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GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2025

10832

LIFE SCIENCES

(PAPER 2)

LIFE SCIENCES: Paper 2

10832E

TIME: 2½ hours

MARKS: 150

19 pages

X05

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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 the ANSWER BOOK.
3. Start the answers 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, flow charts or tables 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 must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

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SECTION A

QUESTION 1

1.1 Various options are provided 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, e.g. 1.1.11 D.

1.1.1 A change in the characteristics of species over time is known as …

A a biological species.
B a population.
C a natural selection.
D biological evolution.

1.1.2 Which of the following options is the correct combination of sources of variation?

A Crossing over, random arrangement of chromosomes, mutations and mitosis.
B Crossing over, random arrangement of chromosomes, continuous variation and random fertilisation.
C Random mating, random fertilisation, mutations and meiosis.
D Meiosis, mutations, discontinuous variation and continuous variation.

1.1.3 Evolution involving long periods of time during which species undergo little or no change, followed by short periods of time where species undergo rapid change through natural selection, is called …

A Lamarckism.
B punctuated equilibrium.
C artificial selection.
D gradualism.

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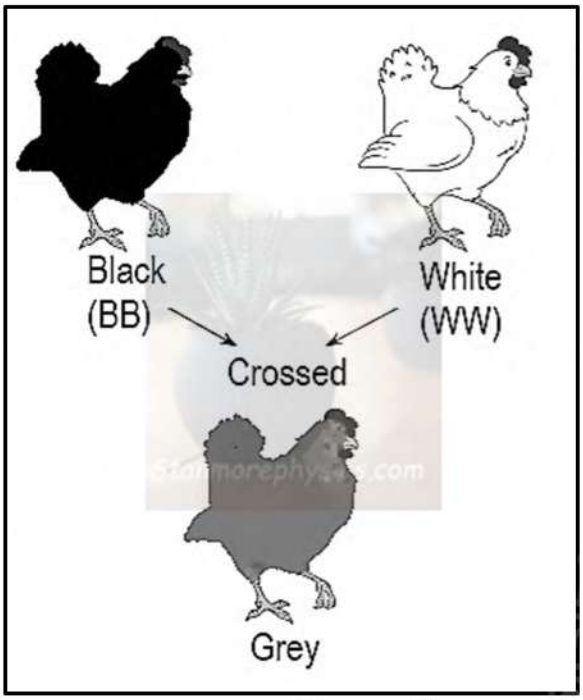
1.1.4 Which of the following fossils does not belong to the *Australophithecus africanus*?

A Mrs Ples
B Lucy
C Little Foot
D Taung Child

1.1.5 Which of the following is only found in an RNA nucleotide?

A Adenine nitrogenous base
B Uracil nitrogenous base
C Deoxyribose sugar
D Phosphate

QUESTIONS 1.1.6 AND 1.1.7 ARE BASED ON THE DIAGRAM BELOW.



[Source: *Nagwa.com*]

1.1.6 What type of dominance results in an intermediate phenotype as shown in the diagram above?

A Co-dominance
B Complete dominance
C Incomplete dominance
D Law of dominance

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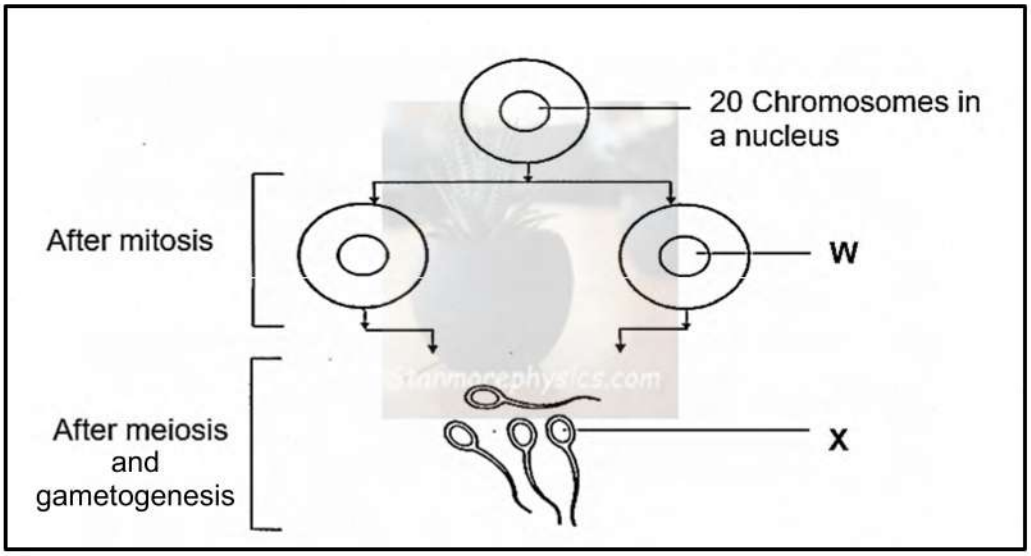
1.1.7 The genotype of the grey chicken is:

A Bb
B BW
C WW
D Bw

1.1.8 The diagram below shows the formation of the sperm cells of a fruit fly.



[Source: GP 2014 Prep P2]

How many chromosomes are present in the nucleus of cells **W** and **X**, respectively?

	W	X
A	10	20
B	10	10
C	20	20
D	20	10

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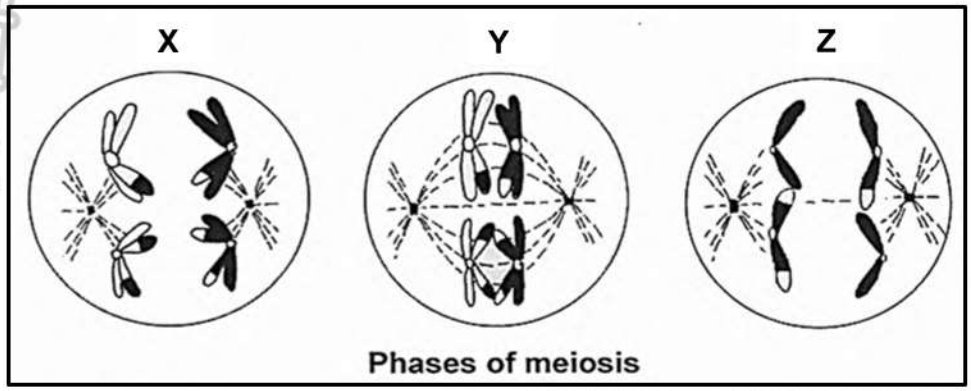
1.1.9 The diagrams below represent different phases of meiosis.



[Adapted from DBE Mind the Gap]

Which of the following represents the correct sequence of phases?

A X, Y and Z
B Y, Z and X
C Z, X and Y
D Y, X and Z

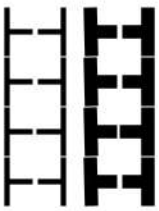
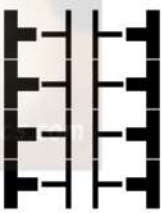
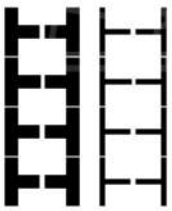
1.1.10 The diagram below shows a DNA molecule on the left and a pool of new nucleotides on the right.

Original DNA molecule

New nucleotides

If replication of the original DNA molecule takes place using the new nucleotides, what would the product of replication look like?

Write down the letter representing the correct product.

