

# SECONDARY SCHOOL IMPROVEMENT PROGRAMME (SSIP)



**GAUTENG PROVINCE**

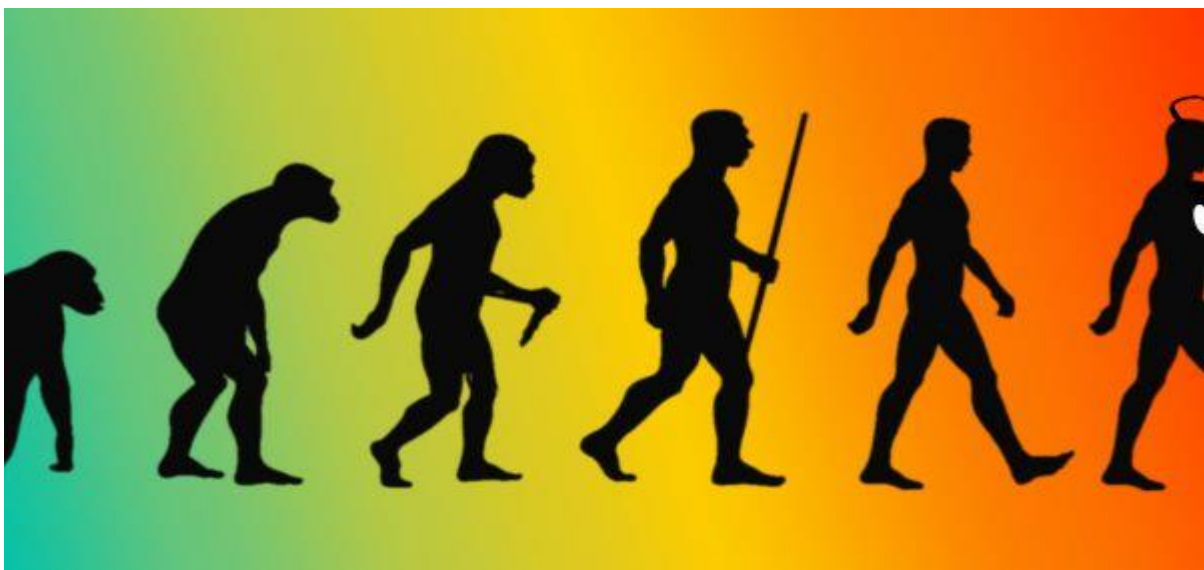
EDUCATION  
REPUBLIC OF SOUTH AFRICA

**GRADE 12**

**SUBJECT: LIFE SCIENCES**

**TEACHER'S BOOKLET 2021**

**OCTOBER CAMP (5 Sessions)**



(Page 1 of 38)

# PAPER 2

SESSION	TOPIC	MARK	PAGE
	Meiosis (Covered in the July camp booklet)	21	
	DNA: Code of life (Covered in the July camp booklet)	27	
	Genetics and Inheritance (Covered in the July camp booklet)	48	
1	Evolution	54	3
	<b>TOTAL</b>	<b>150</b>	

# REVISION

SESSION	TOPIC	MARK	PAGE
2	Paper 1 (Exemplar 1)	150	7
3	Paper 2 (Exemplar 1)	150	15
4	Paper 1 (Exemplar 2)	150	23
5	Paper 2 (Exemplar 2)	150	31

## SESSION 1

## EVOLUTION (54 MARKS)

## QUESTION 1

- |     |   |    |      |
|-----|---|----|------|
| 1.1 | B | ✓✓ |      |
| 1.2 | C | ✓✓ |      |
| 1.3 | B | ✓✓ |      |
| 1.4 | D | ✓✓ |      |
| 1.5 | C | ✓✓ | (10) |

## QUESTION 2

- |     |                     |   |     |
|-----|---------------------|---|-----|
| 2.1 | <i>Homo</i>         | ✓ |     |
| 2.2 | Natural selection   | ✓ |     |
| 2.3 | Phylogenetic tree   | ✓ |     |
| 2.4 | Lamarckism          | ✓ |     |
| 2.5 | <i>Homo habilis</i> | ✓ | (5) |

## QUESTION 3

- |     |      |    |     |
|-----|------|----|-----|
| 3.1 | A    | ✓✓ |     |
| 3.2 | Both | ✓✓ |     |
| 3.3 | None | ✓✓ |     |
| 3.4 | A    | ✓✓ | (8) |

## QUESTION 4

- |     |  |     |
|-----|--|-----|
| 4.1 | The smaller wings enable the penguin to be more streamlined ✓ / have reduced friction and it can therefore move faster ✓ in the water  | (2) |
| 4.2 | <ul style="list-style-type: none"> <li>- According to <b>Lamarck's theory / laws of use and disuse</b>* ✓</li> <li>- and <b>inheritance of acquired characteristics</b>* ✓</li> <li>- the wings of penguins were all normal sized ✓ originally</li> <li>- as the wings of the penguins were not used ✓ / used less</li> <li>- when the penguins adapted to swimming in water ✓</li> <li>- the wings got smaller ✓</li> <li>- the smaller wings acquired ✓ in this way</li> </ul> |     |

- could be passed on to offspring✓ / the next generation / were inherited, resulting in penguins with small wings
- (\*Compulsory 2 marks + any 4)** (6)
- (8)**

### QUESTION 5

- 5.1
- Plan when to do the investigation✓
  - Get all the equipment✓
  - Decide where to obtain shrimp cysts✓
  - Decide on the different concentrations of solution to use✓
  - Decide on how to record the data✓
  - Decide on where to do the investigation✓
- Any 2 (2)
- (Mark first TWO only)**
- 5.2
- (a) Salt concentration✓
  - (b) Percentage of cysts hatched✓
- (2)
- 5.3
- $$\% \text{ Hatched} = \left[ \frac{1}{53} \right] \times 100 \checkmark$$
- $$= 1,8\% \checkmark$$
- (3)
- 5.4
- Room temperature✓
  - The volume of solution used✓/30ml solution was used
  - The amount of time✓/ left the beakers for 48 hours
  - Cysts from the same type of shrimp✓
- Any 3 (3)
- (Mark first THREE only)**
- 5.5
- 1%✓ salt solution (1)
- 5.6
- There was variation✓ amongst the brine shrimp
  - Some had the ability to produce cysts✓
  - and some did not✓
  - When conditions became unfavourable✓
  - the brine shrimp which were unable to produce cysts died✓
  - Those which were able to produce cysts survived✓
  - and reproduced✓
  - The allele for producing cysts was passed on to their offspring✓
  - The next generation therefore had a higher proportion of brine shrimp with the ability to produce cysts✓
- Any 6** (6)

### QUESTION 6

- 6.1 Emu✓ (1)
- 6.2 They share a more recent✓  
- common ancestor✓ (2)

- 6.3 Accept any answer in the following range: 82 - 84 mya✓ (1)
- 6.4 - Millions of years ago a population of ancestors that could fly was separated✓  
 - by the sea✓  
 - and there was no gene flow✓ between the different groups  
 - Each group was exposed to different environmental conditions✓  
 - and natural selection occurred independently✓ in each population  
 - The populations of birds on each continent became different✓ from each other  
 - both genotypically and phenotypically✓  
 - Even if the two populations were to mix again✓  
 - Eventually they could not interbreed to produce fertile offspring✓
- Any 6 (6)

