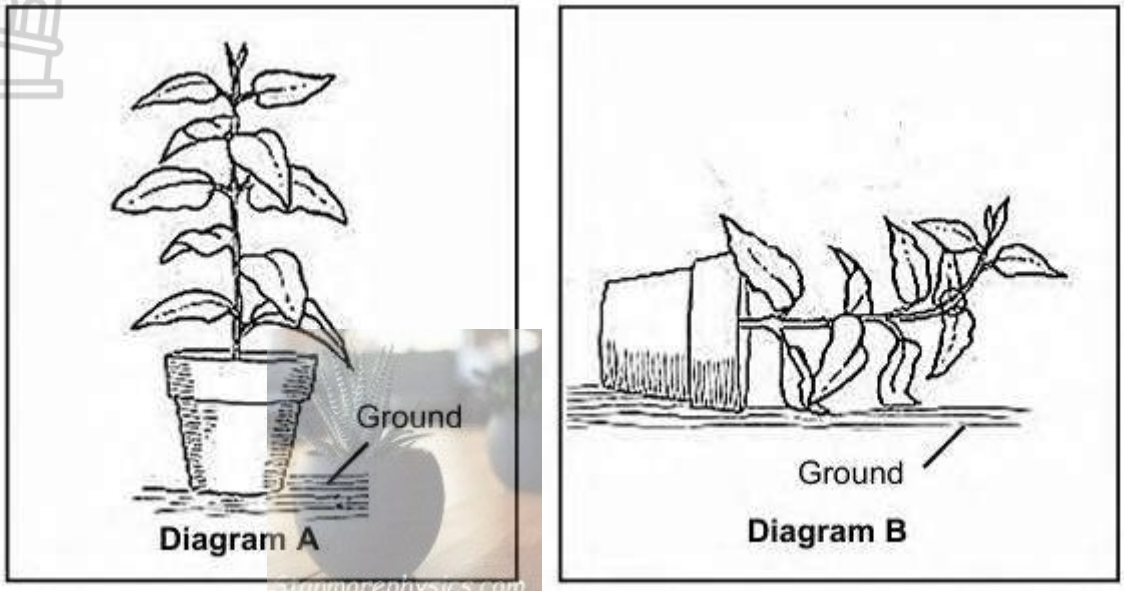
The diagram below illustrates the set-up at the beginning of the investigation.



4.1 Identify the independent variable in this investigation. (1)
4.2 State TWO factors that must be kept constant in this investigation. (2)
4.3 Explain the results observed in:
(a) Shoot **B** after a few days (3)
(b) Shoot **C** after a few days (2)
4.4 Suggest TWO ways in which Thobeka could have improved the reliability of her investigation. (2)
(10)

Activity 5

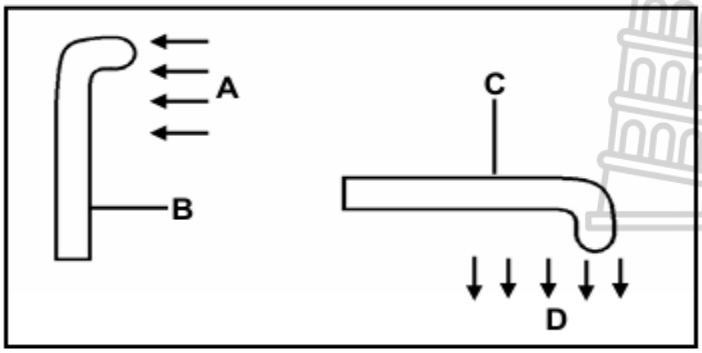
5 Diagram **A** shows an upright pot plant. Diagram **B** shows the same pot plant one week after falling over. The plant was exposed to uniform light from all directions before and after falling over.



