



**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**JUNE 2023**

**LIFE SCIENCES**

**MARKS: 150**

**TIME: 2½ hours**



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This question paper consists of 18 pages.

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**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in your ANSWER BOOK.
3. Start the answer to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, tables or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You may use a non-programmable calculator, protractor and a compass where necessary.
11. Write neatly and legibly.

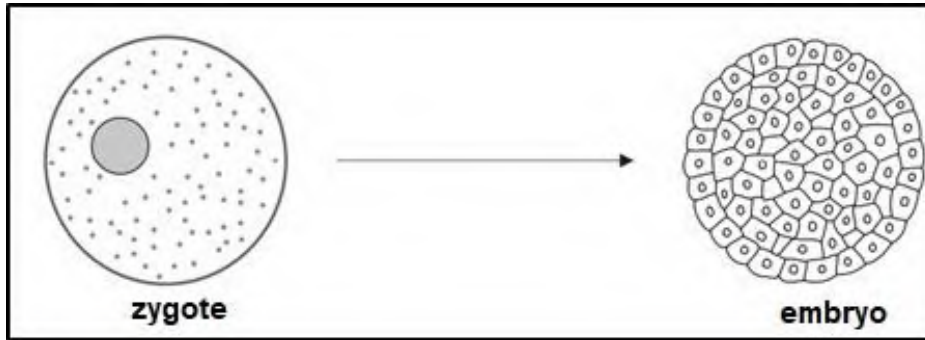


**SECTION A**

**QUESTION 1**

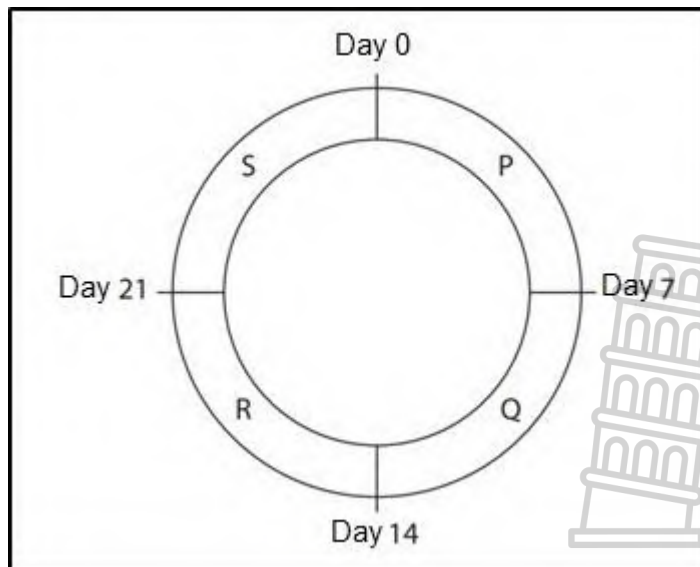
1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which word/term describes the process shown in the diagram?



- A Fertilisation
- B Mitosis
- C Morula
- D Meiosis

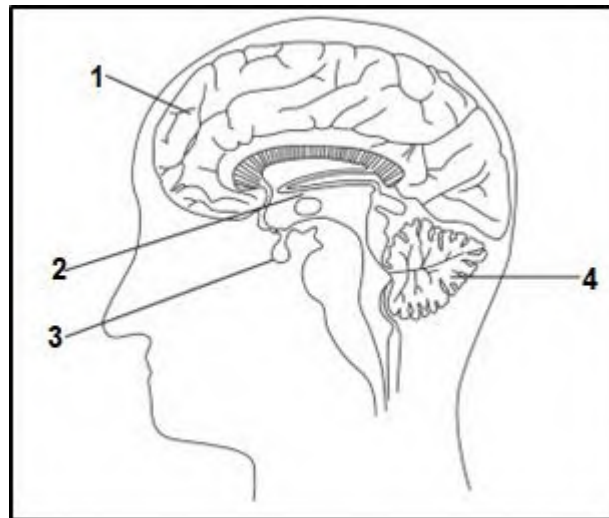
1.1.2 The diagram shows a human 28-day menstrual cycle divided into four parts P, Q, R and S. The ovum is released on day 14.



In which part of the cycle does menstruation occur?

- A P
- B Q
- C R
- D S

1.1.3 The diagram shows a section of the human brain.



Which part is responsible for intelligence?

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

1.1.4 Which ONE of the following represents a single RNA nucleotide?

- A Deoxyribose-adenine-thymine
- B Adenine-ribose-phosphate
- C Deoxyribose-thymine-phosphate
- D Uracil-deoxyribose-phosphate

1.1.5 What percentage of thymine bases is present in a DNA molecule with 2 000 bases if 600 bases are guanine?

- A 20
- B 40
- C 30
- D 60

1.1.6 The central nervous system is made up of the ...

- A cranial and spinal nerves.
- B autonomic and peripheral nervous systems.
- C cranial nerves and the brain.
- D brain and the spinal cord.



1.1.7 The following table shows the events of mitosis and meiosis I.

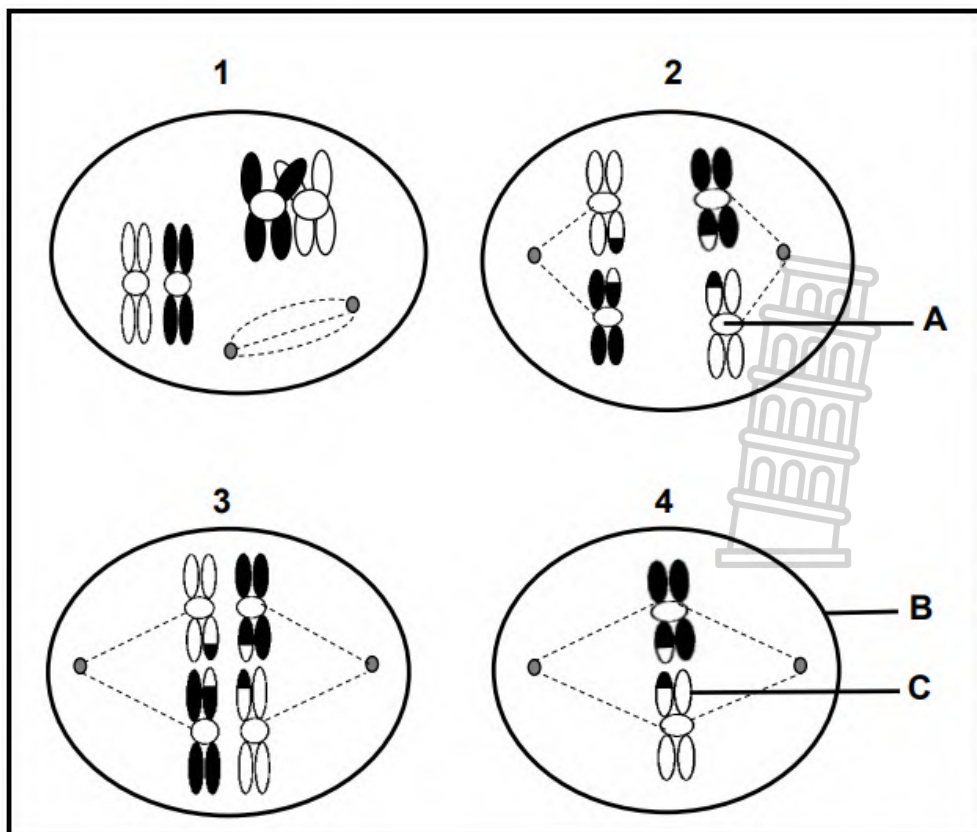
	MITOSIS	MEIOSIS I
(i)	The number of chromosomes remains the same	The number of chromosomes is halved
(ii)	Daughter cells formed are genetically different from each other	Daughter cells formed are genetically identical to each other
(iii)	Single chromosomes are arranged at the equator during metaphase	Homologous chromosomes pairs are arranged at the equator during metaphase
(iv)	Two daughter cells are formed	Four daughter cells are formed

Which ONE of the following is the correct difference between mitosis and meiosis I?