**QUESTION 7**

- 7.1 Bipedal✓ (1)
- 7.2 A✓ and B✓ (2)  
 (Mark first TWO only)
- 7.3 Both have a short✓ and wide ✓ pelvis (2)
- 7.4 Less curved spine✓ / C-shaped spine (1)  
 (Mark first ONE only)

7.5

Humans	African apes
Large cranium✓	Small cranium✓
Brow ridges are not well developed✓	Brow ridges well developed✓
No cranial ridge✓	Cranial ridge across the top of the cranium✓
Jaws less protruding / less prognathous✓	Jaws more protruding / more prognathous✓
Small canines✓	Large canines✓
Foramen magnum in a forward position✓	Foramen magnum in a backward position✓
Palate shape more rounded✓	Palate shape more rectangular✓

(Mark first THREE only) Table✓ + Any 3 x2 (7)

**QUESTION 8**

- 8.1 3,8 mya ✓ (Accept a range 3,8 to 3,9 mya.) (1)
- 8.2 *Homo sapiens* ✓ / *H. sapiens* (1)
- 8.3 *Australopithecus africanus* ✓ / *A. africanus* (1)
- 8.4 1250 – 500 ✓  
 =  $750 / 500 \times 100$  ✓ (3)

=150✓%

- 8.5 They were able to use simple stone tools and implements✓ (1)  
(7)

## SESSION 2

## PAPER 1 (Exemplar 1)

1.1	1.1.1	A✓✓		
	1.1.2	B✓✓		
	1.1.3	C✓✓		
	1.1.4	B✓✓		
	1.1.5	A✓✓		
	1.1.6	C✓✓		
	1.1.7	C✓✓		
	1.1.8	C✓✓		
	1.1.9	A✓✓		
	1.1.10	C✓✓		
	1.1.11	D✓✓		
			(11 x 2)	<b>(20)</b>
1.2	1.2.1	Multiple sclerosis ✓		
	1.2.2	Prolactin ✓		
	1.2.3	Hypothalamus ✓		
	1.2.4	Altricial development✓		
	1.2.5	External fertilisation ✓		
	1.2.6	Ovovivipary ✓		
	1.2.7	Aldosterone✓		
	1.2.8	Reflex action✓		
	1.2.9	Amniotic egg✓		
			(9 x 1)	<b>(9)</b>
1.3	1.3.1	A only ✓✓		(2)
	1.3.2	B only ✓✓		(2)
	1.3.3	B only ✓✓		(2)
	1.3.4	None ✓✓		(2)
				<b>(8)</b>

1.4	1.4.1	(i) C ✓ (ii) B ✓ (iii) D ✓	(3)
	1.4.2	Growth hormone ✓ TSH / Thyroid stimulating hormone ✓ FSH / Follicle stimulating hormone ✓ LH / Luteinising hormone ✓ Prolactin ✓	
		<b>Mark first TWO only</b>	(2)
			<b>(5)</b>
1.5	1.5.1	Negative feedback ✓ mechanism	(1)
	1.5.2	1 – decrease ✓ 2 – pituitary ✓ 3 – TSH ✓ 4 – thyroid ✓ 5 – more ✓	(5)
			<b>(6)</b>
		<b>TOTAL SECTION A:</b>	<b>50</b>

**SECTION B**

**QUESTION 2**

2.1	2.1.1	(a) Testis ✓	(1)
		(b) Epididymis ✓	(1)
		(c) Scrotum ✓	(1)
	2.1.2	- Under the influence of testosterone ✓ - diploid cells ✓	



- in the seminiferous tubules✓ of the testis
  - undergo meiosis✓
  - to form haploid sperm✓
- Any four (4)

- 2.1.3
- The testes will be further away from the body✓
  - The temperature of the testes will therefore be lower than body temperature✓
  - for successful sperm production✓

OR

- Tight underwear will pull the testes closer to the body✓
  - The temperature of the testes will be too high✓
  - and sperm will not mature✓/sperm production is negatively affected
- (3)

- 2.14 (a) - There will be no sperm in the semen✓
- Therefore no fertilisation can take place✓/pregnancy cannot occur
- (2)

- (b)The fluid part of the semen will still be produced✓
- by the accessory glands✓/seminal vesicles/prostate gland/Cowper's glands
- (2)

**(14)**

2.2 2.2.1

	<b>Sperm cell</b>	<b>Ovum</b>
Size	- Very small✓	- Larger in size✓
Structure	- Head, middle piece, tail - Nucleus containing father's genetic material - Has a tail✓ - No jelly coat surrounds head - Acrosome present	- Round - Nucleus containing mother's genetic material - Has no tail✓ - Jelly coat surrounds cell membrane - No acrosome
Motility	- Can move because of the tail	- Can't move on its own

Mark any TWO ✓✓

1 mark for table✓ (3)

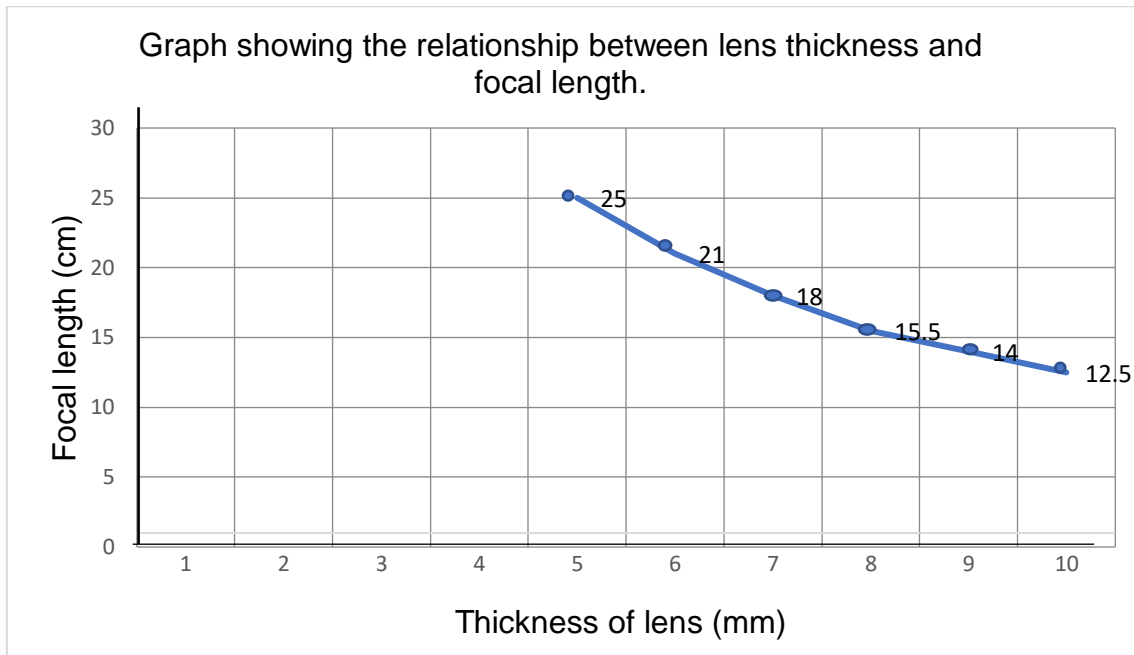
2.2.2	The enzymes digest the outer coat of the ovum ✓ to enable the head to penetrate the ovum and the nuclei to fuse. ✓	(2)
2.2.3	20 cm = 200 mm ✓    200 mm / 4 ✓ = 50 It will take 50 minutes ✓	(3)
2.2.4	The urethra is cleaned prior to ejaculation ✓ by secretions from the Cowper's gland. ✓	(2)
		<b>(10)</b>
2.3	2.3.1	
	(i) Oestrogen ✓	(1)
	(ii) It increases the thickness of the endometrium ✓	(1)
	(iii) Provides a place where the embryo implants ✓ and the placenta forms ✓	(2)
2.3.2	(i) LH / Luteinising hormone ✓	(1)
	(ii) It is produced to burst the Graafian follicle ✓ to release the ovum / stimulate ovulation ✓ Stimulates the development of the corpus luteum ✓	(1)
		ANY 2 (2)
2.3.3	Progesterone ✓	(1)
2.3.4	Prepares endometrium for implantation ✓ / thickens endometrium Maintains endometrium (uterine wall) thickness for pregnancy ✓ Inhibits secretions of FSH and formation of new Graafian follicles ✓ / prevents ovulation	
		ANY ONE (1)
2.3.5	FSH ✓	(1)
2.3.6	Stimulates the growth or development of follicles ✓	(1)
2.3.7	It will decrease ✓	(1)
2.3.8	Corpus luteum is degenerating / getting smaller ✓ The lining of the endometrium is decreasing in size / getting thinner ✓	(2)
		<b>(15)</b>