5.1 Which type of tropism is illustrated in diagram **B**? (1)
5.2 Explain why the stem of the plant bent upwards, as illustrated in diagram **B**. (4)
5.3 State how the roots in diagram **B** would react. (1)
(6)

Activity 6

6 The diagrams below represent the growth responses of two different plant organs to external stimuli.



6.1 Name the group of plant hormones that is responsible for the growth responses observed in the diagrams. (1)
6.2 Name the external stimulus at:

(a) **A** (1)

(b) **D** (1)

6.3 Give ONE observable reason why plant organ **B** is a stem. (1)

6.4 Explain the growth response observed in plant organ **C**. (3)

(7)

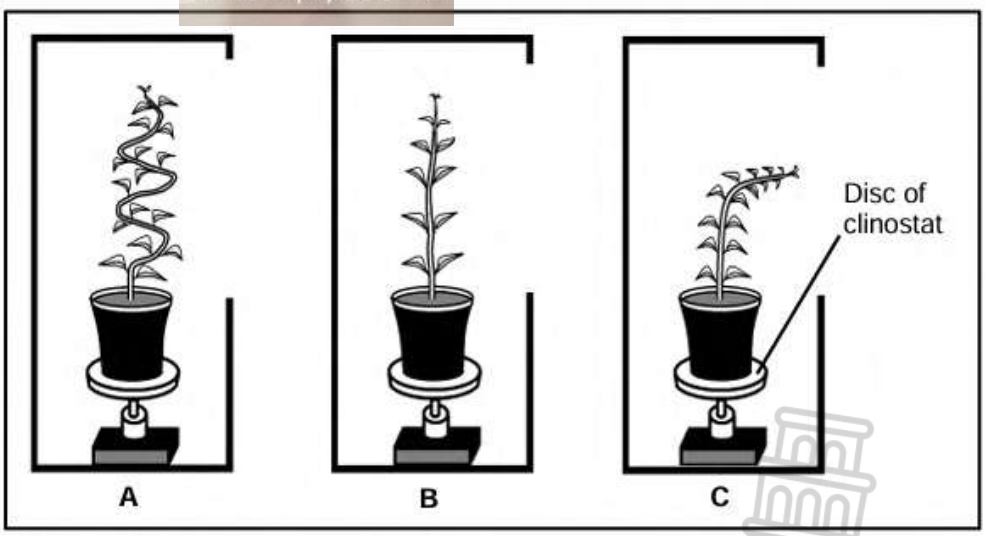
Activity 7

7 A clinostat is a device used to investigate plant growth responses. It has a disc that rotates very slowly when the clinostat is switched on.

During an investigation on plant responses to light, the procedure below was followed:

- Three pot plants of the same species were used.
- Each pot plant was placed on one of three identical clinostats.
- Each set of apparatus, A, B and C, was placed in a box with a single opening.
- Each clinostat was treated in a different way over a period of five weeks.

The results of the investigation are represented in the diagrams below.



7.1 Give ONE reason why the results of this investigation may be considered to be unreliable. (1)

7.2 In which apparatus (**A**, **B** or **C**) was the clinostat:

(a) Switched on and rotating slowly (1)

(b) Switched off, but manually rotated through 180° once a week (1)

7.3 Explain the effect of the unilateral light on the distribution of auxins in the plant in apparatus **C**. (3)

(6)