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

**QUESTIONS 1.1.8 AND 1.1.9 REFER TO THE DIAGRAMS SHOWING SOME PHASES OF MEIOSIS BELOW.**

(The diagrams are not necessarily in the correct order.)



1.1.8 Which ONE of the following is CORRECT regarding labels **A**, **B** and **C** in the diagrams?

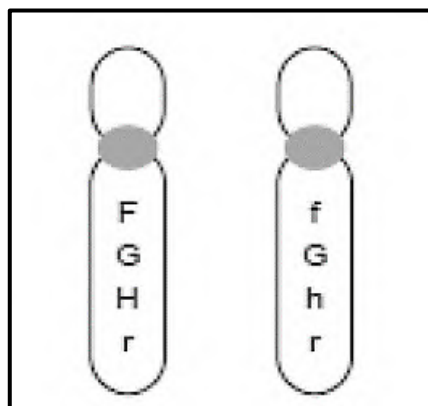


	<b>A</b>	<b>B</b>	<b>C</b>
A	Centrosome	Cell wall	Chromatid
B	Centromere	Cell membrane	Chromosome
C	Centromere	Cell membrane	Chromatid
D	Centrosome	Cell membrane	Chromatid

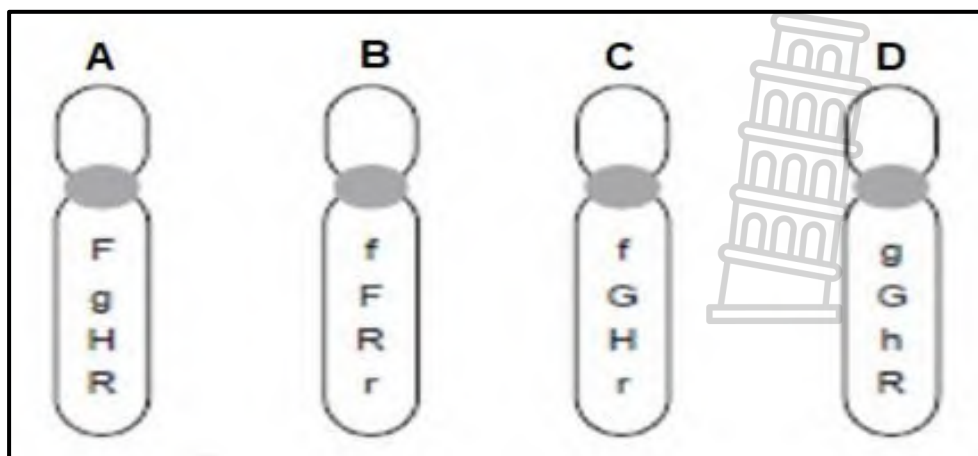
1.1.9 Which ONE of the following shows the correct sequence of the phases in meiosis?

- A 3, 1, 2, 4
- B 2, 1, 3, 4
- C 1, 3, 2, 4
- D 1, 2, 3, 4

1.1.10 A pair of homologous chromosomes involved in normal meiosis in an ovary carries the alleles shown below.



Possible chromosomes produced in the ova would include:



(10 x 2) (20)

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers (1.2.1 to 1.2.7) in the ANSWER BOOK.

1.2.1 The type of dominance resulting in an intermediate phenotype in the heterozygous condition

1.2.2 The name of the process when homologous chromosome pairs fail to separate during meiosis

1.2.3 The number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell

1.2.4 A genetic disorder caused by the absence of a blood clotting agent

1.2.5 Protective membranes surrounding the brain and spinal cord

1.2.6 Eggs are retained/hatch in the female body and the young are born live

1.2.7 It includes the building of nests, protection, teaching of young and feeding – the care, or lack thereof, directly influences the survival of the young (7 x 1) (7)

1.3 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 numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Phase during which cytokinesis takes place	A:	Telophase I
		B:	Telophase II
1.3.2	Development in birds that is complete such that the young are born independent, with eyes open, with down feathers and able to move or feed independently	A:	Precocial development
		B:	Altricial development
1.3.3	Collects nitrogenous waste and assists in the exchange of gases	A:	Chorion
		B:	Allantois

(3 x 2) (6)

- 1.4 In watermelons, there are two alleles for taste, bitter fruit and sweet fruit. The allele for bitter fruit (**B**) is dominant over the allele for sweet fruit (**b**). There are two alleles for skin appearance, yellow spots and no spots. The allele for yellow spots (**N**) is dominant over the allele for no spots (**n**).

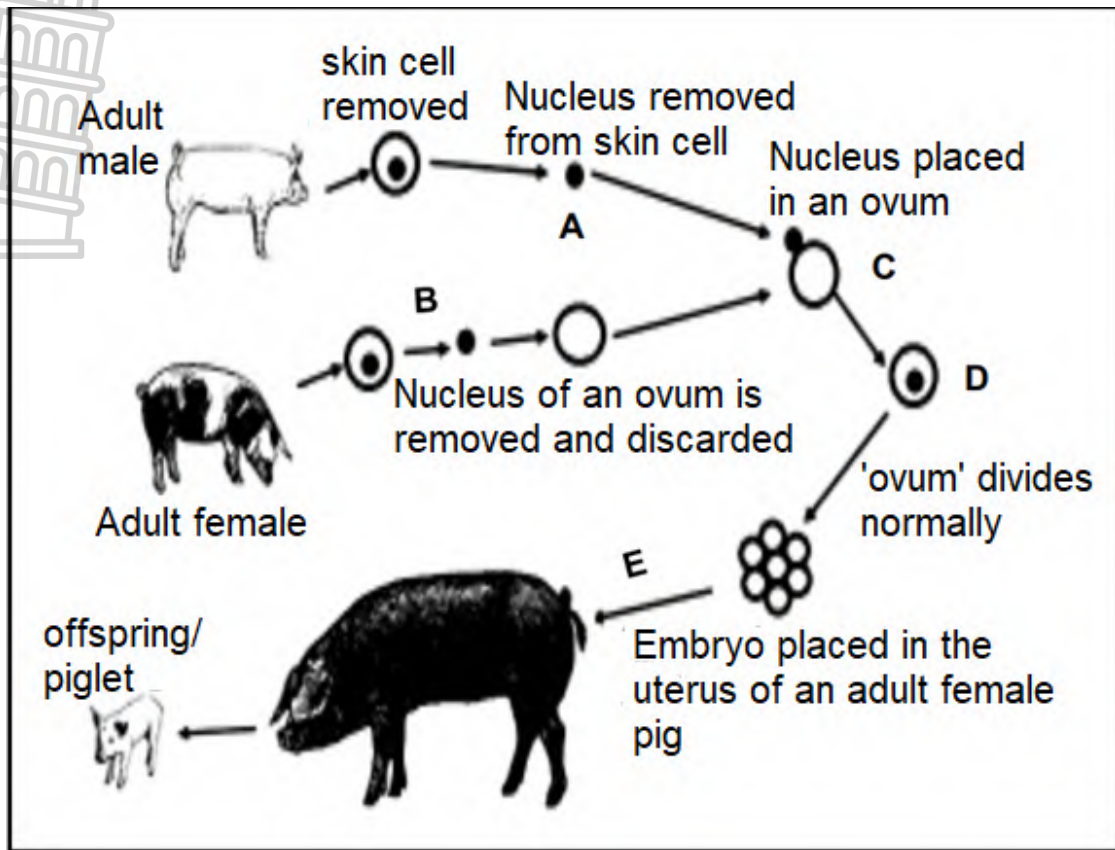
Plant **A**, which is heterozygous for bitter fruit and yellow spots, was crossed with plant **B**, which has sweet fruit and no spots.