- 2.4 2.4.1 Stimulates the conversion of glucose to glycogen ✓/ reduces the blood glucose levels ✓ (1)
- 2.4.2 Glucagon ✓ (1)
- 2.4.3 13:00 ✓ (1)
- 2.4.4 28 / 29 mμ/l ✓  
(Units must be included for mark to be awarded) (1)
- 2.4.5 Blood glucose level increases after a meal is eaten ✓  
Pancreas is stimulated to secrete insulin into blood ✓  
Insulin travels in the blood to the liver ✓  
Stimulates conversion of excess glucose to glycogen ✓  
Glycogen is stored ✓  
Glucose levels in the blood now decreases ✓ and returns back to normal ANY 5 (5)
- 2.4.6 9:00 ✓  
13:00 ✓ (2)
- (11)**  
**[50]**

### QUESTION 3

- 3.1 3.1.1 There are no photoreceptors present ✓/ no rods and cones, therefore no vision is detected as the optic nerve is situated in this region ✓ (2)
- 3.1.2 The A / suspensory ligaments slacken ✓, the tension on the B / lens decreases, ✓ the B / lens becomes more convex ✓/ more rounded / bulges. The refractive power of the B / lens is increased. (3)
- 3.1.3 **Pupillary mechanism / pupil reflex** ✓  
Radial muscles ✓ of the iris contract ✓  
Circular muscles ✓ of the iris relax ✓  
Pupil dilates ✓ / widens / gets bigger ✓ and more light enters the eye (5)  
**\* Compulsory mark +ANY 4**  
**(10)**

3.2 3.2.1 Graph



**Rubric for assessment of the graph:**

Correct type of graph (line graph)	1
Caption for graph	1
Correct label for X-axis (including unit) AND scale for X-axis	1
Correct label for Y-axis (including unit) AND scale for Y-axis	1
Plotting: 1 to 2 points correct	1
All 6 points correct	2
	<b>6</b>

(6)

**Note**

If the wrong graph is drawn, marks will be lost for “correct type of graph”.  
If axes are transposed, marks will be lost for labelling of X-axis and Y-axis.

3.2.2 As the thickness of the lens increases ✓ the focal length decreases ✓ (2)

**(8)**

3.3 3.3.1 A – (external) auditory canal / auditory canal / ear canal / meatus ✓

- B – tympanic membrane / eardrum ✓  
 D – oval window ✓ (3)
- 3.3.2 C – transmits vibrations from the eardrum to the incus ✓  
 E – transmits impulses to the brain ✓ (2)
- 3.3.3 (a) Traps dust ✓  
 Prevents insects / small animals from entering the ear ✓  
 Keeps eardrum moist ✓  
**Mark FIRST TWO only** (2)
- (b) Hearing will worsen / deafness ✓ may result because  
 plug will hamper free movement/ vibrations of tympanic  
 membrane ✓  
 Hearing will weaken / no sound waves will be transferred ✓  
 Plug will limit sound waves entering the tympanic  
 membrane / eardrum (3)
- 3.3.4 - The cristae ✓ in the semi-circular canals ✓  
 - are stimulated by changes in speed and direction ✓ of  
 movement  
 - The cristae convert the stimuli to nerve impulses ✓  
 - The nerve impulses are transported along the  
 auditory nerve ✓  
 - to the cerebellum ✓ to be interpreted (5)
- (15)**
- 3.4 3.4.1 Cold conditions ✓ / any temperature considerably lower than  
 room temperature (1)
- 3.4.2 Heat loss ✓ / radiation (1)
- 3.4.3 Thermoregulation ✓ (1)
- 3.4.4 - Blood vessels of the skin widen ✓ / vasodilation happens  
 - More blood flows to the skin surface ✓ and  
 - more heat is lost ✓  
 - More blood flows to sweat glands ✓  
 - More sweat is secreted ✓ and  
 - evaporation of sweat causes cooling ✓ (any 4) (4)

3.5 3.5.1 (a) Presence of the shoot tip containing the hormone✓ (2)  
(b) growth of the shoot✓

3.5.2 The shoot tip produces a hormone called auxin✓  
This hormone stimulates cell division and cell  
elongation,✓ resulting in the growth of the shoot ✓  
If the tip is removed no growth occurs ✓ due to the lack of  
auxin ✓  
**ANY 4 (4)**

3.5.3 Repeat the investigation several times✓  
Increase sample size✓  
**Mark first ONE only (1)**

3.5.4 Use same type / species of plant✓  
Use same soil in the pots✓  
Same amount of water given when watering shoots✓  
Same environmental conditions✓/ sunlight / humidity  
Same nutrients✓  
**ANY 2**  
**Mark FIRST TWO only (2)**  
**(9)**  
**[50]**

**TOTAL SECTION B: 100**

**GRAND TOTAL: [150]**

**SESSION 3**

**PAPER 2 (Exemplar 1)**

**SECTION A  
QUESTION 1**

1.1

- 1.1.1. D ✓✓
- 1.1.2. A ✓✓
- 1.1.3. C ✓✓
- 1.1.4. C ✓✓
- 1.1.5. D ✓✓
- 1.1.6. A ✓✓
- 1.1.7. B ✓✓
- 1.1.8. C ✓✓
- 1.1.9. D ✓✓
- 1.1.10. B ✓✓

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

1.2.

- 1.2.1. Anaphase ✓
- 1.2.2. Peptide bond ✓
- 1.2.3. Deoxyribose ✓
- 1.2.4. Haploid ✓
- 1.2.5. Mitochondrial DNA ✓ / mt DNA
- 1.2.6. Canines ✓
- 1.2.7. Prognathous ✓
- 1.2.8. Monohybrid ✓
- 1.2.9. Heterozygous ✓ / heterozygote

**(9 x 1) (9)**

1.3.

- 1.3.1. A only ✓✓
- 1.3.2. Both A and B ✓✓
- 1.3.3. None ✓✓

**(3 x 2) (6)**

1.4.