Activity 8

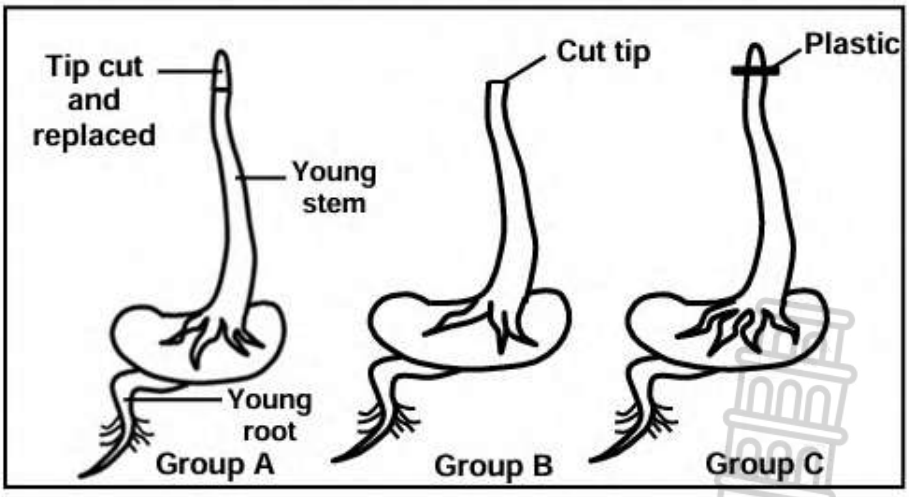
8

A group of learners conducted an investigation to determine the effect of auxins on the growth of stems in bean seedlings.

The procedure was as follows:

- 30 bean seeds were allowed to germinate for 5 days to produce seedlings.
- The seedlings were divided into 3 groups (**A**, **B** and **C**) of 10 seedlings each.
- The tips of all the seedlings were cut at the same length.
- In group **A**, the cut tip was placed back on top of the young stem.
- In group **B**, the tip was not placed back.
- In group **C**, a piece of plastic was placed on top of the cut surface and the tip was then placed on top of the plastic.
- The seedlings in all the groups were placed in a dark cupboard for a week.
- The growth of the stem was then observed.

The diagram below shows how the seedlings in each group were treated.



8.1 Identify the dependent variable in this investigation. (1)

8.2 Why did the learners cut the tips of the young stems? (1)

8.3 Give ONE reason why 10 bean seedlings were used in each group. (1)

8.4 Write down the LETTER(S) (**A**, **B** or **C**) of the group(s) where there will be no upward growth of the stem. (2)

8.5 Describe how auxins cause apical dominance. (3)

(8)

TOPIC: GENERAL EVOLUTION

Activity 1

1 Lamarck based his theory of evolution on two principles, ideas or 'laws'.

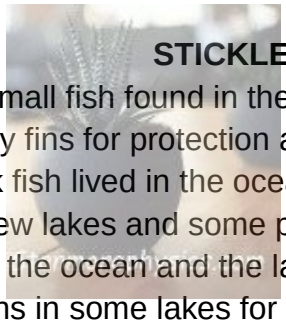
1.1 Name and describe TWO principles that Lamarck used to explain how evolution took place (6)

1.2 Give TWO reasons why Lamarck's theory is NOT accepted. (4)

(10)

Activity 2

2 Read the following passage and answer the questions that follow.



STICKLEBACK FISH

Stickleback fish are small fish found in the ocean and freshwater lakes. The ones in the ocean have spikey fins for protection against predators. Until about 10 000 years ago, most stickleback fish lived in the ocean. But, when the last ice age ended, the melting ice created new lakes and some populations swam into the lakes. The connections between the ocean and the lakes eventually dried up, trapping the stickleback populations in some lakes for thousands of years. Over time, the stickleback fish populations in the lakes lost the spikey fins.

How would Lamarck have explained the absence of spikey fins on stickleback fish in lakes? (5)

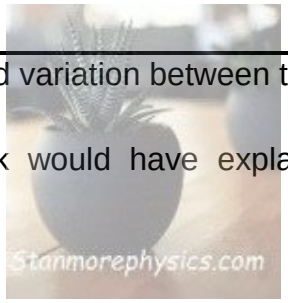
(5)

Activity 3

3 Read the following passage and answer the questions that follow

MUTATION IN GENE ALLOWS TIBETANSTO SURVIVE AT HIGH ALTITUDE

It is possible to cope with the low oxygen content at high altitudes.
One way is for the body to produce more red blood cells in response to an increase in altitude.
Another way of coping has developed in Tibetans as a result of a gene mutation that they inherited from their ancestors. The mutant gene helps them to use the low amount of oxygen present more efficiently. The mutant gene was found in 87% if the Tibetan population but only in 9% of the Han population that live at a lower altitude the Tibetans.