- 1.4.1 Give the term that describes a genetic cross involving two characteristics. (1)
- 1.4.2 Give:
- (a) The genotype of plant **B** (2)
  - (b) The dominant phenotype for taste in watermelons (1)
  - (c) All possible genotypes of the gametes of plant **A** (2)
- 1.4.3 List TWO ways in which the phenotype of a watermelon with genotype  $bbNn$  differs from the phenotype of a watermelon with genotype  $Bbnn$ . (2)
- 1.4.4 State Mendel's principle of independent assortment. (2)





1.5 The diagram below shows a genetic engineering process. A donor cell was taken from the skin cell of a male pig to create a new offspring.



1.5.1 Name the genetic engineering process shown in the diagram above. (1)

1.5.2 State TWO advantages of the process mentioned in QUESTION 1.5.1 in agriculture. (2)

1.5.3 Name the type of cell division through which:

(a) Cell **D** divides (1)

(b) Ovum **B** is produced (1)

1.5.4 A somatic cell in a pig contains **38** chromosomes.

How many chromosomes would there be in:

(a) Structure **A** (1)

(b) A skin cell in organism **E** (1)

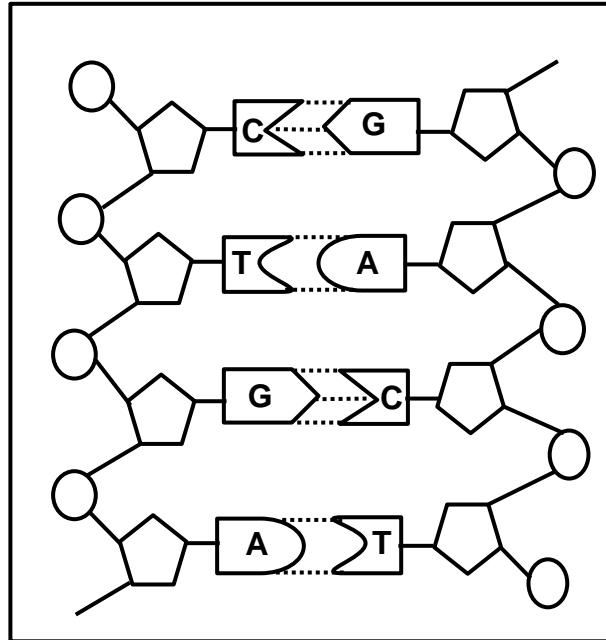


**TOTAL SECTION A: 50**

## SECTION B

## QUESTION 2

2.1 The diagram below represents part of a DNA molecule.



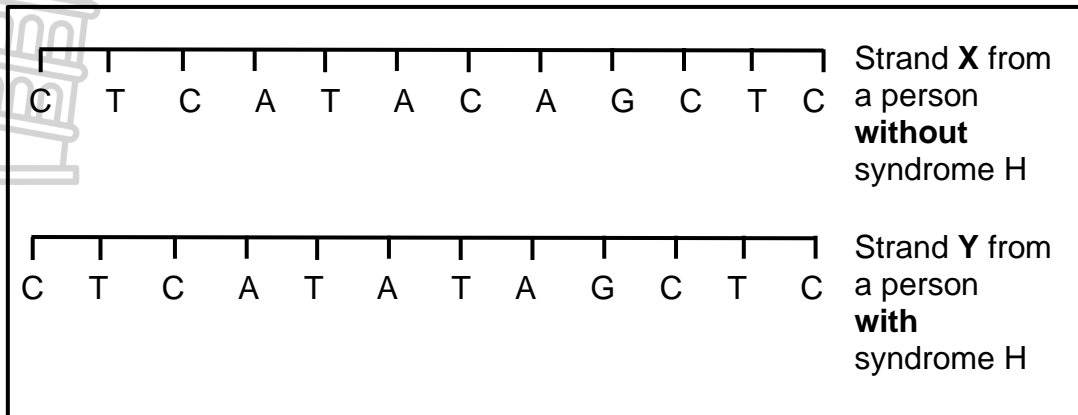
- 2.1.1 Name the structures inside the nucleus that contain DNA. (1)
- 2.1.2 Besides the nucleus, name ONE other place in a cell where DNA is found. (1)
- 2.1.3 What type of substances are labelled **A**, **G**, **C** and **T** in the DNA molecule shown above? (1)
- 2.1.4 The coded message in DNA is used in the process of protein synthesis.

Name and describe the stage during protein synthesis responsible for the copying of the coded message from DNA.

(\*1 compulsory mark + Any 5) (6)

2.2 **Syndrome H** is an inherited condition. People with **syndrome H** do not produce the enzyme IDUA. All enzymes are proteins.

The diagram below shows part of a gene coding for the enzyme IDUA.



The table below shows mRNA anticodons and the amino acids they code for.

mRNA codons	Amino acid
AUA	Methionine
AUC	Isoleucine
CAG	Glutamine
CUC	Leucine
GAG	Glutamic acid
GUC	Valine
UAU	Tyrosine

2.2.1 For strand X, state the number of:

- (a) Codons for the corresponding mRNA molecule (1)
- (b) Different amino acids coded for (1)