- 1.4.1. Weak hydrogen bond ✓ (1)
- 1.4.2. Adenine with Thymine/ A-T ✓  
Guanine with Cytosine/ G-C ✓ (2)

1.4.3. (a)

- DNA unwinds ✓ / changes from double helix form to a ladder shape

- It unzips✓/ weak hydrogen bonds between strand break
- Strands separate out✓
- Each strand✓ receives  
free-floating DNA nucleotides✓ from the nucleoplasm✓
- Forming complementary strands✓/adenine with thymine/ guanine with cytosine
- This process is enzyme-controlled✓ (Any 4)

(Mark first 4 only) (4)

(b) Interphase ✓ (1)

(c) Doubles the genetic material so it can be shared between the resulting daughter cells during cell division✓

Results if the formation of identical daughter cells during mitosis✓ (Any 1) (1)

**(9)**

1.5

1.5.1

- Food can be produced more cheaply✓
- Crop yields/ food security can be increased✓/ GMOs provide a stable and efficient way to sustain enough crops to feed the ever growing population of people in the world.
- Pests that attack the food crop can be controlled✓
- The food can have a longer shelf-life✓
- GMO's can be altered to have a better flavour and increased nutritional value✓
- GMO food crops require less chemicals to thrive thus reducing the amount of soil and water pollution✓
- Crops are resistant to disease✓keep yields high and prices for consumers low

(Any 4)

(Mark first 4 only) (4)

1.5.2 Gene transfer requires altering the genetic identity of the organism ✓

Cloning does not involve any manipulation of genes✓/ the clones have the same genetic identity as the parent cell/ organism.

(2)

**(6)**

**TOTAL SECTION A: 50**



**SECTION B**

**QUESTION 2**

2.1.

2.1.1. (a) 2/ Two ✓ (1)

(b)  Individuals from groups A and B are able to produce fertile offspring when they are interbred ✓

Therefore they belong to the same species ✓ / A and B = one species

Individuals from B and C and from A and C cannot produce fertile offspring ✓

Therefore C = one species ✓ (4)

2.1.2.

- The original mouse population was separated/ by gullies (geographic barriers) \* ✓
- Groups A and B faced similar environmental conditions ✓
- Group C faced unique environmental conditions ✓
- Natural selection occurred independently ✓
- Individuals from Groups A and B were phenotypically and genotypically suitable ✓ for effective interbreeding
- But individuals from Groups A and B were phenotypically and genotypically different from those in Group C ✓
- Hence there could not be gene flow ✓ / no interbreeding to produce fertile offspring
- Two new species were produced. ✓

**Credit compulsory mark(\*) and any 5 points (6)**

2.1.3. This process increased biodiversity ✓

because initially there was one species ✓ of mouse population

but at the end there are two species ✓ in three locations ✓ / habitats. (3)

**(14)**

2.2.

2.2.1. GTA ✓; CAC ✓; CAG ✓ (3)

2.2.2. AGG ✓ (1)

2.2.3. Cysteine ✓ and Threonine ✓ (2)

2.2.4. The process is translation\* (compulsory mark) ✓

The codon UAU of mRNA ✓

was exposed on the ribosome ✓

The tRNA with the complementary anticodon AUA ✓

Brought the amino acid tyrosine ✓

From the cytoplasm to the ribosome ✓

It was then bonded to the neighbouring/ previous amino acid by a peptide bond ✓

**Credit compulsory mark and any 4 points in sequence** (5)

NB. No credit for generic description of translation process if it does not relate to amino acid 11 in the table.

2.2.5. Structural difference between DNA and RNA

DNA	RNA
Deoxyribose sugar✓	Ribose sugar✓
Nitrogenous base thymine✓	Nitrogenous base uracil✓
It is double stranded✓	It is single stranded✓

Marking guidelines: 1 mark for table  
Mark the first difference ONLY.

(3)

2.3.

2.3.1. (a) Co-dominance✓ (1)

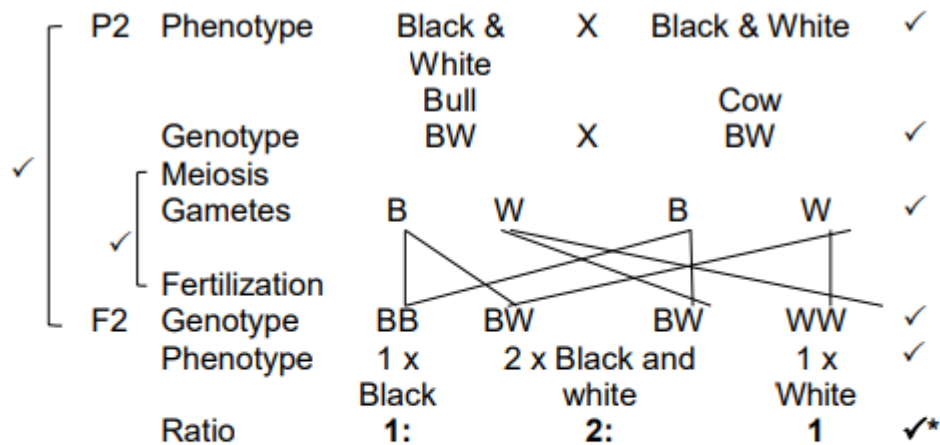
(b) In the F1 generation, the phenotypes (fur colour) of both parents appear✓ and there is no intermediate colour trait ✓ (2)

2.3.2. (a) WW✓ (1)

(b) BB✓ (1)

(c) BW/WB✓ (1)

2.3.3.



**PUNNET SQUARE**

Gametes	B	W
B	BB	BW
W	BW	WW

Correct gametes ✓

Correct F2 genotypes ✓

(6)

(12)

2.4.1 □ Non-disjunction✓ occurred during Anaphase I ✓

- Two chromosomes moved to the one pole ✓ and
- none moved to the other pole ✓ (3)

2.4.2  Gamete A has 2 chromosomes ✓ / an extra chromosome

- When it fertilises a normal ovum ✓
  - the zygote will have 3 chromosomes ✓
  - at position 21 ✓
- Any 3 (3)

2.4.3 (a) Prophase I ✓ (1)

- (b)  Adjacent chromatids of homologous chromosomes cross ✓
- at a point called the chiasma ✓
- There is an exchange of DNA segments ✓ / genetic material (3)

(10)

**TOTAL= (50)**

### QUESTION 3

3.1

3.1.1. (a)  $X^H X^h$  ✓ (1)

(b) Haemophilic female ✓ (1)

3.1.2. Tumi inherited a normal allele  $X^H$  from Mandy (his mother) ✓

He also inherited a Y chromosome from Peter (his father) ✓

which does not carry the allele for haemophilia ✓

Therefore, Tumi has the normal blood clotting factor ✓

Mark any 3 (3)

3.1.3. (a) No ✓ (1)

(b) Rena inherited one recessive allele for haemophilia ( $X^h$ ) ✓

from Peter who is a haemophiliac male ✓

She also inherited another recessive allele for  $X^h$  ✓

from Mandy who is normal but heterozygous/ carries  $X^h$  ✓

Since Rena is a female, she had  $X^h X^h$  \* ✓ **(Compulsory mark)**

that caused her haemophiliac condition ✓

Therefore Rena inherited her condition from Peter and Mandy ✓

Hence the above statement is incorrect

**Credit for compulsory point and any three** (4)

3.1.4. Crossing over during Prophase 1 ✓

Random arrangement of chromosomes during Metaphase ✓

Mutations ✓

Random fertilisation ✓

**NB (Do not credit for random mating)**

Mark first three only (3)  
**(14)**

3.2.1. a) GgTt ✓ (1)

b) Yellow ✓ leaves no thorns ✓ (2)