A	B	C	D
			

[Source: *Coursehero.com*]

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

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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 A diagram used to show the evolutionary relationships between species

1.2.2 The ability of a chimpanzee to walk on all four limbs

1.2.3 The part of the skull that houses the brain

1.2.4 The structure in an animal cell that gives rise to spindle fibres during cell division

1.2.5 A sex-linked genetic disorder whereby blood does not clot

1.2.6 The genetic state of having two identical alleles for a particular characteristic

1.2.7 An organelle containing DNA, found in plant cells and not in animal cells

(7 x 1) **(7)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY, B ONLY, BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only, B only, both A and B or none** next to the question numbers (1.3.1 to1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Law of use and disuse	A: Eldredge and Gould B: Lamarck
1.3.2	Chromosome complement of a woman with Down syndrome	A: 44 + XX B: 44 + XXX
1.3.3	Father of genetics	A: Mendel B: Watson

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

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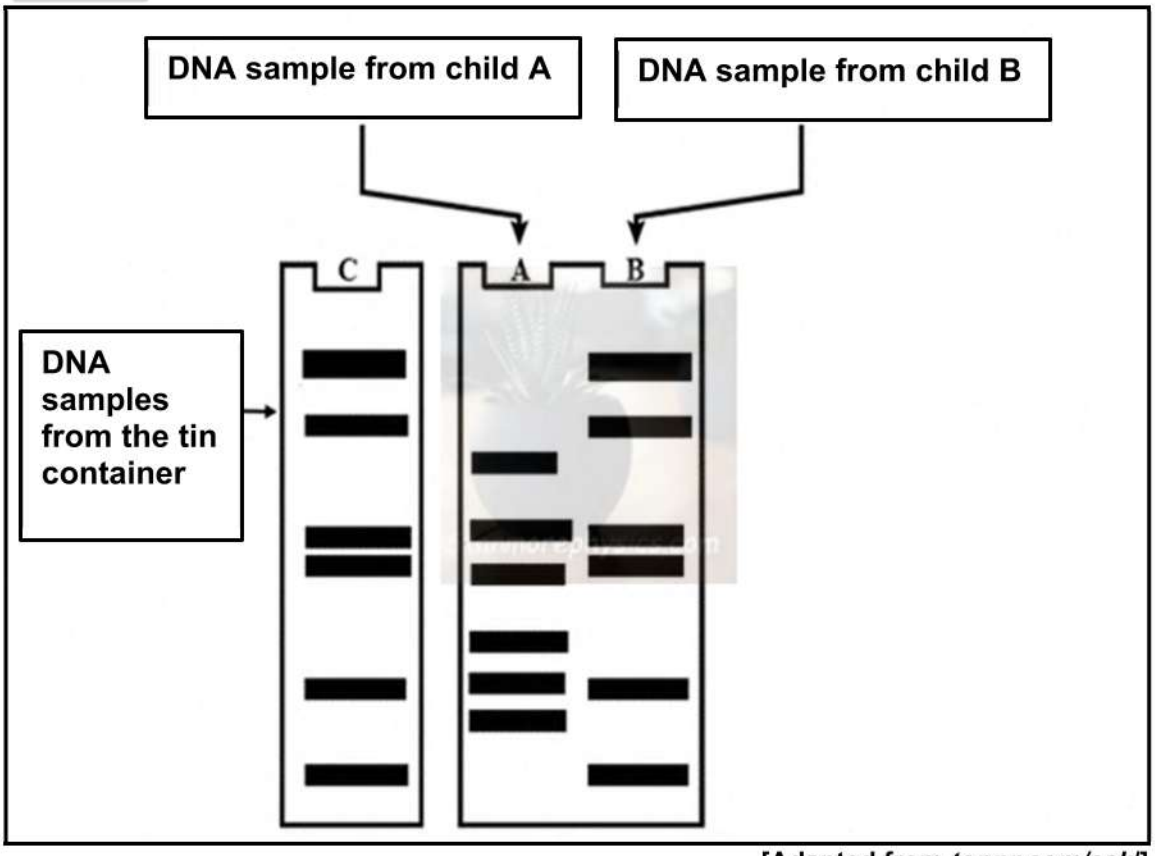
1.4 Mrs Forbes had baked a graduation cake for her sister and then left it in a tin container in the cupboard. When she returned from work, all that remained in the tin container were crumbs from the cake and traces of blood droplets, where the thief had grazed his/her finger on the sharp part of the container.

Below are the DNA samples of her two children, along with the DNA sample from the blood found on the tin container.



[Adapted from *toppr.com/ask/*]

1.4.1 Name the technique used to compare the DNA bars to identify the suspect. (1)

1.4.2 Give the letter of the child who most likely ate the cake. (1)

1.4.3 From the list below, write down the LETTERS of the TWO correct uses of the technique named in QUESTION 1.4.1.

A Cloning
B Identifying genetic disorders
C To establish family relations
D Genetic engineering (2)

(4)

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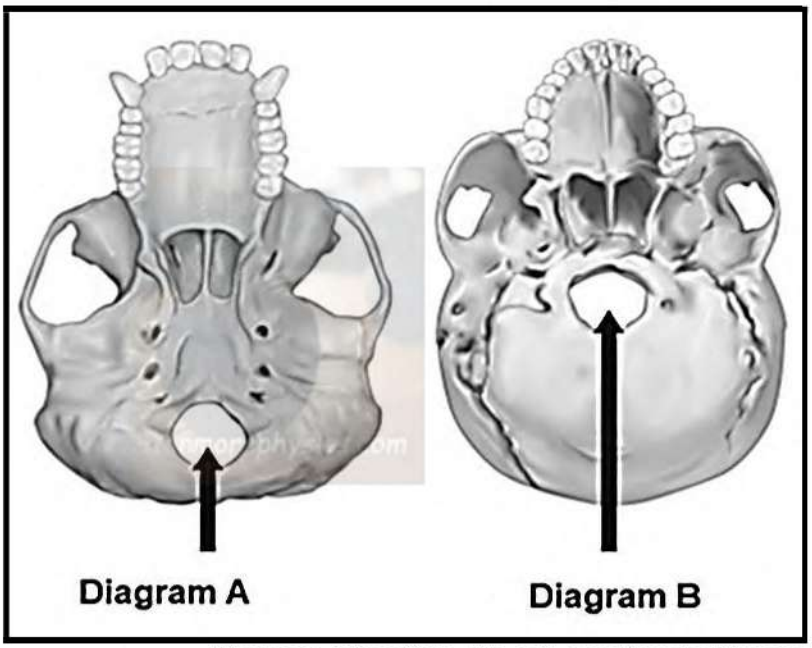
1.5 Diagrams **A** and **B** show the skulls of two hominids.



[Source: *https://ars.els-cdn.com/content/image*]

1.5.1 Which diagram (**A** or **B**) shows …

(a) a larger cranium? (1)

(b) a skull of a chimpanzee? (1)

1.5.2 Name the opening to which the arrows are pointing. (1)

1.5.3 State the shape of the jaw in diagram **A**. (1)

1.5.4 Give the letter of the diagram (**A** or **B**) representing a bipedal hominid. (1)

1.5.5 Which skull in the diagram (**A** or **B**) is better adapted to eating raw, uncooked food? (1)

1.5.6 Give the scientific name of the modern human. (1)
(7)

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1.6 In humans, one gene controls hairline and another controls freckles. The hairline can be curved, forming a point down the forehead (called a widow's peak) (**H**) or straight (**h**). Freckles, which are tiny brown spots on the face, can be present (**F**) or absent (**f**). The diagram below shows a cross between a male and female who are both heterozygous for both genes.