A gene mutation caused variation between the Tibetan population and the Han population.
Describe how Lamarck would have explained the survival of Tibetans at high altitudes (6)
(6)

Activity 4

4 Explain why modern-day Spider monkeys all have long tails whereas ancestors of Spider monkeys had much shorter tails using:
4.1 Lamarck's theory (4)
4.2 Darwin's theory (7)
(11)

Activity 5

5 Describe Darwin's theory of evolution by natural selection. (7)
(7)

Activity 6

6

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.

6.1 How did the scientists determine that the two populations of lizards on both islands still belong to the same species? (3)

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

(10)

Activity 7

7 Read the passage below.

NATURAL SELECTION IN WOLVES

In 1986 there was a huge radioactive disaster in Chernobyl and all humans immediately left the area because of the deadly high radiation. Animals exposed to this high radiation developed cancer or died. Almost 40 years later, scientists have been studying the wolves that live in this highly radioactive environment where they are exposed to high radiation. They found that these wolves have a mutation that makes them immune to cancer.

Use Darwin's theory of natural selection to explain the development of immunity to cancer in these wolves. (7)

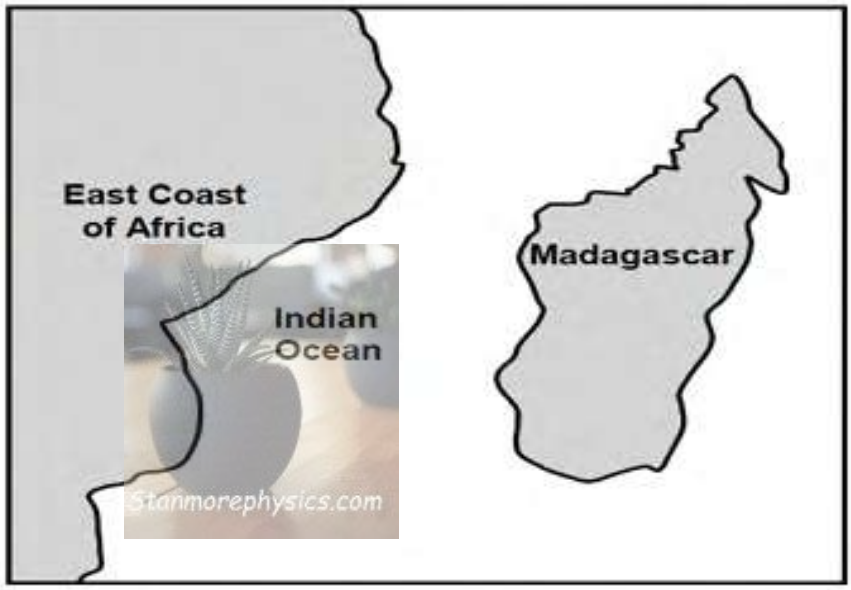
(7)

Activity 8

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

Activity 9

9 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.



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

9.2 Describe the speciation of the Pottos and lemurs to become different (6)

(10)

Activity 10

10 Read the following passage and answer the questions that follow.

Datura flowers open in the evening and release a powerful fragrance which attracts hawk moths. The Datura produces a highly addictive nectar which ensures that the hawk moths stay longer inside the flower and only visit Datura flowers.