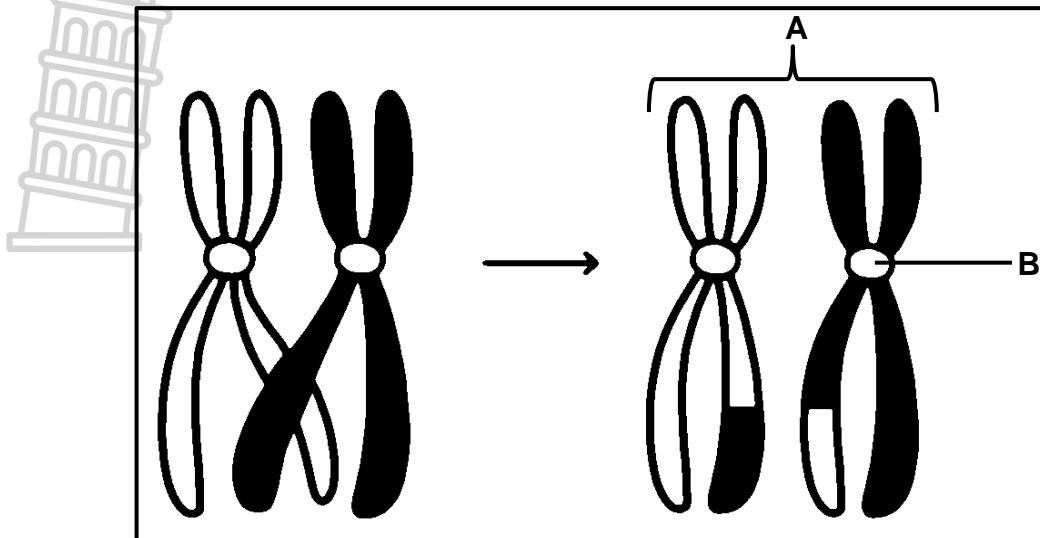
2.2.2 Give the DNA triplet on strand Y that codes for the amino acid glutamic acid. (1)

2.2.3 Strand Y shows a mutation in the DNA which has caused syndrome H.

The enzyme IDUA helps to break down a carbohydrate in the human body. The enzyme IDUA produced from Strand Y will not work.

Explain how the mutation could cause the enzyme not to work. (5)

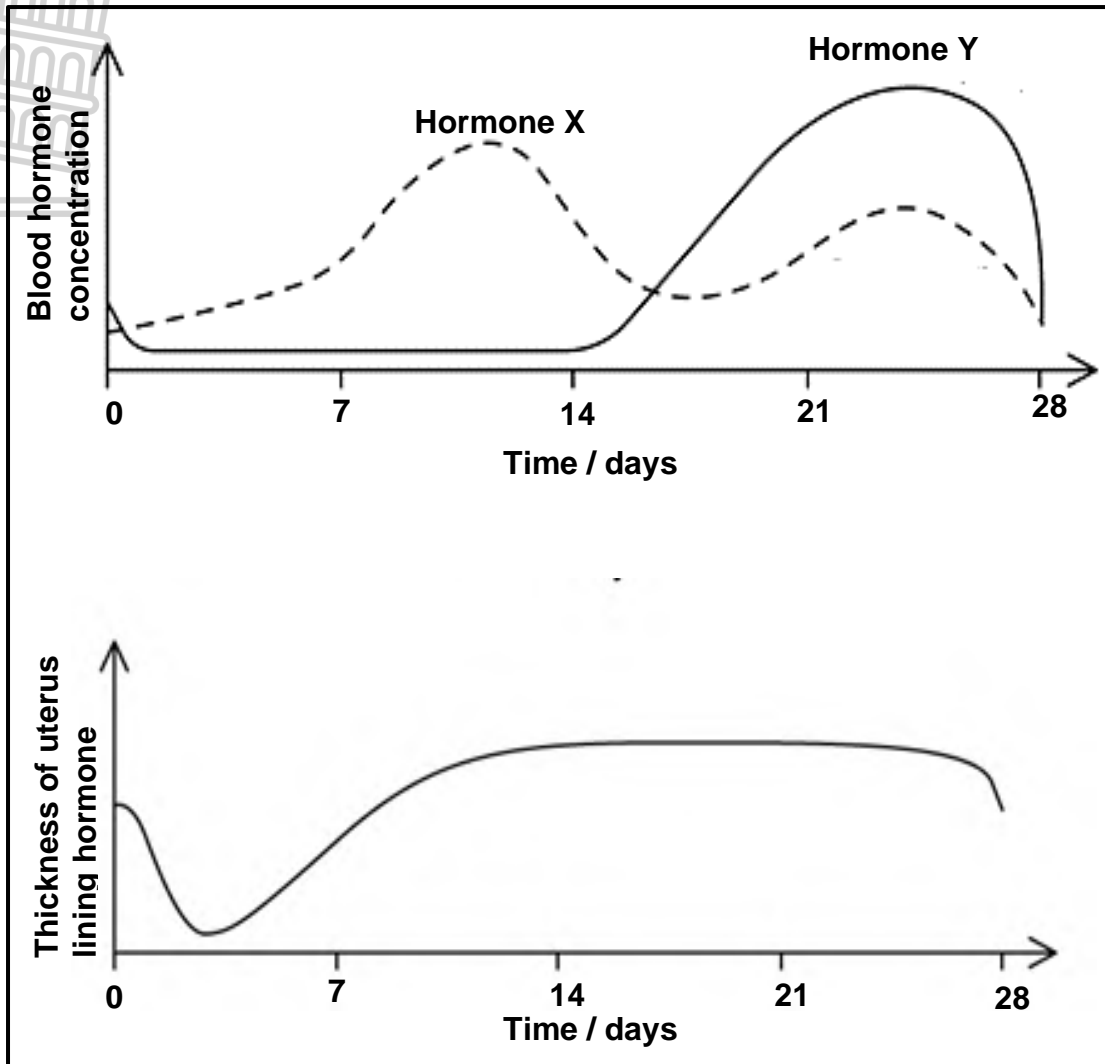
- 2.3 The diagram below is a representation of chromosomes during and after a certain process during meiosis.



- 2.3.1 Name the process represented above. (1)
- 2.3.2 Identify part **A**. (1)
- 2.3.3 Give ONE function of part **B**. (1)
- 2.3.4 Describe the behaviour of chromosomes during the process mentioned in QUESTION 2.3.1. (3)
- 2.3.5 Explain ONE significance of the process shown. (2)



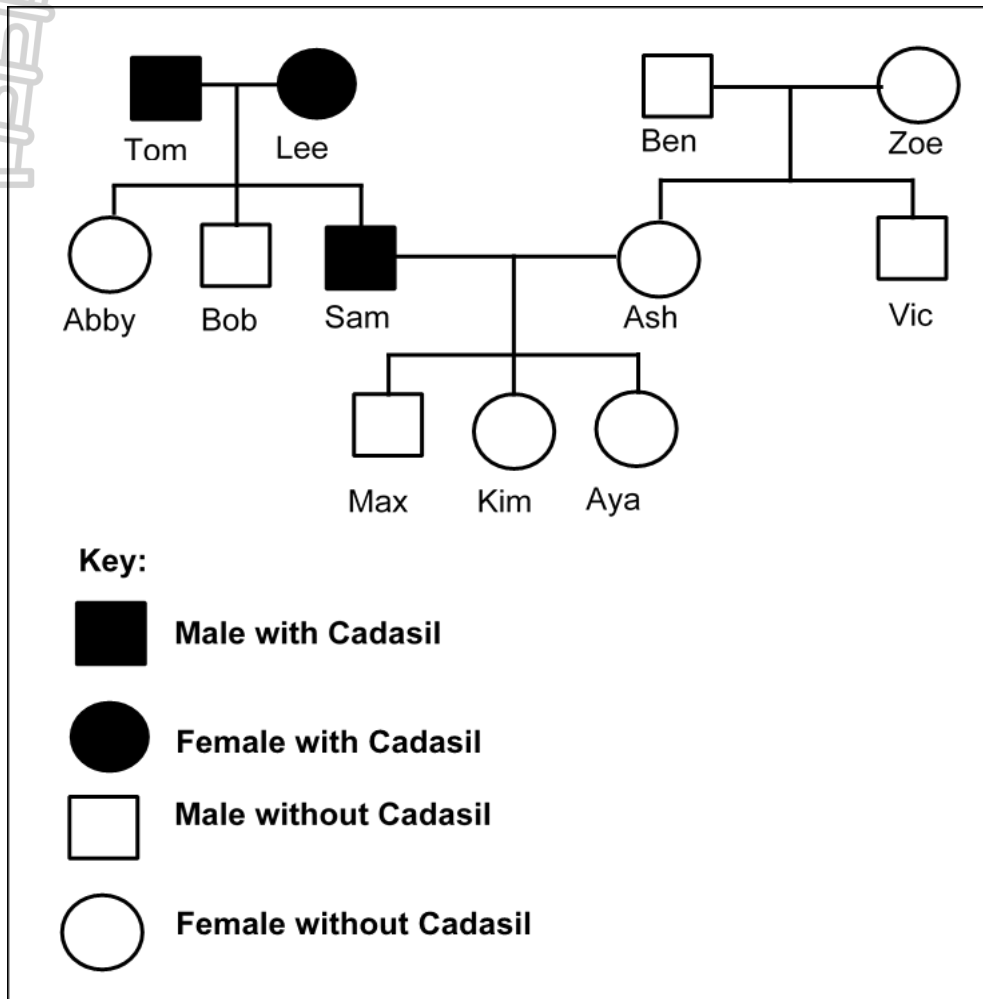
2.4 The graphs below show the blood hormone concentration of two ovarian hormones and changes that occur in the uterus lining during a 28-day cycle of a woman.