HhFf

HhFf

	HF	**Hf**	**hF**	**Hf**
HF	HHFF	HHFf	HhFF	**X**
Hf	HHFf	HHff	HhFf	Hhff
hF	HhFF	HhFf	hhFF	hhFf
hf	HhFf	Hhff	hhFf	**Y**

[Adapted from *Shiken.ai*]

1.6.1 Name the type of genetic cross represented above. (1)

1.6.2 State the dominant characteristic of the hair line. (1)

1.6.3 Name the process in reproduction indicated by the:

(a) Arrows (1)

(b) Punnett square (1)

1.6.4 Give the:

(a) Genotype of offspring **X** (1)

(b) Phenotype of offspring **Y** (1)

(6)

TOTAL SECTION A: 50

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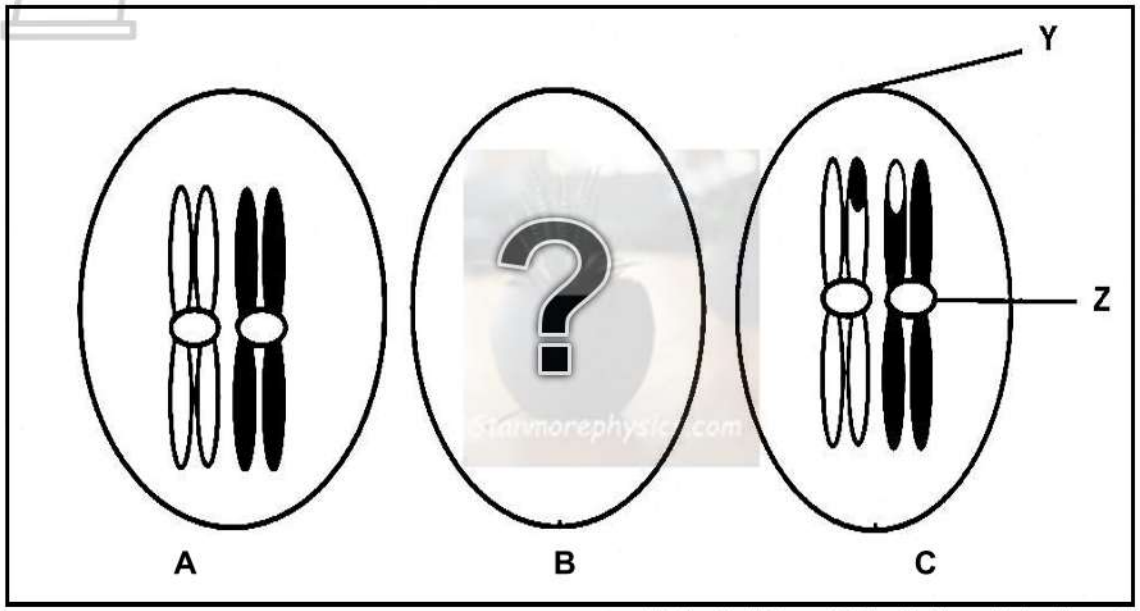
SECTION B

QUESTION 2

2.1 The diagrams below represent a chromosome pair in a male human cell. The cells (**A**, **B** and **C**) show different events in a phase of meiosis.



[Adapted from DBE National Textbook]

2.1.1 Provide labels for the following structures:

(a) **Y** (1)
(b) **Z** (1)

2.1.2 Name and describe the process that caused the chromosomes in cell **C** to look different from the original chromosomes in cell **A**. (4)

2.1.3 Explain the impact of the process named in QUESTION 2.1.2 for the survival of a species. (3)

2.1.4 Draw a labelled diagram showing how the chromosomes would appear in cell **B** during the process named in QUESTION 2.1.2.
(Do NOT include labels for **Y** and **Z**.) (5)
(14)

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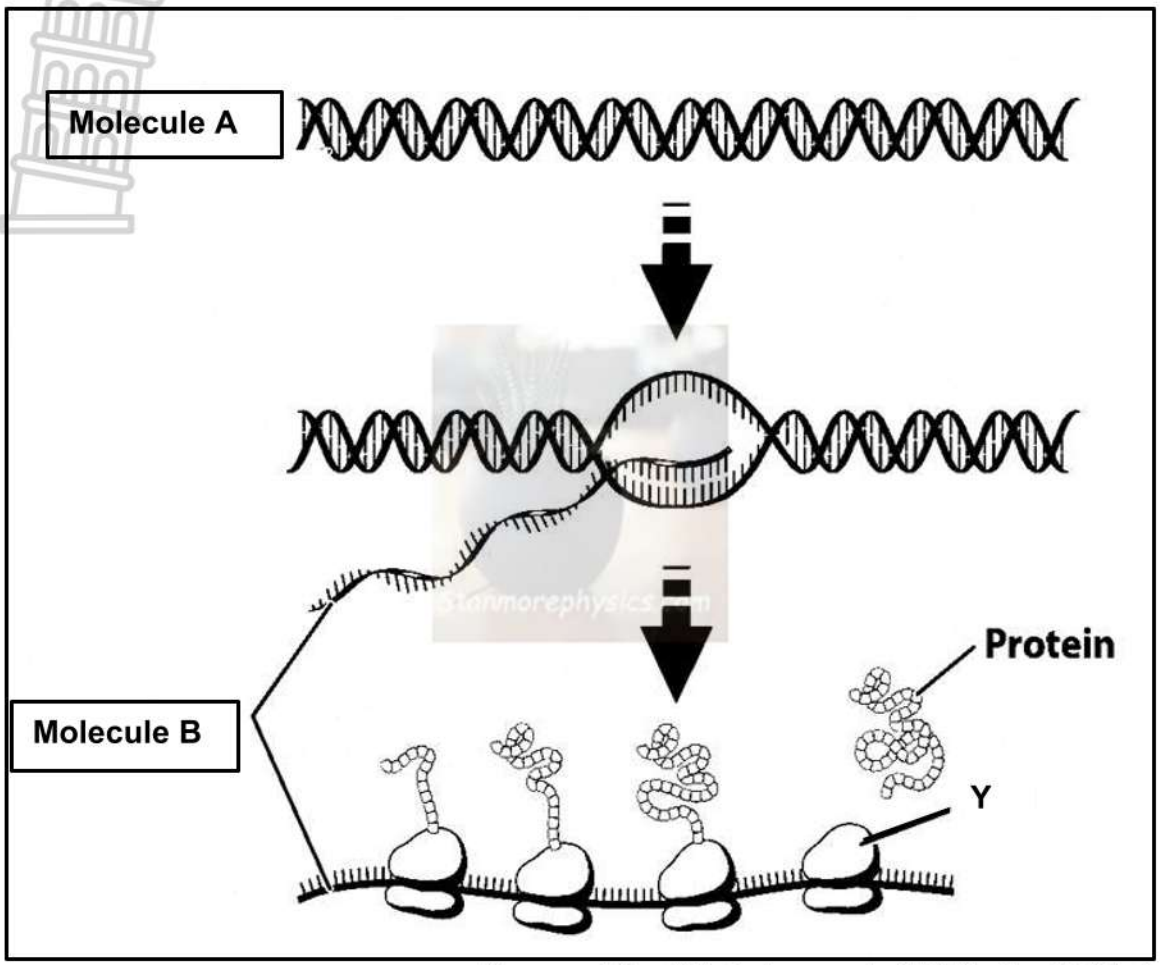
2.2 The diagram below represents processes that occur during protein synthesis.