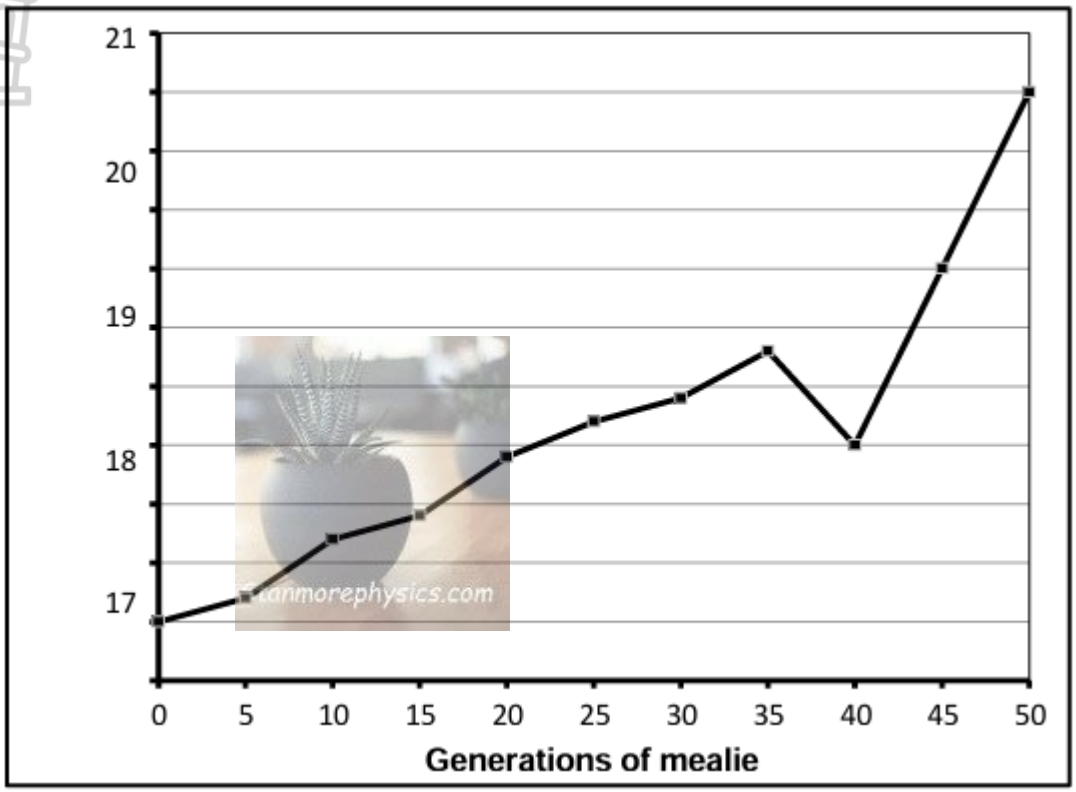
10.1 Explain TWO ways in which the Datura plants ensure that they are reproductively isolated. (4)

10.2 State TWO other mechanisms that would ensure reproductive isolation in plants. (2)

(6)

Activity 11

11 The graph below shows the results of artificial selection for protein content in mealie plants over 50 generations.



11.1 Describe how this farmer did artificial selection of the mealie plant. (3)

11.2 Describe ONE way in which the process of artificial selection is different from genetic engineering. (2)

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

(10)

Activity 12

12 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

12.1 Name the process whereby the different breeds of dogs were produced. (1)
12.2 Describe how humans carried out the process named in QUESTION 13.1 (3)
(4)

TOPIC: HUMAN EVOLUTION

Activity 1

1

The malaria parasite is transmitted to human blood by mosquitoes. People living in malaria-affected areas take antimalarial drugs to prevent infection. If the antimalarial drugs are effective, there should be no parasites in their blood. The presence of parasites, even after treatment, indicates that they have evolved to be drug-resistant.
Researchers wanted to determine if the use of antimalarial drugs caused drug resistance in the malaria parasite.

The procedure was as follows:

- Blood samples were collected from people in affected areas who were taking the drugs.
- The collection of blood samples was done in seven villages in the affected areas.
- The number of blood samples having the malaria parasite was counted.
- The investigation was repeated three times in the same seven villages during a year.