3.2.2 GGtt ✓

Ggtt ✓

ggTT ✓

ggTt ✓ (4)  
**(7)**

3.3

3.3.1 I<sup>A</sup> ✓, I<sup>B</sup> ✓, i ✓ (3)

3.3.2 2 ✓ (1)

3.3.3 - Any individual inherits one allele ✓

- from each parent ✓ (2)

3.3.4 - Each child ✓

- has an equal ✓ / 25% chance of having

- any blood group ✓ (3)  
**(9)**

3.4

- There is variation in the snail population ✓ / some are dark in colour and some are white

- The dark snails are camouflaged ✓ / blend in with the garden at night

- The white snails are not camouflaged ✓ / do not blend in with the garden at night

- Predators eat the white snails ✓ / the white snails die

- The dark snails survive ✓

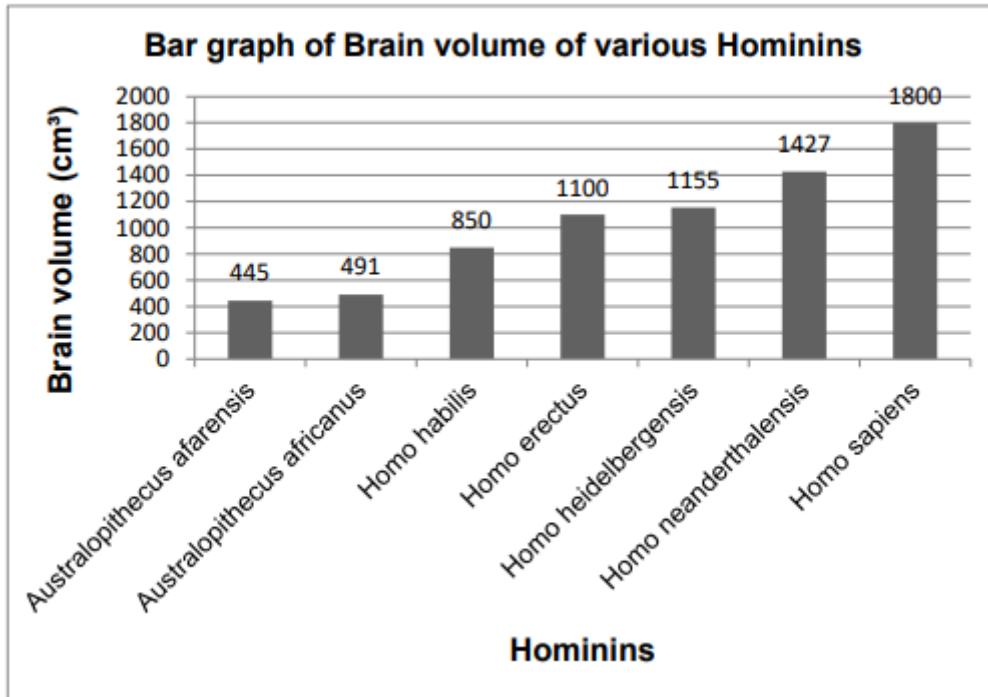
- and will reproduce ✓ / pass this characteristic on to their offspring

- increasing the proportion of dark brown snails in **subsequent generations** ✓

**Any (5)**

3.5

3.5.1



Rubric for marking graph:

Criteria	Mark allocation
Correct type of graph: Bar graph	1
Correct title of the graph: the brain volume Hominids	1
Correct label for X axis and Y axis	1
Correct scale for X axis (uniform spacing of bars) and Y axis (numerical)	1
Drawing of the graph	1: 1-6 bars plotted correctly 2: All 7 bars plotted correctly

3.5.2. % increase = (larger volume – smaller volume) x 100

$$\begin{aligned}
 & \text{Smaller volume} \\
 & = \frac{1800\text{cm}^3 - 1100\text{cm}^3}{1100} \times 100 \\
 & = 63.6\% \text{ increase} \quad (3)
 \end{aligned}$$

3.5.3. Brain volume development increases as new Homo species are formed/ evolved (2)

3.2.4. (a) Continuous variation (1)

(b) Brain volume increases from the lowest capacity to the maximum capacity ✓  
along the continuous sequence of Homo species evolution/ formation. ✓ (2)

3.2.5. - Binocular vision ✓ / eyes positioned in the front

- Opposable thumbs ✓
- Upright posture ✓
- Long and rotating fore limbs ✓
- Diminished sense of smell ✓
- Flat nails ✓
- Bare/naked fingertips ✓
- Fewer offspring ✓ (Mark first two only) (2)

3.2.6. (a) Homo sapiens ✓ (1)

(b) They have the largest brain volume ✓ (1)

**(17)**

**TOTAL(50)**

**GRAND TOTAL [150]**

## SESSION 4

## PAPER 1 (Exemplar 2)

## SECTION A

## QUESTION 1

1.1	1.1.1	C✓✓		
	1.1.2	D✓✓		
	1.1.3	C✓✓		
	1.1.4	B✓✓		
	1.1.5	D✓✓		
	1.1.6	D✓✓		
	1.1.7	C✓✓		
	1.1.8	C✓✓		
	1.1.9	C✓✓		
	1.1.10	D✓✓	(10 x 2)	<b>(20)</b>
1.2	1.2.1	Blastula✓		
	1.2.2	Insulin✓		
	1.2.3	Chemical✓ protection		
	1.2.4	Prolactin✓		
	1.2.5	Puberty✓		
	1.2.6	Aldosterone✓		
	1.2.7	Alzheimer's disease/Alzheimer's✓		
	1.2.8	Amniotic✓ fluid		
	1.2.9	Precocial✓ development	(9 x 1)	<b>(9)</b>
1.3	1.3.1	Only A✓✓		
	1.3.2	None✓✓		

	1.3.3	Only A✓✓	(3 x 2)	<b>(6)</b>
1.4	1.4.1	(a) Absciscic acid✓/Auxins		(1)
		(b) Gibberellins✓		(1)
	1.4.2	(a) Auxins✓/Absciscic acid		(1)
		(b) Growing tips of stems/apical meristem of stems✓ Growing tips of roots/apical meristem of roots✓		(2)
		(c) <u>For Auxins:</u> - Stimulate cell elongation✓ - Stimulate the development of fruit✓ - Control the abscission of leaves and fruit✓ - Stimulate the development of adventitious roots in stem cuttings✓ - Cause tropism in stems and roots✓		
		<b>OR</b>		
		<u>For Absciscic acid</u> - Contributes to the dormancy of seeds✓/inhibition of germination - Promotes the abscission of leaves & fruits✓ - Causes the closing of stomata✓ (Any 1)		(1)
		<b>(Mark the first ONE only)</b>		
	1.4.3	Plant hormones are organic✓ compounds and act as chemical messengers✓		(2) <b>(8)</b>
1.5.	1.5.1	(a) A✓		(1)
		(b) C✓		(1)
		(c) A✓		(1)
	1.5.2	(a) D ✓ - Spinal cord ✓		(2)
		(b) B ✓ - Corpus callosum ✓		(2)
				<b>(7)</b>
		<b>TOTAL SECTION A:</b>		<b>50</b>