[Source: *https://biotech.gsu.edu/2107/lecture24.html*]

2.2.1 Identify:

(a) Molecule **A** (1)
(b) Molecule **B** (1)

2.2.2 Describe THREE structural features of molecule **A**. (3)

2.2.3 State the function of organelle **Y**. (1)

2.2.4 Name and describe the stage of protein synthesis that takes place at organelle **Y**. (5)
(11)

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2.3 The information below shows the sequences of a protein's first six amino acids found in the saliva of Angela and Brian. A mutation caused a change in Brian's sequence of amino acids. The amino acids are sequenced from left to right.

	Sequence of amino acids					
Angela	Glycine	Valine	Histidine	Proline	Isoleucine	Tyrosine
Brian	Glycine	Valine	Histidine	Valine	Isoleucine	Tyrosine

2.3.1 Describe how a mutation caused the change to Brian's amino acid sequence. (4)

2.3.2 How many mRNA nucleotides would be involved in forming the portion of the protein shown for Angela in the table above? (1)

2.3.3 A section of mRNA has the following base sequence and is read from left to right:

CUG ACG

Write down the DNA base triplet sequence (from left to right) for the mRNA sequence above. (2)

(7)

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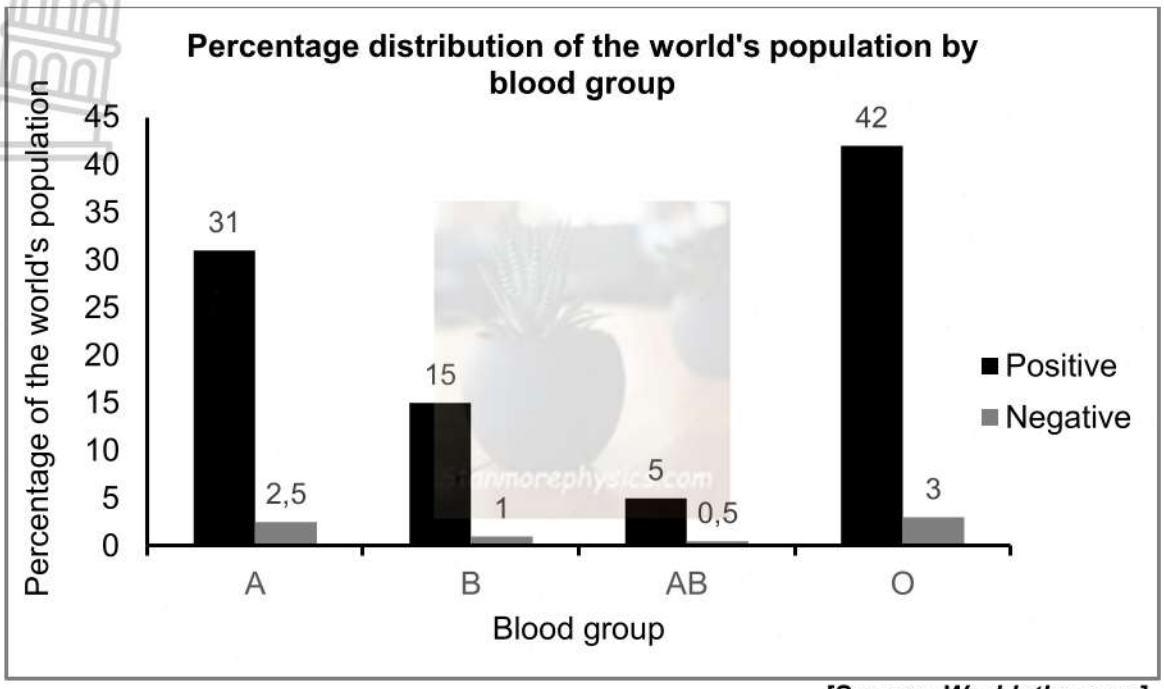
2.4 The graph below shows the percentage distribution of the world's population according to blood groups A, B, AB and O, and whether they have the positive or negative forms.



[Source: *Worldatlas.com*]

2.4.1 According to the data, what is the total percentage of the world's population with blood group O? (1)

2.4.2 Tabulate TWO differences between the type of dominance shown by the inheritance of blood group A compared to blood group AB. (5)

2.4.3 Use a genetic cross to show how parents with the two least common blood groups in the world could have a child with blood group A. (6)
(12)

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2.5 The CCR5 gene in humans is located on chromosome number 3. This gene is responsible for producing a protein on white blood cells. The HI virus normally uses this protein to attach to and infect white blood cells.

A mutation in the CCR5 gene appears to offer some protection against the HI virus by changing the shape of the protein on the white blood cells.

Scientists have discovered that long-term reduction of the HI virus in patients is possible through stem cell transplants from individuals with this mutation. Bone marrow is a rich source of adult stem cells. These stem cells can develop into new white blood cells.

[Adapted from *link.springer.com*]

2.5.1 Name the type of chromosome on which the CCR5 gene is found. (1)

2.5.2 Define a *stem cell*. (2)

2.5.3 Using the information provided, explain how stem cells from a person with the mutation could reduce the HI virus in patients. (3)

(6)

[50]

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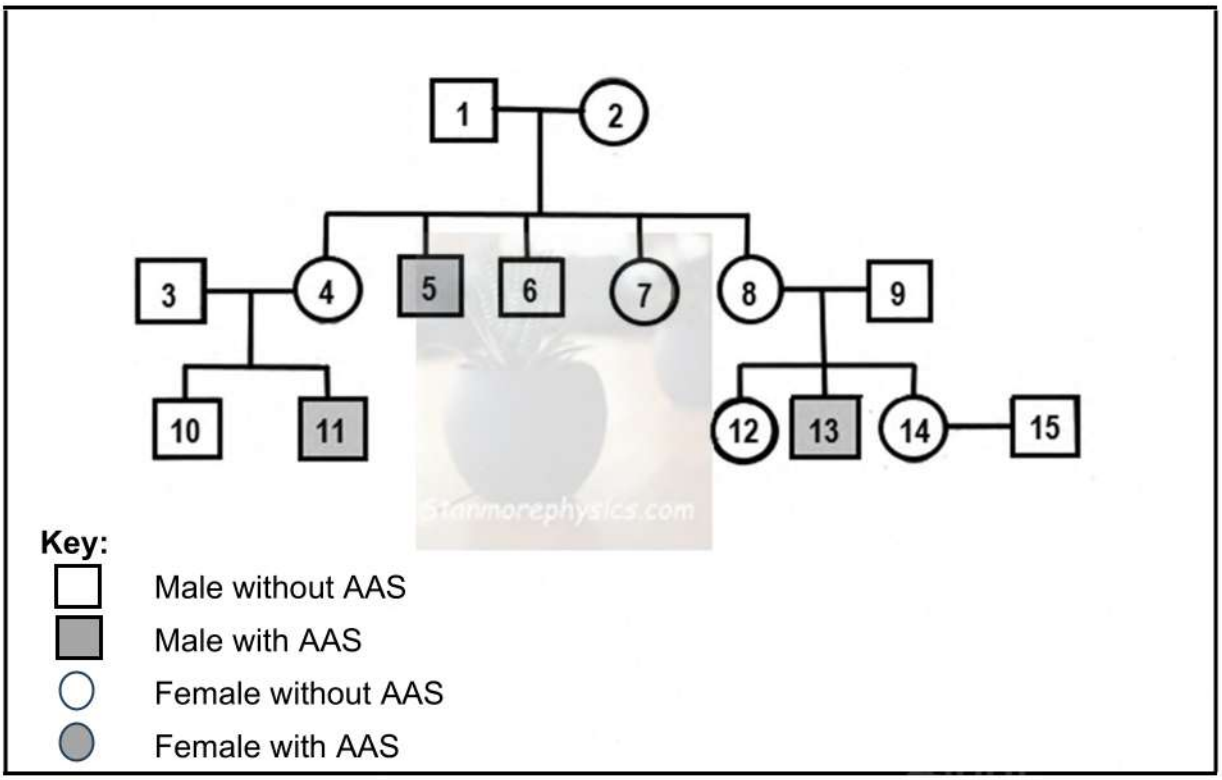
QUESTION 3

3.1 Aarskog-Scott syndrome (AAS) is a rare genetic disorder caused by a recessive allele (X^a) located on the X chromosome. The dominant allele (X^A) results in normal physical features.