In total, 1 485 samples were collected and 551 had the malaria parasite

1.1 Describe how the malaria parasite developed drug resistance through natural selection. (7)

(7)

Activity 2

2

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.

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

2.1 Describe the evolution of resistance to antiretroviral medication in the HI virus. (5)

(5)

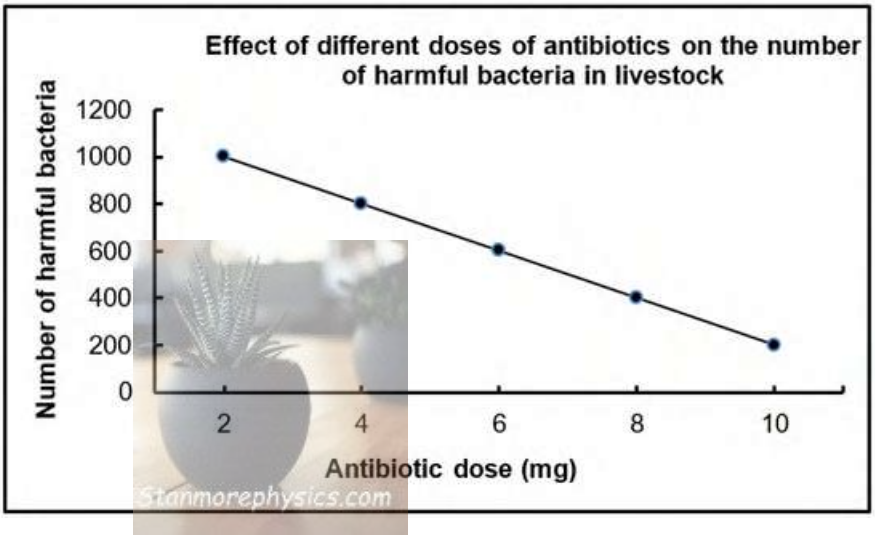
Activity 3

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

(8)

Activity 4

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



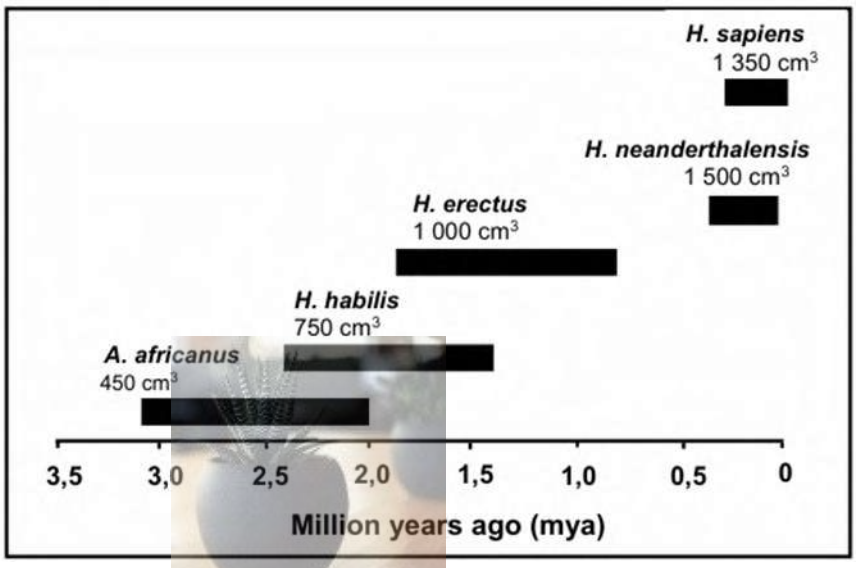
4.1 Use evidence from the graph to explain why higher doses of antibiotics will benefit the farmer economically. (4)

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

(10)

Activity 5

5 The diagram below shows the evolutionary relationships between different hominids. Their average brain volume is also indicated.