**SECTION B**

**QUESTION 2**

- 2.1 2.1.1 (a) Accommodation✓ (1)
- (b) - Ciliary muscles contract✓  
 - The ciliary body moves closer to the lens✓  
 - The suspensory ligaments slacken✓  
 - The lens becomes more convex✓  
 - More refraction of light✓  
 - for a clear image to form on the retina✓ (Any 5) (5)
- 2.1.2 People cannot memorise the pattern/arrangement/sizes✓ therefore they need to rely on their eye sight✓ (2)
- 2.1.3 (a) Images from both eyes✓ are able to perceive a three-dimensional image✓ (2)
- (b) It provides a wider field of vision✓ to improve the driver's driving ability✓/reactions  
 It creates a perception of depth✓ that will ensure the driver's ability to judge distance✓ (2 x 2) (4)
- (14)**
- 2.2 2.2.1 A – Pupil ✓  
 B – Iris ✓ (2)
- 2.2.2 C – Sclera✓\*  
 it protects internal / underlying structures of the eye✓ / it is a place for the attachment of muscles that move the eye / it helps maintain the shape of the eye.
- Mark first ONE only** 1\* for name and 1 for function (2)
- 2.2.3 – In dimmer light /walking into the house  
 – the circular muscles of the iris / part B relax✓  
 – the radial muscles of the iris / part B contract✓  
 – the diameter of the pupil / part A increases✓  
 – allowing more light to enter the eye.✓ (4)
- 2.2.4 – The pupil will react slowly to the light ✓ / will not react immediately.  
 – as alcohol inhibits autonomic actions✓ / as the impulse reaches the brain more slowly and therefore constriction will occur slowly. (2)

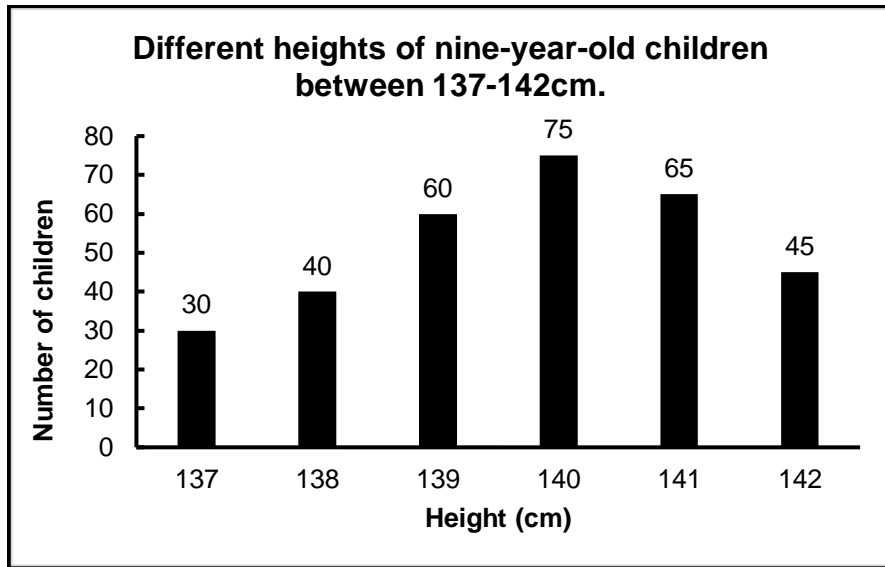
**(10)**

2.3	2.3.1	Phototropism✓	(1)
	2.3.2	Auxin✓	(1)
	2.3.3	B✓	(1)
	2.3.4	A✓	(1)
	2.3.5	Geotropism✓	(1)
	2.3.6	Root✓	(1)
	2.3.7	It would have grown straight.✓ / It would not have bent towards the sunlight.	
		<b>Mark first ONE only</b>	Any 1 (1)
			<b>(7)</b>
2.4	2.4.1	Any temperature between 37,6° C - 37,9°C✓ (include unit)	(1)
	2.4.2	40 minutes✓	(1)
	2.4.3	- Blood vessels become narrower✓ - Less blood flows to the surface of the skin✓ - Less sweat is secreted✓ - and therefore less heat is lost✓	(Any 3) (3)
			<b>(5)</b>
2.5		- Less ADH is secreted✓ by the pituitary into the bloodstream - The kidney tubules become less permeable✓ to water - Less water is reabsorbed✓ from the tubules - and the blood volume decreases✓ - More water is excreted in the urine✓/urine is less concentrated✓ - Water levels in blood return back to normal✓	(Any 4) (4)
2.6	2.6.1	B – Thyroid gland ✓ C – Trachea ✓	(2)
	2.6.2	Goitre ✓	(1)
	2.6.3	Iodine ✓	(1)
	2.6.4	- Iodine necessary to make thyroxin ✓ - This causes an under-secretion of thyroxin and thyroid enlarges to make up for shortage ✓	(2)
	2.6.5	- When levels of thyroxin/Hormone C are below normal, this is detected by the pituitary gland. ✓ - This causes the pituitary gland to secrete more TSH ✓ - TSH is transported via the bloodstream to the thyroid gland✓ - which stimulates increased secretion of thyroxin. ✓ - The level of thyroxin is increased back to normal. ✓	Any 4 (4)
			<b>(10)</b>
			<b>[50]</b>

**QUESTION 3**

- 3.1 3.1.1 Middle ear✓ (1)
- 3.1.2 (a) C ✓ - oval window✓ (2)
- (b) A ✓ - tympanic membrane✓ (2)
- (c) E ✓ - Eustachian tube✓ (2)
- 3.1.3 - Ossicles ✓\*/anvil/incus  
 - It transmits✓ and  
 - amplifies✓ vibrations from  
 - the tympanic membrane✓  
 - to the oval window✓ /from the middle ear to the inner ear  
 (1\* compulsory + 4 marks) (5)
- 3.1.4 (a) Middle ear infection✓ (1)
- (b) (Small cut) in the tympanic membrane✓ (1)
- (c) - Due to the infection the Eustachian tube cannot  
 function properly✓  
 - Air pressure in the middle ear would differ from  
 atmospheric pressure✓/air cannot be replaced in the  
 middle ear  
 - and fluid accumulates in the middle ear cavity✓  
 - The tympanic membrane is unable to vibrate ✓ and  
 vibrations are not being transmitted to the oval  
 window✓ (Any 3) (3)
- 3.2. 3.2.1 Exocrine gland: (17)
- Secretion is done directly at the tissue✓  
 - Secretes enzymes✓  
 - Usually in a duct✓
- Endocrine gland:
- Secretion is done directly in the blood✓  
 - Secretes hormones✓  
 - Usually do not have a duct✓ (Any 1 x 2) (2)
- 3.2.2 Pituitary✓/Hypophysis
- Growth hormone/STH/Somatotropic hormone✓ (2)
- 3.2.3  $\left. \frac{75}{425} \right\} \checkmark \times 100$
- = 17,65✓ % (2)