People with AAS often have the following physical features:

- Widely spaced eyes
- A small nose
- A long area between the nose and mouth
- A widow's peak hairline
- A shawl scrotum (in which the scrotum surrounds the penis instead of hanging below)
- Undescended testes (Less often)

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



[Source: *Medlineplus.gov*]

3.1.1 Using the information provided, state TWO characteristics of AAS that are unique to males. (2)

3.1.2 Define a *recessive allele*. (2)

3.1.3 How many offspring do individuals **8** and **9** have? (1)

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3.1.4 State the:

(a) Phenotype of individual **11** (1)

(b) Genotype of individual **4** (1)

3.1.5 Explain why females are less likely to inherit AAS. (3)
(10)

3.2

Cloning is a type of biotechnology used by people who want to keep their beloved dog in their lives. It allows them to produce a genetically identical dog to their previous one; however, it is a very expensive process and reduces genetic variation. During this process, the nucleus from the skin cell of the dog being cloned is removed and placed into the ovum of another female dog (from which the nucleus has been removed). Once the embryo of the cloned dog has formed, it gets implanted into the uterus of a surrogate female dog, where it will develop further until the cloned dog is born.

[Source: *Shutterstock.com*]

3.2.1 Based on the information above, state TWO disadvantages of cloning. (2)

3.2.2 Explain why the nucleus of the ovum was replaced with the nucleus of a skin cell. (4)
(6)

3.3

Frogs produce different sounds to attract females of the same species to the breeding site. The calls signal the start of a breeding season. *H. ornate* breeds in summer, and the males make strong chorus sounds. However, *P. adspersus* breeds in spring, and the males make deep, low-pitched whoops.

3.3.1 List THREE requirements that organisms must satisfy before they can be called a species. (3)

3.3.2 Use the text above to identify and describe TWO reproductive isolation mechanisms between these frog species. (4)

3.3.3 Frogs become reproductively isolated because they are different species. This may have happened due to geographic isolation.

Describe speciation through geographic isolation. (6)
(13)

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3.4 Tuberculosis (TB) is a bacterial infection caused by the bacterium *Mycobacterium tuberculosis*. TB can be life-threatening. Resistant strains of *Mycobacterium tuberculosis* have evolved because some patients do not complete their antibiotic treatment. Isoniazid is one of the antibiotics used as a first-line treatment for TB and to prevent TB from becoming active.

A survey conducted by the National Institute of Communicable Diseases from 2013 – 2014 compared the percentage of patients in whom TB has developed resistance to Isoniazid antibiotics with that of a 2001 – 2002 survey.

The 2013 – 2014 survey was conducted as follows:

- 349 patients with TB receiving treatment with Isoniazid were selected. They were from different South African hospitals or clinics in all nine provinces.
- All the patients were over 18 years of age.
- All the patients' medical records were reviewed.

The table below shows the percentage of patients in which TB has developed resistant to Isoniazid antibiotic in each of the 9 provinces for both surveys.

Province	The percentage of patients in whom TB has developed resistance to Isoniazid antibiotic over the years	
	2001 – 2002	2013 – 2014
Eastern Cape	3,5	5,0
Free State	3,7	5,6
Gauteng	1,3	4,7
KwaZulu-Natal	3,4	4,3
Limpopo	2,9	4,2
Mpumalanga	2,7	6,3
North West	1,4	5,0
Northern Cape	4,2	7,0
Western Cape	2,4	6,1

[Source: *https://www.nicd.ac.za/assets/files/K-12750%20NICD%20National%20Survey%20Report_Dev_V11-LR.pdf*]

3.4.1 Name the theory that Charles Darwin proposed to explain how *Mycobacterium tuberculosis* evolved to become antibiotic-resistant. (1)

3.4.2 Identify the dependent variable. (1)

3.4.3 Which province had the highest percentage of TB patients with resistance to Isoniazid in the 2013 – 2014 survey? (1)

3.4.4 State ONE way in which the reliability of this survey was ensured. (1)

3.4.5 Give TWO factors that were kept constant during this investigation. (2)

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3.4.6 Calculate the average percentage of patients who had drug resistance to Isoniazid in South Africa during the 2013 – 2014 survey.

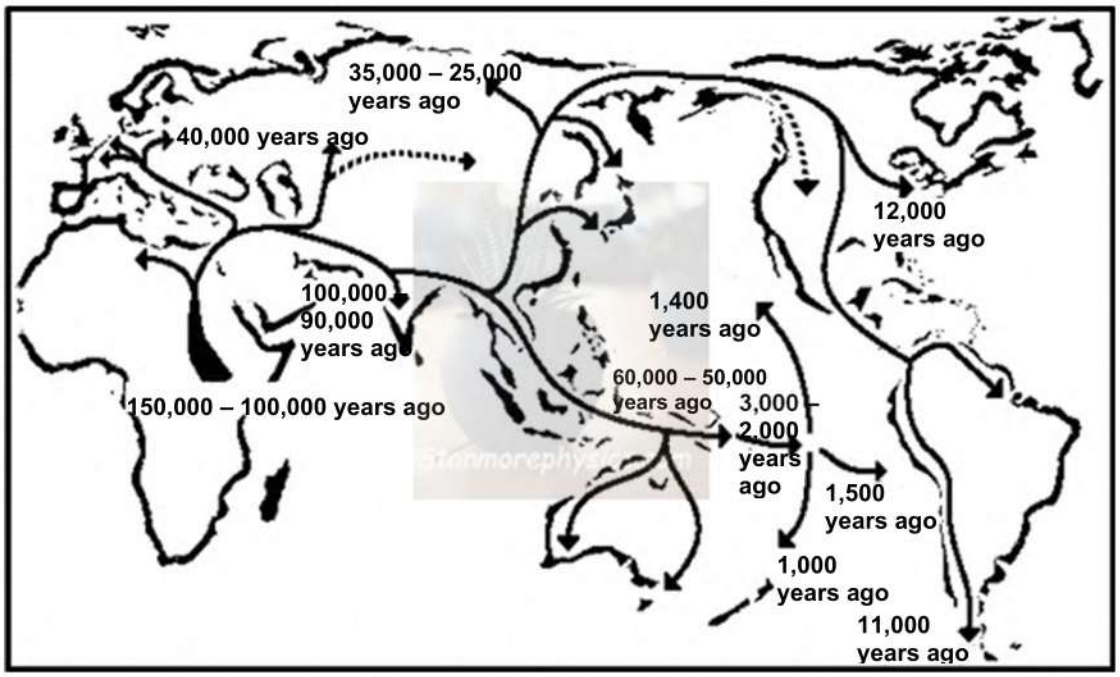
Show ALL calculations. Round-off your answer to two decimal places. (3)

3.4.7 Use the information in the table to formulate a conclusion for this survey. (2)

3.4.8 Draw a bar graph representing the 2013 – 2014 survey results for the Eastern Cape, Free State, North West and Northern Cape only. (6)

(17)

3.5 The map below represents a hypothesis used in evolution to describe the origin of modern humans based on the ages of fossils discovered worldwide.