5.1 When did A. africanus become extinct? (1)

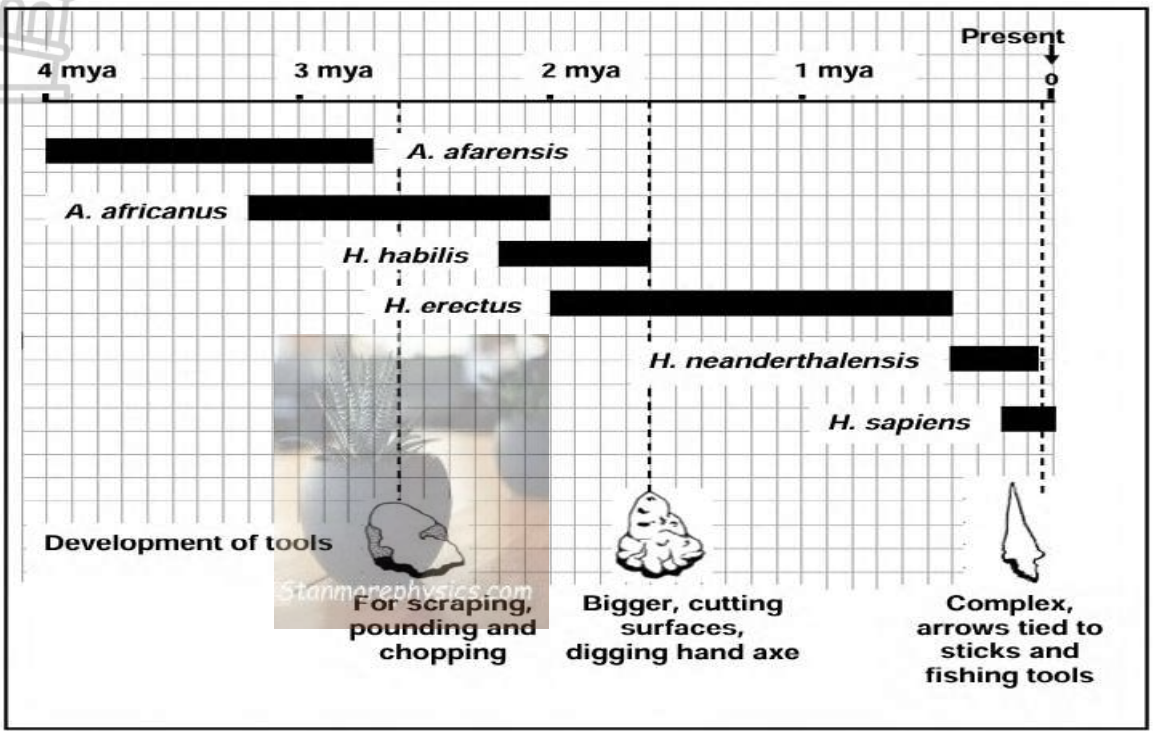
5.2 Using only the species in the diagram, describe the fossil evidence that supports the 'Out-of-Africa' hypohesis. (4)

5.3 Explain the influence of brain volume on the complexity of tools made by H. habilis and H. sapiens. (3)

(8)