- 2.4.1 Identify hormone Y. (1)
- 2.4.2 Explain the reason for your answer to QUESTION 2.4.1 by referring to both graphs. (2)
- 2.4.3 State the biological term used for the uterus lining. (1)
- 2.4.4 Explain whether fertilisation occurred during the cycle of this woman. (3)
- 2.4.5 Name and describe how the two hormones secreted from the pituitary gland control the menstrual cycle. (4)

- 2.5 Cadasil is an inherited disorder which leads to the weakening of blood vessels in the brain. It is caused by a dominant allele (**D**).

The pedigree diagram shows the inheritance of Cadasil in a family.



- 2.5.1 (a) State what a dominant allele is. (1)
- (b) Give evidence from the pedigree diagram that Cadasil is caused by a dominant allele. (1)
- 2.5.2 (a) Is Sam homozygous or heterozygous for the Cadasil allele? (1)
- (b) Give evidence from the diagram for your answer to QUESTION 2.5.2 (a). (1)
- 2.5.3 Sam and Ash are planning to have another baby.

Use a genetic cross to find the percentage chance that the new baby will develop into a person with Cadasil. (6)

2.6 Read the passage below and answer the questions that follow.

Scientists are trying to develop treatment for Cadasil by using stem cells.

Specially treated stem cells would be injected into the damaged part of the brain. Embryonic stem cells can be obtained by removing a few cells from a human embryo. Scientists have discovered how to change adult skin cells into stem cells.

2.6.1 Why would scientists use stem cells in the treatment of Cadasil? (3)

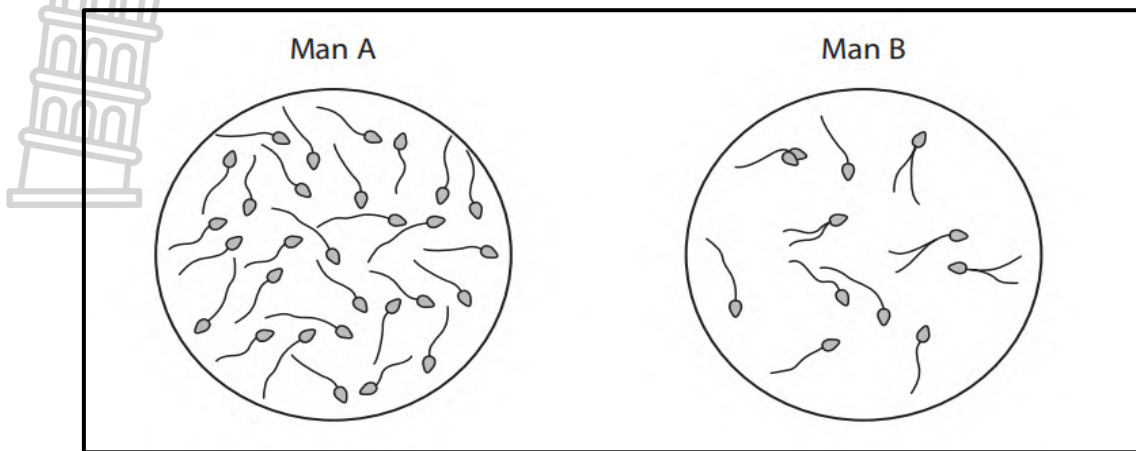
2.6.2 Suggest ONE advantage of using stem cells from adult skin cells than from embryos. (1)

**[50]**



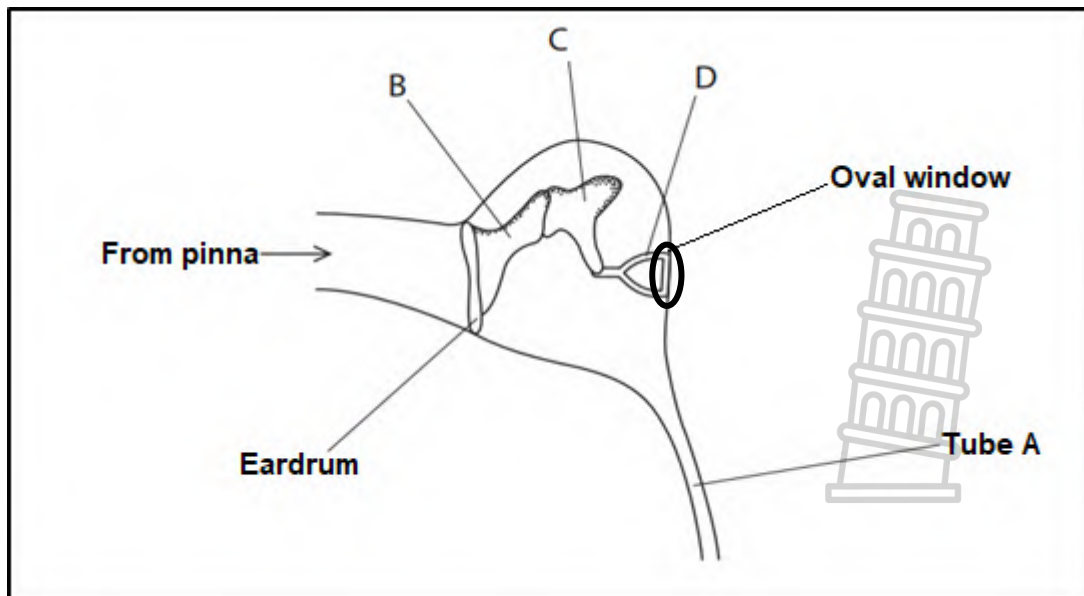
**QUESTION 3**

3.1 The diagram shows sperm cells, viewed using a microscope, from two different men.



- 3.1.1 Use the information in the diagram to give TWO reasons why man **A** is more fertile than man **B**. (2)
- 3.1.2 Discuss TWO structural adaptations of the sperm cells to reach the ovum in the Fallopian tube of the female. (4)
- 3.1.3 “The father determines the gender of a baby.” Explain why this statement can be regarded as true. (3)
- 3.1.4 Tabulate TWO differences between spermatogenesis and oogenesis. (5)