3.2.4



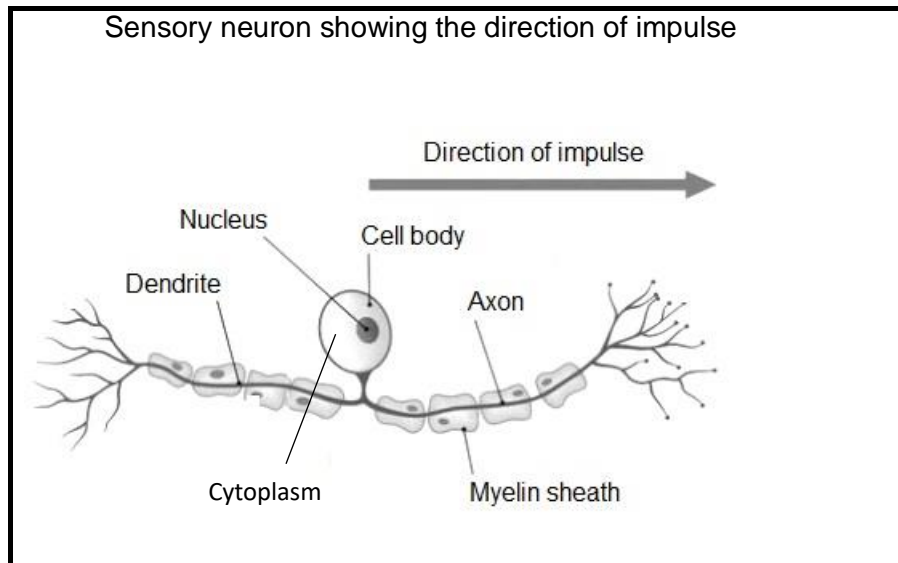
**Guideline for assessing the graph**

Type: Bar graph drawn	(T)	1
Title of the graph	(C)	1
Correct: - <b>Scale</b> for Y-axis and - Width and interval of bars on X-axis	(S)	1
Correct: - Label and unit for X-axis and - Label for Y-axis	(L)	1
Plotting of bars	(P)	1. 1 to 5 bars plotted correctly 2. All 6 bars plotted correctly (More than 6 bars drawn - loses one mark)

(6)  
(12)

- 3.3 3.3.1 (a) Seminal vesicle✓ (1)
- (b) Testis✓ (1)
- 3.3.2 The urethra transports both urine ✓ and sperm ✓ (in semen) to the exterior (2)
- 3.3.3 - 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)
- 3.3.4 - The laptop radiates heat to the body✓  
 - The temperature of the testes will be higher✓ because  
 - the scrotum cannot function normally✓  
 - Sperm production will not be at an optimum✓  
 - therefore producing less sperm✓ or  
 - sperm with a low quality✓  
 - which reduces the chance of fertilization✓/decreasing fertility (Any 3) (3)
- (11)**
- 3.4 3.4.1  $(45 - 40) / 5 \div 40 \times 100 = 12,5\%$  (3)
- 3.4.2 Myelin sheath✓ (1)
- 3.4.3 The wider / broader the neuron the faster the reflex action would be. ✓✓
- OR**
- The narrower / thinner the neuron the slower the reflex action would be. ✓✓ (2)
- 3.4.4 Synapse✓ / Synaptic gap (1)

3.4.5



**Rubric for assessment of the diagram**

Correct type of neuron drawn ( <b>T</b> )	<b>1</b>
Direction of impulse correct ( <b>D</b> )	<b>1</b>
ANY 2 correct labels ( <b>L</b> )	<b>2</b>
<b>TOTAL</b>	<b>4</b>

(10)

[50]

**GRAND TOTAL: 150**

## SESSION 5

## PAPER 2 (Exemplar 2)

## SECTION A

## QUESTION 1

1.1	1.1.1	D✓✓		
	1.1.2	B✓✓		
	1.1.3	A✓✓		
	1.1.4	C✓✓		
	1.1.5	B✓✓		
	1.1.6	B✓✓		
	1.1.7	B✓✓		
	1.1.8	D✓✓		
	1.1.9	B✓✓		
	1.1.10	A✓✓	(10 x 2)	<b>(20)</b>
1.2	1.2.1	Evolution✓		
	1.2.2	Homologous✓ chromosomes		
	1.2.3	Australopithecus✓		
	1.2.4	Interphase✓		
	1.2.5	Transitional fossils✓		
	1.2.6	Cytokinesis✓		
	1.2.7	Variation✓		
	1.2.8	Binocular vision/stereoscopic vision✓		
	1.2.9	Hominidae✓		
	1.2.10	Discontinuous variation✓	(10 x 1)	<b>(10)</b>

1.3	1.3.1	Both A and B✓✓		
	1.3.2	Both A and B✓✓		
	1.3.3	None✓✓	(3 x 2)	<b>(6)</b>
1.4	1.4.1	Suspect 1✓		(1)
	1.4.2	All the bars of the DNA-profile of the skin tissue✓ correspond with ALL the bars of the DNA- profile of suspect 1✓		(2)
	1.4.3	<ul style="list-style-type: none"> <li>• By repeating✓ the test with the DNA sample several times to make sure they get the same results✓</li> <li>• To do the test at different laboratories✓ to make sure they get the same results✓</li> </ul>	(1 x 2)	(2)
		<b>(Mark first ONE only)</b>		
	1.4.4	Yes ✓ /Saliva could be used Saliva will have some DNA containing cells✓ from the lining of the mouth.		(2) <b>(7)</b>
1.5.	1.5.1	Nucleus✓		(1)
	1.5.2	(a) Amino acid✓ (b) Peptide✓		(1) (1)
	1.5.3	(a) UAU✓✓ (b) ACA✓✓		(2) (2)
				<b>(7)</b>
			<b>TOTAL SECTION A:</b>	<b>50</b>



**SECTION B**

**QUESTION 2**

- 2.1 2.1.1 Haemophilia ✓ (1)
- 2.1.2 a) Male with haemophilia ✓/affected male (1)  
 b)  $X^H X^h$  ✓✓ (2)
- 2.1.3 Individual 3 is a male and his genotype is  $X^h Y$  ✓  
 The Y chromosome is inherited from the father ✓  
 The Y chromosome does not carry an allele ✓  
 The  $X^h$  chromosome is inherited from the mother which is heterozygous/ $X^H X^h$  ✓ (4)

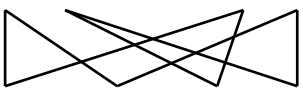
2.1.4 **P<sub>1</sub>** Phenotype Unaffected female x Unaffected male ✓

Genotype  $X^H X^h$  x  $X^H Y$  ✓

*Meiosis*

**G/gametes**  $X^H, X^h$  x  $X^H, Y$  ✓

*Fertilization*



**F<sub>1</sub>** Genotype  $X^H X^H$   $X^H Y$   $X^H X^h$   $X^h Y$  ✓

0% \* Compulsory mark

**P<sub>1</sub>** and **F<sub>1</sub>** ✓  
 Meiosis and fertilization ✓

**\*Compulsory 1 + Any 5**

**OR**

**P<sub>1</sub>** Phenotype Unaffected female x Unaffected male ✓

Genotype  $X^H X^h$  x  $X^H Y$  ✓

Meiosis			
	Gametes	$X^H$	$X^h$
Fertilisation	$X^H$	$X^HX^H$	$X^HX^h$
	Y	$X^HY$	$X^hY$
1 mark for correct gametes ✓ 1 mark for correct genotypes ✓			

**F<sub>1</sub>**

Genotype  $X^HX^H$   $X^HY$   $X^HX^h$   $X^hY$  ✓

0% **\*Compulsory mark**

P<sub>1</sub> and

F<sub>1</sub> ✓

Meiosis and fertilization ✓ **\*Compulsory 1 + Any 5**

(6)  
**(14)**

2.2 2.2.1 m-RNA ✓ (1)

2.2.2 (a) 270 ✓ (1)

(b) 90 ✓ (1)

2.2.3 Translation ✓\*

- Each t-RNA carries a specific amino acid ✓
- When the anticodon on the t-RNA ✓
- matches the codon on the m-RNA ✓
- then t-RNA brings the required amino acid ✓
- to the ribosome ✓
- Amino acids become attached by peptide bonds – to form the required protein ✓ **\*Compulsory 1 + Any 5**