Activity 6

6 The diagram below shows a timeline of different hominid species and the development of tools.



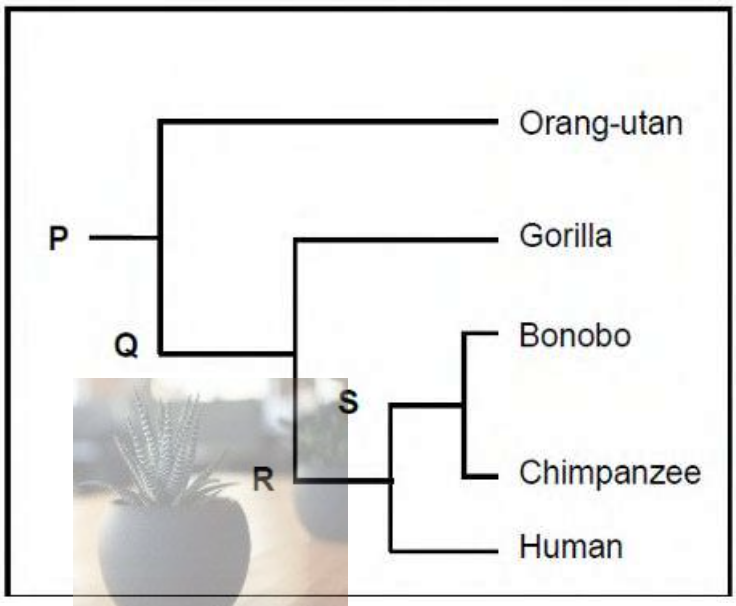
6.1 Calculate the period (million years) in which the A. afarensis and A. africanus coexisted. Show ALL working. (2)

6.2 Explain how the changes in brain size over time relates to the development of tools. (3)

(5)

Activity 7

7 The diagram below represents the evolution of the family Hominidae.



7.1 Name the type of diagram represented above. (1)

7.2 Give the LETTER of the organism which:

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

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

7.3 Name TWO organisms that:

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

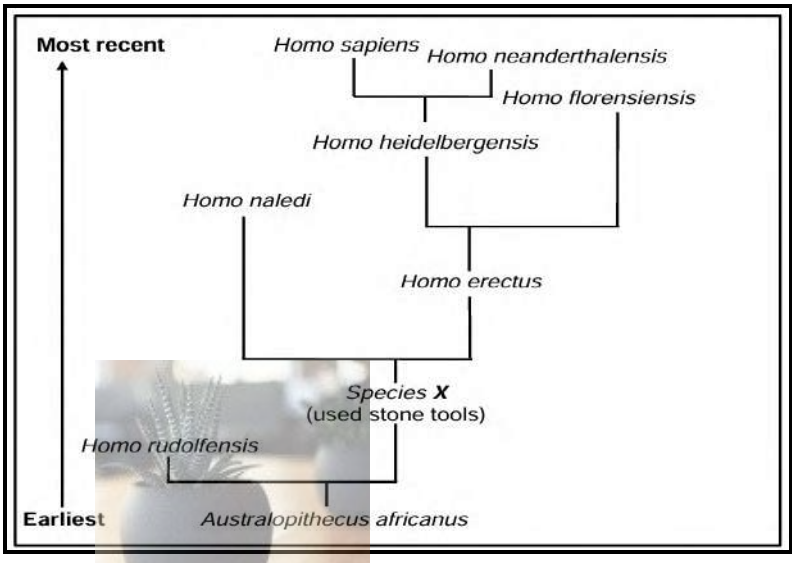
(b) Are quadrupedal (2)

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

(10)

Activity 8

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



8.1 The average cranial capacity of Homo sapiens is 1 500 cm3 compared to 520 cm3 in Australopithecus africanus.

Explain the significance of the difference in cranial capacity. (3)

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

(7)

Activity 9

9 The 'Out of Africa' hypothesis is one explanation of the evolution of modern humans.

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

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

(6)

Activity 10

10 The passage below describes Homo erectus fossils.

Evidence from fossils of Homo erectus shows that they appeared in Africa about 2 million years ago. They spread to many parts of Asia. Homo erectus is the oldest known species to be fully bipedal and have a human-like body. Their brain size was smaller than that of humans today. A prominent brow ridge was present over their eye sockets.

10.1 Describe how the fossils of Homo erectus are used to support the 'Out-of-Africa' hypothesis. (3)

10.2 Describe how all OTHER fossil evidence is used to support the 'Out-of-Africa' hypothesis. (4)

10.3 Use the information in the passage regarding Homo erectus and tabulate TWO differences between the features of Homo erectus and Homo sapiens. (5)

10.4 What observation of the skull of Homo erectus would have led scientists to conclude that Homo erectus was bipedal? (1)

(7)