[Source: *https://factsanddetails.com/archives/003/201810/5bd26afc8eef2.png*]

3.5.1 Identify the hypothesis represented by the map above. (1)

3.5.2 Describe how genetic evidence can support the hypothesis identified in QUESTION 3.5.1. (2)

3.5.3 Name ONE type of evidence used to support the hypothesis identified in QUESTION 3.5.1 other than genetic evidence. (1)

(4)

[50]

TOTAL SECTION B: 100

TOTAL: 150

END

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GAUTENG PROVINCE
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REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2025

MARKING GUIDELINES

LIFE SCIENCES (PAPER 2) (10832)

14 pages

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Additional notes to the marking of Life Sciences Prelims P2 2025

- Many of these are concessions, they should not be taught in class.
- Any information in brackets is not compulsory for awarding marks
- Any text that is underlined is compulsory for the answer.

QUESTION 1

1.1. If the candidate gave more than one answer, they will get no marks e.g. 1.1.2 C/D X

1.2. If learners give more than one answer, or provide slash answers, they will lose the mark irrespective if the first option is correct or not. The exception is when the two terms given are different words for the same term e.g. quadraperpedalism/quadrapedal.

1.2.2 Accept quadruped

1.4.1 NOT DNA Profile (that is the collective sequence of bars of a person not the process of comparing the bars).

1.5.6 Genus name's first letter MUST be capitalized, and for the species name all MUST be in lowercase. Do not penalise if the candidate did not underline (this is a concession)

1.6.2 & 1.6.4 b) In place of Widow's peak, accept "hairline is curved, forming a point" (ALL must be included)

1.6.3.a) No mark for spermatogenesis/oogenesis (the question asked for arrow**s** not arrow), Accept spermatogenesis AND oogenesis

1.6.4 a) No mark if there is a significant gap between the letters or a separator

e.g. HH Ff X

HH,Ff X etc.

Also don't accept if the letters are mixed HFHf X

Accept FfHH✓

1.6.4 b) In place of Freckles absent, accept "No/absent tiny brown spots"

QUESTION 2

2.1.2 The second bullet must clearly indicate that it is the two chromatids of different chromosomes that that are overlapping. Alternative wordings include.

- Chromatids of maternal and paternal chromosomes overlap
- Inner chromatids of the chromosomes/homologous pair overlap, etc.

2.2.2 Long molecule, not accepted as long has to be relative to something else, mRNA is also long relative to tRNA etc.

Accept that the two strands run anti parallel

2.2.3. Accept is "the site of translation"

2.4.2 If the learner used Complete dominance and Co-dominance as table column headings, they will get 1 mark for the table and 2 marks for the headings being the first difference.

2.4.3 Accept just A/B/AB when in line with phenotype. Learners must be encouraged to write out blood group A etc. as in a sentence A, can be confusing for markers and learners will not get marks.

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At F1 Phenotype, only look for the mention of Group A to award the mark.

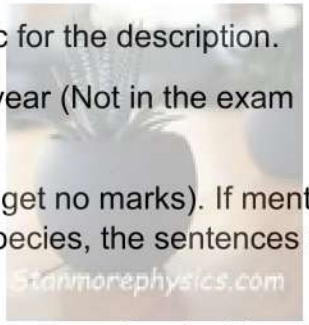
QUESTION 3

3.1.5 If the learner refers to males, no marks for those parts, e.g. males have only one X chromosome, etc.

If a learners write, females have 2 XX, that is incorrect as it means 4 X chromosomes

3.3.2 Names of species must be mentioned with the characteristic for the description.

Accept "Temporal isolation" for breeding at different times of the year (Not in the exam guidelines!)



3.3.3 The word **population** is compulsory (if not mentioned, they get no marks). If mentioned once it suffices to give the marks after that. If it is replaced with species, the sentences are incorrect.

3.4.2 (The percentage of patients with TB's) development of resistance to Isoniazid antibiotic (over the years) *Do not penalise learners for including the aspects in brackets.

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PRINCIPLES RELATING TO THE MARKING OF LIFE SCIENCES

1. **If more information than marks allocated is given**
   Stop marking when maximum marks are reached and place a wavy line and 'max' in the right-hand margin.

2. **If, for example, three reasons are required and five are given**
   Mark only the first three irrespective of whether all or some are correct/incorrect.

3. **If the whole process is given when only part of it is required**
   Read all and credit relevant part.

4. **If comparisons are asked for but descriptions are given**
   Accept if 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 the sequence is muddled and links do not make sense**
   Where the sequence and links are correct, credit. Where the sequence and links are incorrect, do not credit. If the sequence and links become correct again, resume credit.

9. **Non-recognised abbreviations**
   Accept if first defined in the answer. If not defined, do not credit the unrecognised abbreviation but credit the rest of answer if correct.

10. **Wrong numbering**
    If the 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.

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13. **If common names are given in terminology**
Accept, provided it was accepted at the memo discussion meeting.

14. **If only the letter is asked for and 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.

19. **Changes to the marking guidelines**
No changes must be made to the marking guidelines without consulting the provincial internal moderator.

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SECTION A

QUESTION 1

1.1 1.1.1 D ✓✓

1.1.2 C ✓✓

1.1.3 B ✓✓

1.1.4 B ✓✓

1.1.5 B ✓✓

1.1.6 C ✓✓

1.1.7 B ✓✓

1.1.8 D ✓✓

1.1.9 D ✓✓

1.1.10 C ✓✓

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

1.2 1.2.1 Phylogenetic tree ✓/Cladogram

1.2.2 Quadrupedalism✓/Quadrupedal

1.2.3 Cranium ✓

1.2.4 Centriole ✓/Centrosome

1.2.5 Haemophilia ✓

1.2.6 Homozygous ✓

1.2.7 Chloroplast ✓

(7 x 1) **(7)**

1.3 1.3.1 B only ✓✓

1.3.2 None ✓✓

1.3.3 A only ✓✓

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

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1.4	1.4.1	DNA profiling ✓	(1)
	1.4.2	(Child) B ✓	(1)
	1.4.3	B ✓ C ✓ **(Mark first TWO only)**	(2) **(4)**
1.5	1.5.1	(a) B ✓ (b) A ✓	(1) (1)
	1.5.2	Foramen magnum ✓	(1)
	1.5.3	Rectangular ✓/U-shaped	(1)
	1.5.4	B ✓	(1)
	1.5.5	A ✓	(1)
	1.5.6	*Homo sapiens* ✓	(1) **(7)**
1.6	1.6.1	Dihybrid ✓	(1)
	1.6.2	Widow's peak ✓ hairline	(1)
	1.6.3	(a) Gametogenesis✓/meiosis (b) Fertilisation ✓	(1) (1)
	1.6.4	(a) HHFf✓/HhFf (b) Straight hairline and freckles absent ✓	(1) (1) **(6)**

TOTAL SECTION A: 50

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SECTION B

QUESTION 2

2.1 2.1.1 (a) Cell membrane ✓ (1)