3.2 The diagram shows part of the human ear.



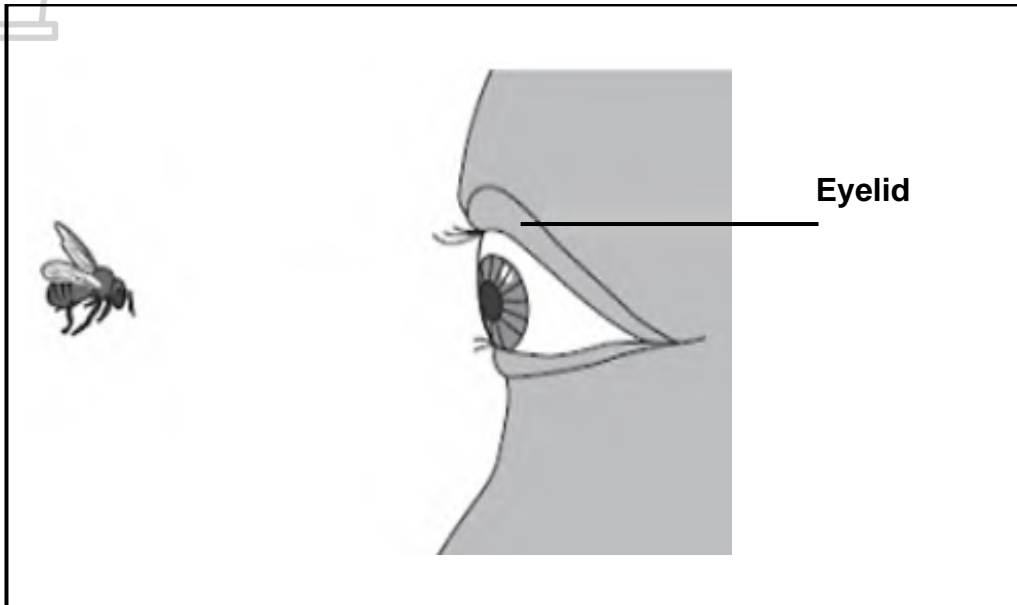
- 3.2.1 Name the part of the ear that contains structures **B**, **C** and **D**. (1)
- 3.2.2 Give the collective name for structures **B**, **C** and **D**. (1)
- 3.2.3 Explain the consequence if part **B** and **C** are fused. (2)



3.2.4 Tube **A** may be blocked when a person has a throat infection. Name tube **A** and explain why it would be dangerous for such a person to go skydiving. (4)

3.2.5 Explain how the eardrum and the oval window contribute to the amplification of sound. (2)

3.3 The diagram below shows a bee flying towards a man's eye.



As the bee approaches the man's eye, light from the bee reaches the light sensitive cells in the eye. The muscles in the eyelid shut the man's eye before the bee hits his eye.

3.3.1 Name the type of response that results in the shutting of the man's eye before the bee hits his eye. (1)

3.3.2 Describe the pathway taken by the nerve impulse to cause the response mentioned in QUESTION 3.3.1. (5)

3.3.3 The population of the USA is 322 million, of which 151,34 million are over 40 years of age. 17,2% of the people over the age of 40 develop a cataract.

(a) Explain how a cataract would affect the ability to see. (2)

(b) Calculate the number of people in the USA over the age of 40 who develop a cataract. (3)

3.4 Scientists conducted an investigation to determine the effect of caffeine on an individual's reaction time.

The procedure was as follows:

- (i) Individual **A** held a 30 cm ruler just above the hand of individual **B**.
- (ii) Individual **A** let go of the ruler.
- (iii) Individual **B** caught the ruler as soon as possible.
- (iv) The experiment was repeated seven more times
- (v) Individual **B** (catcher) drank a cup of strong coffee.
- (vi) Coffee contains caffeine
- (vii) Fifteen (15) minutes after individual **B** drank the coffee, steps (i)–(iv) were repeated.

The results of the experiment are presented in the table below:

Experiment	Distance the ruler fell before it was caught (cm)	
	Before drinking coffee	After drinking coffee
1	18	8
2	21	13
3	25	11
4	15	17
5	19	10
6	16	14
7	12	13
8	21	13
<b>Average</b>	18,4	<b>X</b>

3.4.1 Identify the:

- (a) Independent variable (1)
- (b) Dependent variable (1)

3.4.2 Calculate the average distance indicated as **X** in the table above. (2)

3.4.3 State ONE way in which the reliability of the investigation was ensured. (1)

3.4.4 Suggest TWO ways in which the reliability of this investigation can be improved. (2)

3.4.5 Plot a bar graph showing the average distance the ruler fell before it was caught before and after drinking coffee. (6)

3.4.6 The scientists used the reading on the ruler as a measure of the reaction time.

By looking at the results what can you conclude about the effect of caffeine on reaction time. (2)

[50]

**TOTAL SECTION B: 100**  
**GRAND TOTAL: 150**



**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**JUNE 2023**

**LIFE SCIENCES  
MARKING GUIDELINE**

**MARKS: 150**



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This marking guideline consists of 11 pages.

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**PRINCIPLES RELATED TO MARKING LIFE SCIENCES**

1. **If more information than marks allocated is given**  
Stop marking when maximum marks are reached and put a wavy line and 'max' in the right-hand margin.
2. **If, for example, three reasons are required and five are given**  
Mark the first three irrespective of whether all or some are correct/incorrect.
3. **If whole process is given when only a part of it is required**  
Read all and credit the relevant part.
4. **If comparisons are asked for, but descriptions are given**  
Accept if the differences/similarities are clear.
5. **If tabulation is required, but paragraphs are given**  
Candidates will lose marks for not tabulating.
6. **If diagrams are given with annotations when descriptions are required**  
Candidates will lose marks.
7. **If flow charts are given instead of descriptions**  
Candidates will lose marks.
8. **If sequence is muddled and links do not make sense**  
Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links become correct again, resume credit.
9. **Non-recognised abbreviations**  
Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation, but credit the rest of the answer if correct.
10. **Wrong numbering**  
If answer fits into the correct sequence of questions, but the wrong number is given, it is acceptable.
11. **If language used changes the intended meaning**  
Do not accept.
12. **Spelling errors**  
If recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.
13. **If common names are given in terminology**  
Accept, provided it was accepted at the national memo discussion meeting.
14. **If only the letter is asked for, but only the name is given (and vice versa)**  
Do not credit.

15. **If units are not given in measurements**  
Candidates will lose marks. Marking guidelines will allocate marks for units separately.
16. **Be sensitive to the sense of an answer, which may be stated in a different way.**
17. **Caption**  
All illustrations (diagrams, graphs, tables, etc.) must have a caption.
18. **Code-switching of official languages (terms and concepts)**  
A single word or two that appear(s) in any official language other than the learner's assessment language used to the greatest extent in his/her answers should be credited, if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.