(6)  
**(9)**

2.3 2.3.1 Female ✓ (1)

2.3.2 The two gonosomes/pair 23 are similar ✓/pair 23 is XX/same size (1)

2.3.3 45 ✓ (1)

2.3.4 Down syndrome ✓/Trisomy 21 (1)

- 2.3.5
- During Anaphase ✓ I/II
  - homologous chromosomes ✓
  - at chromosome pair 21 ✓
  - fail to separate/non-disjunction takes place ✓
  - An abnormal gamete forms with 24 chromosomes/extra chromosomes at pair 21 ✓
  - If the abnormal gamete fuses with a normal gamete ✓  
/with 23 chromosomes

		<ul style="list-style-type: none"> <li>the new cell has a chromosome number of 47✓ and Down syndrome comes about Any 6</li> </ul>	(6) <b>(10)</b>
2.4	2.4.1	Genetic manipulation✓/Genetic engineering/Genetic modification	(1)
	2.4.2	(a) <ul style="list-style-type: none"> <li>Bananas are easily accessible ✓ You don't have to go to a clinic or a hospital for an injection/you can buy it at a shop ✓</li> <li>Eating a banana with vaccines of hepatitis B are more comfortable and easy✓ than an injection that needs to be sterilized and given by an experienced person/nurse/doctor✓</li> <li>Bananas do not need to be carefully stored and are administered easily✓ where as a vaccine must be refrigerated and administrated✓ <b>(Any 2 x 2)</b></li> </ul> <b>(Mark first TWO only)</b>	(4)
		(b) <ul style="list-style-type: none"> <li>Expensive✓/research money could be used for other needs/the initial cost will be high in the beginning</li> <li>Interfering with nature✓/Ethical issues</li> <li>Potential health impacts on humans✓</li> <li>Unsure of long-term effects on the enviroment✓</li> </ul> <b>(Any 2)</b> <b>(Mark first TWO only)</b>	(2) <b>(7)</b>
2.5	2.5.1	A – Centriole✓ / Centrosome B – Cell membrane✓/plasmalemma / plasma membrane C – Unreplicated / Single stranded chromosome✓	(3)
	2.5.2	Diagram 3 ✓	(1)
	2.5.3	<ul style="list-style-type: none"> <li>– Crossing-over✓*</li> <li>– Adjacent chromatids ✓</li> <li>– of homologous chromosomes cross✓</li> <li>– at a point called the chiasma ✓</li> <li>– There is an exchange of DNA segments ✓/genetic material</li> </ul>	<b>1 Compulsory + Any 3</b>
	2.5.4	(a) 23✓ / twenty three (b) 46✓ / forty six	(2) <b>(10)</b> <b>[50]</b>

**QUESTION 3**

3.1 3.1.1 Tim White✓ (1)

3.1.2 A smaller cranium✓ /brain and modern humans have a larger cranium/brain✓

Face sloping✓/Forehead slope more backwards and in modern humans it is less backwards✓

Brow ridges pronounced✓ and modern humans less pronounced✓

Larger canines✓ and modern humans have smaller canines✓

Diastema✓ (spaces between the teeth) exist and modern humans has no diastema✓

Big jaw and are prognathous✓ and modern humans have small jaw and is non prognathous✓

Poorly developed chin✓ and modern human has a well developed chin✓

**(Mark first THREE only) (Any 3 x 2) (6)**

3.1.3 They could look for tools (pots, knives, weapons etc.)✓ that are cultural evidence✓of human evolution (2)

3.1.4 Increased awareness of the environment✓ in sensing danger/food✓  
Freeing of the hands✓ to use implements✓/carry objects/weapons/ offspring  
Exposure of a large surface area✓ for thermoregulation✓/lose body heat to surroundings in hot conditions/reduce overheating  
Display of sex organs✓ /breasts as part of courtship behaviour✓  
**(Mark first TWO only) (Any 2 x 2) (4)**

3.1.5 *H. erectus*✓/*H. habilis*/*Australopithecus* (1)

3.1.6 **Brain volume of different homo species**

SPECIES	BRAIN VOLUMES
<i>H. habilis</i>	600 cm <sup>3</sup>
<i>H. erectus</i>	860 cm <sup>3</sup>
<i>H. sapiens</i>	1300 cm <sup>3</sup>

**Marking criteria**

Table drawn	(1)
Heading of the table	(1)
Correct information (1 mark per species)	(3)

(5)  
**(19)**

- 3.2 3.2.1 FFBB✓  
ffbb✓ (2)
- 3.2.2 a) ffBB✓ (1)
- b) ffBB✓ OR ffBb✓ (1)
- c) Few bunches and big fruits✓  
Many bunches and big fruits✓  
Few bunches and small fruits✓  
Many bunches and small fruits✓ (4)  
**(8)**
- 3.3
- Because of the random arrangement of chromosomes at the equator during metaphase ✓/any one of two alleles of a characteristic can sort with any two of another characteristic (Ft) and (Bb)
  - the alleles of different genes move independently of each other into the gametes ✓
  - They can therefore appear in the gametes in different combinations ✓/Hence **FfBb** provides the following combinations **FB, Fb, fB, fb** (3)
- 3.4 3.4.1 The average height of the plants decreases✓ as the altitude increases✓
- OR**
- The average height of the plants increases✓ as the altitude decreases✓ (2)
- 3.4.2 - All seeds from different altitudes were planted under the same environmental conditions✓  
- Same number of seeds for each height was used✓  
- Seeds from the same species (*Achillea millefolium*) are used✓  
- Different altitudes must be kept constant✓ **Any 2**  
**(Mark 1<sup>st</sup> TWO only)** (2)
- 3.4.3 - There is variation in the height✓ of the plant species (*Achillea millefolium*)  
- Some plants are short at high altitudes and some are tall at low altitudes✓  
- The tall plants survive at low altitudes because there are less strong winds and harsh environmental conditions✓  
- Short plants survive at high altitudes because they are not damaged by strong winds and harsh environmental conditions✓  
- The allele for short plants were passed to the next generation at high altitudes✓ and  
- The allele for tall plants were passed to the next generation at low altitudes. ✓

		- Higher altitudes have a bigger ratio of short plants ✓ and - Lower altitudes have a bigger ratio of taller plants ✓ <b>Any 6</b>	(6) <b>(10)</b>
3.5	3.5.1	Number of mosquitoes ✓	(1)
	3.5.2	1968 ✓	(1)
	3.5.3	Spraying of DDT causes an increase ✓ in the number of resistant ✓ mosquitoes and a decrease in non-resistant mosquitoes. ✓ <b>OR</b> Spraying of DDT causes an increase ✓ in the number of resistant mosquitoes ✓ and when DDT is not sprayed the non-resistant mosquito number increases. ✓ <i>(Conclusion refers to: DDT spraying ✓ increase/decrease in number of mosquitoes ✓ and the phenotype of mosquitoes. ✓)</i>	(3)
	3.5.4	AUG ✓ AGC ✓ GUA ✓	(3)
	3.5.5	Change the type of amino acid ✓ change the function of protein. ✓	(2)
			<b>(10)</b>
			<b>[50]</b>
		<b>TOTAL SECTION B:</b>	<b>100</b>
		<b>GRAND TOTAL:</b>	<b>150</b>