(b) Centromere ✓ (1)

2.1.2 **Crossing over** ✓*

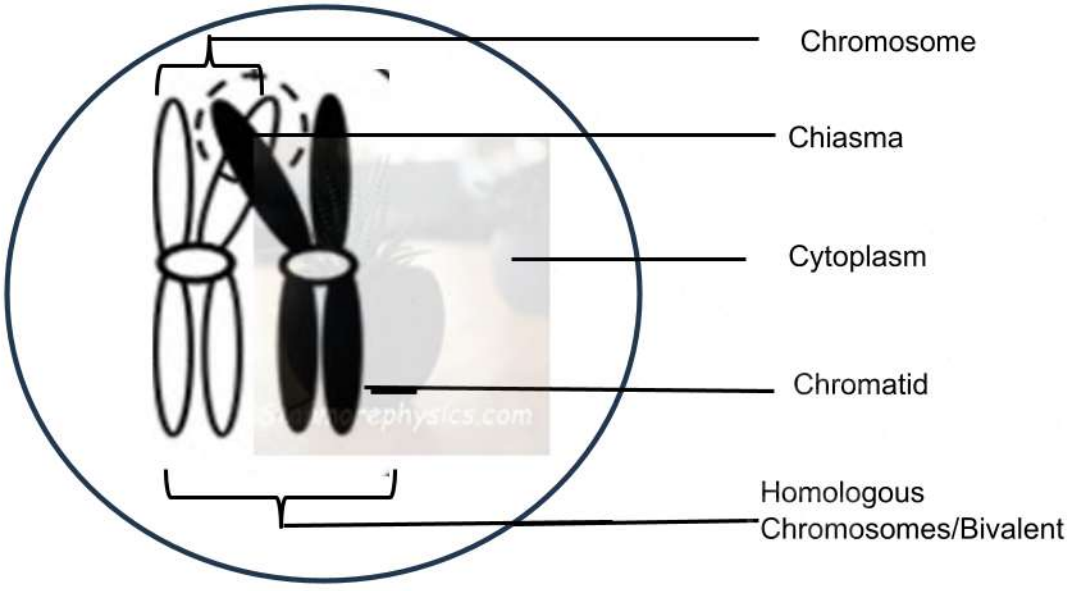
- Homologous chromosomes lie next to each other ✓
- Adjacent/non-sister chromatids of each chromosomes overlap✓.
- at points called chiasmata ✓
- and genetic material is exchanged ✓

1* Compulsory mark + Any 3 (4)

2.1.3
- The gametes that form will be genetically different ✓/introduces genetic variation in gametes
- leading to variation in the offspring ✓/increasing the gene pool.
- It provides variation for natural selection to work on ✓/offspring are better adapted to a particular environment
- The species has a better chance of survival ✓

Any 3 (3)

2.1.4 **Diagram showing (how chromosomes appear during) crossing over (in Cell B)**



Criteria	Description	Marks
Caption **(C)**	Including "crossing over"	1
Correct drawing **(D)**	Drawing showing crossing over at one point ONLY.	1
Shading **(S)**	One chromosome shaded and one chromosome unshaded	1
Labels **(L)**	1 label correct ANY 2 labels correct	1 2

(5)

(14)

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2.2 2.2.1 (a) DNA ✓/Deoxyribonucleic acid (1)

(b) mRNA ✓/Messenger RNA (1)

2.2.2
- (Molecule A/DNA) is double-stranded ✓/Nitrogenous bases are held together by weak hydrogen bonds/base pairing occurs/A–T and C–G.
- It has a double helix✓ (shape).
- It is composed of (monomers/smaller molecules called) nucleotides✓.
- It has the nitrogenous bases A, C, G and T ✓, /Has the nitrogenous base Thymine/T.
- (Nucleotides) have deoxyribose sugar ✓
- and a phosphate. ✓/sugar-phosphate backbone

(Mark first THREE only) Any (3)

2.2.3 Site for protein synthesis ✓ (1)

2.2.4
- **Translation** * ✓
- Each tRNA carries a specific amino acid. ✓·
- When the anticodon on the tRNA ✓
- matches the codon on the mRNA ✓
- the tRNA brings the required amino acid to the ribosome. ✓
- Amino acids become attached to each other by peptide bonds ✓
- to form the required protein. ✓

1* Compulsory mark + Any 4 (5)

(11)

2.3 2.3.1
- The mutation caused a change in the sequence of nitrogenous bases in the DNA✓/the DNA base triplet changes.
- This changed the mRNA sequence✓/codon,
- which in turn changed the tRNA sequence ✓/anticodon.
- Hence, the fourth amino acid in Brian's protein is valine. ✓/Brian has two valines in his sequence/Brian has valine in place of proline. (4)

2.3.2 Eighteen ✓/18 (1)

2.3.3 GAC ✓ TGC ✓ (2)

(7)

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2.4 2.4.1 45✓% (1)

2.4.2

(Dominance in) blood group A/complete dominance	(Dominance in) blood group AB/Co-dominance
Complete dominance ✓	Co-dominance ✓
One allele is dominant, and the other is recessive ✓/recessive allele is present in the heterozygous state/ I^A is dominant over i.	Both alleles are equally dominant✓/no recessive allele is present in the heterozygous state /I^A is equally dominant to I^B.
Only the dominant allele is expressed in the phenotype ✓/ recessive allele is masked in the phenotype.	Both alleles are expressed in the phenotype. ✓

(Mark first TWO only) (2 x 2) + (1)(**T**) table with column headings ✓ (5)

2.4.3 **P**$_1$ Phenotype Blood group B X Blood group AB ✓

Genotype I^Bi X I^AI^B ✓

Meiosis

G/Gametes I^B i X I^A I^B ✓

Fertilisation

F$_1$ Genotype I^AI^B I^BI^B I^Ai I^Bi ✓

Phenotype Blood group AB
Blood group B
Blood group A ✓

P$_1$ and **F**$_1$ ✓

Meiosis and fertilisation ✓

OR

P$_1$ Phenotype blood group B X Blood group AB ✓

Genotype I^Bi X I^AI^B ✓

Meiosis

G/Gametes

Fertilisation

	I^B	I
I^A	I^AI^B	I^Ai
I^B	I^BI^B	I^Bi
1 Mark for correct gametes ✓ 1 Mark for correct genotype ✓		

F$_1$ Phenotype Blood group AB
Blood group B
Blood group A ✓

P$_1$ and **F**$_1$ ✓

Meiosis and fertilisation ✓

Any (6)

(12)

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2.5 2.5.1 Autosome ✓/autosomal (1)

2.5.2 Undifferentiated/unspecialised cells ✓ that can become into any type of cell/tissue✓ in the body. (2)

2.5.3
- Stem cells with the CCR5-mutation can develop into new white blood cells, ✓
- with a protein that has a different shape, ✓
- therefore, the HI virus cannot attach to the white blood cells ✓
- and cannot infect the white blood cells. ✓ Any (3)

(6)
[50]

QUESTION 3

3.1 3.1.1
- Shawl scrotum✓/scrotum surrounds the penis
- Undescended testes ✓

(Mark the first TWO only) Any (2 x 1) (2)

3.1.2 An allele that is masked in a heterozygous state/by the dominant allele ✓ and, therefore, is not expressed in the phenotype. ✓
OR
An allele that is only expressed in the phenotype ✓ when in a homozygous state. ✓ (2)

3.1.3 3 ✓/Three (1)

3.1.4 (a) Male with AAS ✓ (1)
(b) X^AX^a ✓ (1)

3.1.5
- Females have two X chromosomes ✓/XX.
- If they inherit one X chromosome with the recessive allele (for AAS), they may have another X chromosome that has a dominant allele. ✓/Females can be heterozygous/ $\mathbf{X^A\ X^a}$.
- The dominant allele/$\mathbf{X^A}$ will mask the recessive allele/$\mathbf{X^a}$. ✓/in the heterozygous form they will not have AAS.
- Only if they have two recessive alleles/$\mathbf{X^a\ X^a}$ will they have AAS. ✓ Any (3)

(10)

3.2 3.2.1
- Reduces genetic variation ✓
- It is expensive. ✓

(Mark the first TWO only) (2)

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3.2.2
- The nucleus of the ovum is haploid ✓/has half the chromosome number of a dog (the species)/does not have the complete genetic code
- and it does not contain the desired DNA/genetic information of the dog being cloned. ✓/it has the genetic material of another female dog.