## SECTION A

## QUESTION 1

- 1.1 1.1.1 B ✓✓  
 1.1.2 A ✓✓  
 1.1.3 A ✓✓  
 1.1.4 B ✓✓  
 1.1.5 A ✓✓  
 1.1.6 D ✓✓  
 1.1.7 C ✓✓  
 1.1.8 C ✓✓  
 1.1.9 C ✓✓  
 1.1.10 C ✓✓ (10 x 2) (20)
- 1.2 1.2.1 Incomplete ✓ dominance  
 1.2.2 Non-disjunction ✓  
 1.2.3 Karyotype ✓  
 1.2.4 Haemophilia ✓  
 1.2.5 Meninges ✓  
 1.2.6 Ovovivipary ✓  
 1.2.7 Parental care ✓ (7 x 1) (7)
- 1.3 1.3.1 Both A and B ✓✓  
 1.3.2 A only ✓✓  
 1.3.3 None ✓✓ (3 x 2) (6)
- 1.4 1.4.1 Dihybrid cross ✓ (1)  
 1.4.2 (a) bbnn ✓✓ (2)  
 (b) Bitter ✓ (1)  
 (c) BN Bn bN bn ✓✓ (2)  
 1.4.3 bbNn is sweet with yellow spots ✓  
 Bbnn is bitter with no yellow spots ✓ (2)  
 1.4.4 The various 'factors' controlling the different characteristics are separate entities, not influencing each other in any way, and sorting themselves out independently during gamete formation. ✓✓ (2)

1.5 1.5.1 Cloning ✓ (1)



- 1.5.2 - Better quality fruits/vegetables/meat/increased shelf-life/better nutritional value ✓  
- Better yield/higher quantity of products  
- More money for the farmer/community ✓

**(MARK FIRST TWO ONLY)** (2)

1.5.3 (a) Mitosis ✓ (1)

(b) Meiosis ✓ (1)

1.5.4 (a) 38 ✓ (1)

(b) 38 ✓ (1)

**TOTAL SECTION A: 50**




## SECTION B

## QUESTION 2

- 2.1 2.1.1 Chromosomes ✓/chromatids/genes/allele (1)
- 2.1.2 - Mitochondria ✓  
- Chloroplasts ✓
- (Mark first ONE only)** (1)
- 2.1.3 (Nitrogenous) bases ✓ (1)
- 2.1.4 - Transcription ✓\*  
- The double helix DNA unwinds ✓  
- The double-stranded DNA unzips ✓/weak hydrogen bonds break  
- to form two separate strands ✓  
- One strand is used as a template ✓  
- to form mRNA ✓  
- using free RNA nucleotides from the nucleoplasm ✓  
- The mRNA is complementary to the DNA ✓/A complements U, G complements C  
- mRNA now has the coded message for protein synthesis ✓
- 1 compulsory mark + Any 5** (6)
- 2.2 2.2.1 (a) 4 ✓/ Four (1)
- (b) 3 ✓/Three (1)
- 2.2.2 CTC ✓ (1)
- 2.2.3 - The DNA triplet CAG changed to TAG ✓/ C changed  
- The codon GUC changed to AUC ✓  
- The anticodon sequence changed ✓/ CAG to UAG  
- The amino acid valine was replaced by isoleucine ✓  
- This results in a different protein ✓/ enzyme  
- The active site of the enzyme changes ✓\*/shape of enzyme changes  
- Therefore, the enzyme no longer fits the substrate/ carbohydrate ✓\*
- \* 2 compulsory marks + Any 3** (5)
- 2.3 2.3.1 Crossing over ✓ (1)
- 2.3.2 Homologous chromosomes ✓ (1)
- 2.3.3 - Attaches the chromosome to the spindle fiber ✓  
- Joins the two halves of a double-stranded chromosome (Any 1) (1)



- 
- 2.3.4 - Chromosomes pair ✓ up/homologous pairs form  
- exchange of genetic material occurs ✓  
- between chromatids ✓ /adjacent chromosome pairs  
- at points called chiasmata ✓/chiasma (Any 3 x 1) (3)
- 2.3.5 - It brings about variation ✓ which may  
- improve chances of survival ✓ of organisms (2)
- 2.4 2.4.1 Progesterone ✓ (1)
- 2.4.2 - The blood concentration of hormone Y increased after day 14 ✓ /  
ovulation  
- maintaining the thickness of the uterus lining ✓/endometrium (2)
- 2.4.3 Endometrium ✓ (1)
- 2.4.4 - The level of hormone Y/progesterone decreased ✓  
- resulting in a decrease in the thickness of the uterus lining ✓  
- followed by menstruation ✓  
- This indicates that fertilisation did not occur ✓ (Any 3 x 1) (3)
- 2.4.5 - FSH ✓ / Follicle Stimulating Hormone  
- stimulates the development of the follicles into an ovum ✓  
- LH ✓/ Luteinising Hormone  
- stimulates ovulation ✓ (4)
- 2.5 2.5.1 (a) An allele that is expressed (shown) in the phenotype when found  
in the heterozygous and homozygous condition ✓ (1)
- (b) Two parents (Tom and Lee) both with Cadasil have a child  
(Abby/ Bob) without Cadasil ✓

**OR**

- If recessive all of Tom and Lee's children would have Cadasil ✓ (1)
- 2.5.2 (a) Heterozygous ✓ (1)
- (b) He has children without Cadasil ✓

**OR**

If he was homozygous all children would have Cadasil (1)

2.5.3 P<sub>1</sub> Phenotype Male with Cadasil x Female without Cadasil ✓

Genotype Dd x dd ✓

*Meiosis*

G/gametes D, d x d, d ✓


*Fertilisation*

F<sub>1</sub> Genotype Dd, Dd, dd, dd ✓

Phenotype 50% child with Cadasil, 50% child without Cadasil ✓\*

P<sub>1</sub> and F<sub>1</sub> ✓

Meiosis and fertilisation ✓



**\*1 compulsory mark + Any 5**

**OR**

P<sub>1</sub> Phenotype Male with Cadasil x Female without Cadasil ✓

Genotype Dd x dd ✓

*Meiosis*

*Fertilisation*

Gametes	D	d
d	Dd	dd
d	Dd	dd

1 mark for correct gametes  
1 mark for correct genotypes

F<sub>1</sub> Phenotype 50% child with cadasil, 50% child without cadasil ✓\*

P<sub>1</sub> and F<sub>1</sub> ✓

Meiosis and fertilisation ✓

**\*1 compulsory mark + Any 5 (6)**

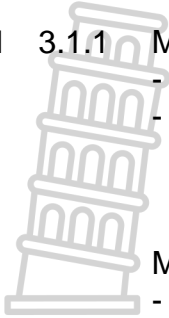
- 2.6 2.6.1 - Stemcells are undifferentiated cells ✓  
 - That have the ability to grow and differentiate ✓  
 - into any tissue ✓ in the body (3)

2.6.2 It is less controversial ✓ using skin cells than embryonic cells. (1)

**[50]**

**QUESTION 3**

- 3.1 3.1.1 Man A has:
- Many ✓ /enough/more sperms
  - normally shaped ✓ /healthy sperms



**OR**

- Man B has
- Fewer ✓ /not enough/lesser sperms
  - abnormally shaped ✓ /unhealthy sperms
- (2)

- 3.1.2
- Sperm has a neck area with large amount of mitochondria ✓ which will produce energy ✓ for the sperm to move to the Fallopian tube.
  - Sperm has a tail ✓ which propel the sperm/make movements ✓ so the sperm could move to the Fallopian tube
- (2 x 2) (4)

- 3.1.3
- Females have XX (identical) type and males have XY (non-identical) chromosome and one Y chromosome ✓
  - When the sperm with X chromosome fuses with the ovum, the child will have XX type of sex chromosomes (girl child) ✓
  - If the sperm with a Y chromosome fuses with the ovum, the child will have an XY type of sex chromosome (boy child) ✓
- (3)

3.1.4

<b>Spermatogenesis</b>	<b>Oogenesis</b>
Occurs in the testes/ seminiferous tubules ✓	Occurs in the ovary ✓
Influenced by testosterone ✓	Influenced by FSH
Occurs continuously ✓	Occurs once during every menstrual cycle ✓
Four sperm cells are produced ✓	One ovum is produced ✓

**(Mark first TWO only)** Table 1 + (Any 2 x 2) (5)

- 3.2 3.2.1 Middle ear ✓ (1)

- 3.2.2 Ossicles ✓ (1)

- 3.2.3
- The bones will not move and vibrate ✓ in reaction to sound
  - resulting in hearing loss ✓
- (2)

- 3.2.4
- Eustachian tube ✓\*
  - When a person goes skydiving, the atmospheric pressure changes all the time ✓
  - When descending, the Eustachian tube cannot equalise the pressure ✓ on both sides of the tympanic membrane/the pressure on both sides will not be the same.
  - which may cause the tympanum to rupture ✓/damage
- 1\* compulsory mark + 3** (4)

- 3.2.5 The surface area of the eardrum is larger than that of the oval window, ✓ thus a greater force is concentrated into a smaller area. ✓ (2)



3.3 3.3.1 Reflex action ✓ (1)



3.3.2 As the bee approaches the man's eye,

- light from the bee reaches the light sensitive cells (receptors) in the eye ✓ /the receptors in the eyes are stimulated and converted stimulus into an impulse ✓
- the impulse travels via the sensory neuron ✓ to the spinal cord
- In the spinal cord, the sensory neuron makes a synaptic contact ✓
- with the interneuron. ✓
- Which makes synaptic contact with motor neuron ✓ and
- transmits the impulse ✓
- to the muscles in the eyelid ✓/ effectors
- The muscles in the eyelid respond by contracting ✓
- shutting the man's eye before the bee hit his eye ✓
- This is known as reflex action. (Any 5 x 1) (5)

3.3.3 (a) - cataract scatters and blocks the light ✓ as it passes through the lens,  
- preventing a sharply defined image from reaching your retina ✓  
- as a result, your vision becomes blurred ✓ (Any 2 x 1) (2)

(b)  $\frac{17,2}{100} \checkmark \times 151,34 \checkmark \text{ million} = 26,03 \text{ million} \checkmark$  (3)

3.4 3.4.1 (a) effect of caffeine ✓ (1)

(b) (an individual's) reaction time ✓ (1)

3.4.2  $(8 + 13 + 11 + 17 + 10 + 14 + 13 + 13) = \frac{99}{8} \checkmark = 12,4 \checkmark$  (2)

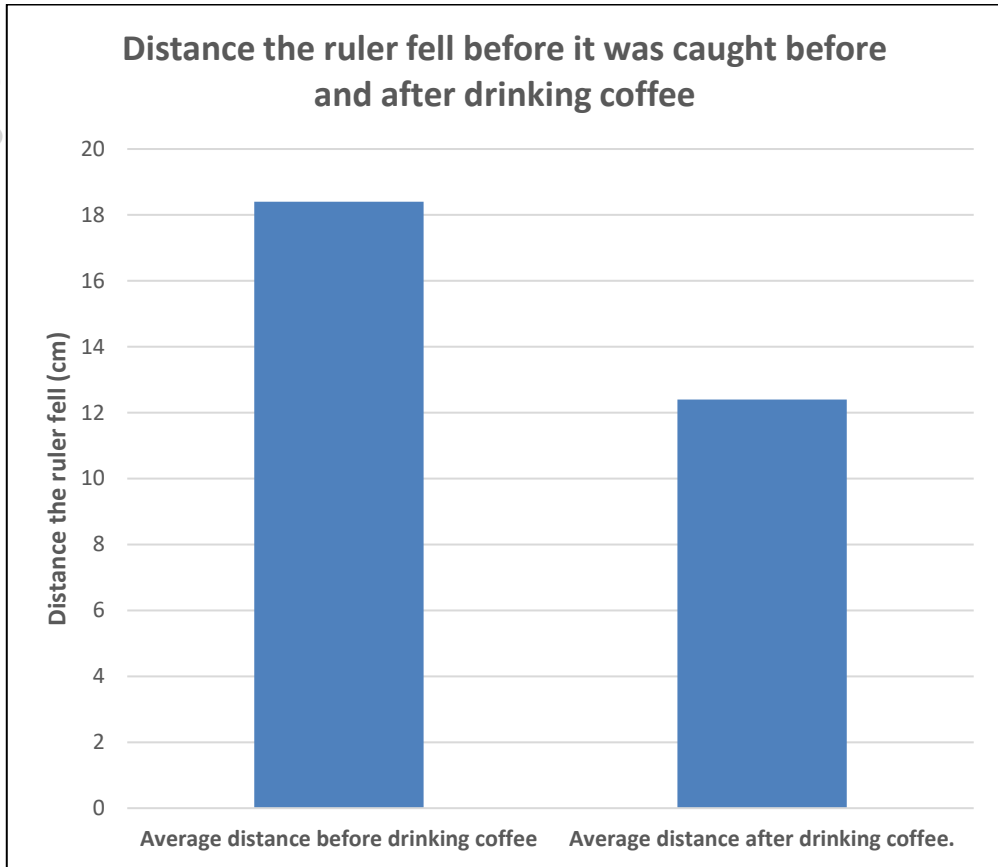
3.4.3 - The experiment was repeated seven more times ✓  
- The average was used ✓ (1)

3.4.4 - Use a larger sample of individuals ✓ / perform investigation on several other people  
- Use other (measures) amounts of coffee ✓  
- Use different / more time intervals ✓

**(Mark first TWO only)** (2)



3.4.5



**Criteria for marking the graph**

Title of the graph (both variables) (T)	1
Bar graph is drawn (Type) (B)	1
Correct labels for X- and Y-axes + correct unit (L)	1
Appropriate scale for both axes (S)	1
Only the correct 3 areas have been represented (A)	1
Plotting of the graph (P)	1 bar drawn correctly: 1
	2 bars drawn correctly: 2

**NOTE:**

If the wrong type of graph is drawn, marks will be lost for:

- Correct type of graph ✓
- Plotting of the graph ✓

The axes can be transposed.

A bar graph can have horizontal bars.



(6)

3.4.6 Caffeine slows down ✓/reduce an individual's reaction time. ✓

(2)

[50]

**TOTAL SECTION B: 100**  
**GRAND TOTAL: 150**