OR

- When the nucleus of the skin cells is inserted in the ovum, it creates a diploid cell ✓/cell that has the full chromosome number of a dog
- and has all the desired DNA ✓/genetic information for the dog being cloned only.

OR

- If it was left, the result would be haploid plus diploid ✓/too many chromosomes/triploid.
- Which could be unviable ✓/Cause disorders/could be miscarried/spontaneous abortion. (Any 2 x 2) (4)

(6)

3.3 3.3.1
- Similar organisms ✓/(Organisms) with similar characteristics
- Capable of interbreeding ✓
- Can produce fertile offspring ✓ (3)

3.3.2
- Species-specific courtship behaviour ✓
- *H. ornate males make a strong chorus, while P. adspersus males make a deep, low-pitched whoop.* ✓
- Breeding at different times of the year ✓
- *H. ornate* breeds in summer, while P. *adspersus* breeds in spring. ✓ (4)

3.3.3
- If a **population** of a single species becomes separated by a geographical barrier ✓/example
- then the **population** splits into two. ✓
- There is now no gene flow between the two **populations**. ✓
- Since each **population** may be exposed to different environmental conditions ✓/the selection pressure may be different,
- natural selection occurs independently ✓ in each of the two **populations**
- such that the individuals of the two **populations** become different, ✓
- genotypically and phenotypically. ✓
- even if the two **populations** were to mix again, ✓
- they will not be able to interbreed. ✓

Any (6)

(13)

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3.4 3.4.1 Natural selection ✓ (1)

3.4.2 Development of resistance to Isoniazid antibiotic ✓ (1)

3.4.3. Northern Cape ✓ (1)

3.4.4
- 349 patients (with TB) were selected. ✓
- A survey was repeated in 2013 – 2014. ✓
- The survey was conducted over a period of 2 years. ✓

(Mark the first ONE only) (1)

3.4.5
- All patients had TB. ✓
- All the patients were over 18 years. ✓
- All the patients' medical records were reviewed. ✓
- All patients were from South Africa. ✓
- Development of resistance was seen for the same medication ✓/ Isoniazid/all were treated with the same antibiotic.
- Same duration of the 2 surveys ✓/2 years each

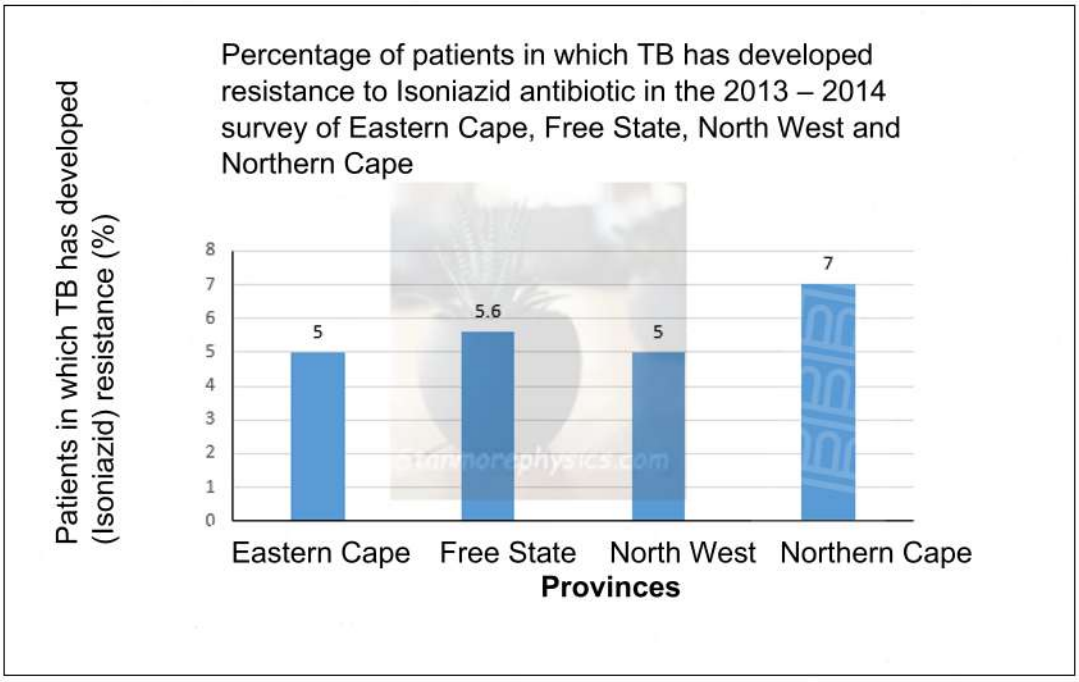
(Mark the first TWO only) (2)

3.4.6 $\frac{5,0 + 5,6 + 4,7 + 4,3 + 4,2 + 6,3 + 5,0 + 7,0 + 6,1}{9}$ ✓ ✓ **OR** $\frac{48,2}{9}$

= 5,36 ✓% (3)

3.4.7 The percentage of patients in which TB has developed resistance to Isoniazid antibiotic has increased over time✓✓ (2)

3.4.8



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Rubric for assessment of the graph

Criteria	Elaboration	Symbol	Mark
Type of graph	Bar graph drawn	**T**	1
Caption	Includes TB developed resistance to Isoniazid, years 2013 – 2014 and mention of 4 provinces/Eastern Cape, Free State, North West and Northern Cape	**C**	1
Labels	Correct label of X-axis and Y-axis (including unit %)	**L**	1
Scale	Correct scale for the Y-axis and equal spaces and width of bars on the X-axis	**S**	1
Plotting	1 – 3 co-ordinates correctly plotted ONLY 4 requested co-ordinates correctly plotted	**P**	1 2

- Histogram or line graph drawn - Lose marks for type of graph (**T**) and for scale (**S**)
- Transposed axes: - Can get full credit, if axes labels are also swapped and bars are horizontal - If labels are not corresponding, then lose marks for labels (**L**) and scale (**S**) - Check that the plotting is correct for the given labels (6)
[17]

3.5 3.5.1 Out of Africa ✓ hypothesis (1)

3.5.2 - Mitochondrial DNA/mtDNA is passed on from mother to child. ✓
- By studying mutations in Mitochondrial DNA ✓/mtDNA,
- the female line of ancestors can be traced. ✓
- It shows that the oldest female ancestor/s of modern humans is/are from Africa. ✓ Any (2)

3.5.3 Fossil ✓ evidence
(Mark the first ONE only) (1)
(4)
[50]

TOTAL SECTION B: 100

TOTAL: 150