

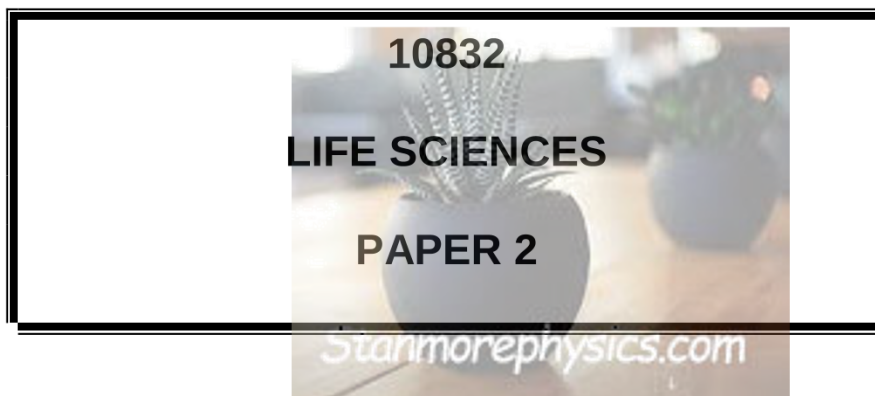


GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA



PREPARATORY EXAMINATION

2022



LIFE SCIENCES: Paper 2



10832E

TIME: 2½ hours

MARKS: 150

21 pages

X05



INSTRUCTIONS AND INFORMATION

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

downloaded from stanmorephysics.com

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 1.1.8) in the ANSWER BOOK, e.g., 1.1.9 E.

1.1.1 Which of the following is a function of meiosis?

- A Reduces genetic variation in a species
- B Cancels out the doubling effect of fertilisation
- C Doubles the amount of mitochondrial DNA
- D Slows down evolutionary changes in a species

1.1.2 Natural selection acts upon an organism's ...

- A habitat.
- B genotype.
- C phenotype.
- D environment.

1.1.3 Give the correct sequence of events which occur during METAPHASE 1 and ANAPHASE 1 of meiosis, respectively:

- (i) Homologous chromosomes arrange themselves at the equator.
- (ii) Chromosomes are pulled to the poles.
- (iii) Spindle fibres shorten.
- (iv) Spindle fibres attach to the centromere.

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

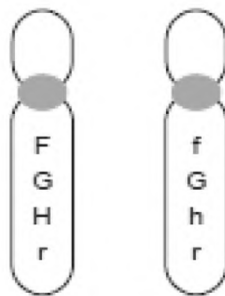
1.1.4 A genetic disorder that results in the absence of blood-clotting factors is ...

- A polydactyly.
- B albinism.
- C Down syndrome.
- D haemophilia.

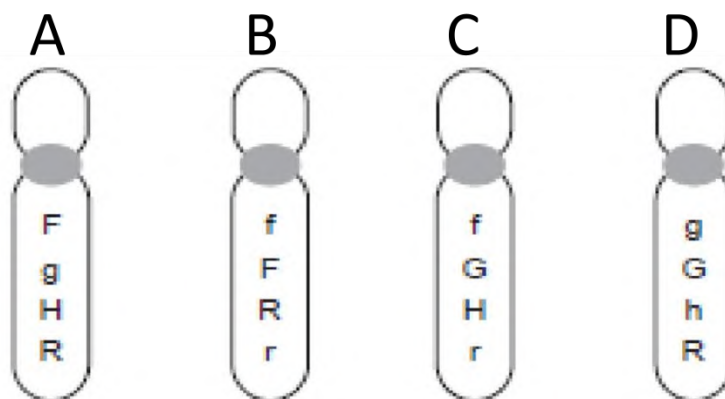
1.1.5 Which process will result in genetic variation in gametes at the end of meiosis?

- A Crossing-over
- B Cytokinesis
- C Random fertilisation
- D DNA replication

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



Possible chromosomes in the ova produced would include:



1.1.7 Hominids are believed to have evolved in Africa because ...

- A the oldest hominid fossils have been found in Africa.
- B the most hominid fossils have been found in Africa.
- C monkey fossils were found in Africa.
- D Africa is the oldest continent.

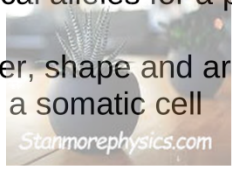
1.1.8 The scientist who discovered *Australopithecus sediba* in the Cradle of Humankind is:

- A Raymond Dart
- B Mary Leakey
- C Lee Burger
- D Donald Johanson

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

P.T.O.

- 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 Point of contact between two homologous chromosomes where the exchange of genetic material occurs
- 1.2.3 The monomer of a nucleic acid
- 1.2.4 Opening in the base of the skull through which the spinal cord passes
- 1.2.5 A genetic disorder due to the absence of proteins in the photoreceptors of the eye
- 1.2.6 Two identical alleles for a particular characteristic
- 1.2.7 The number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell



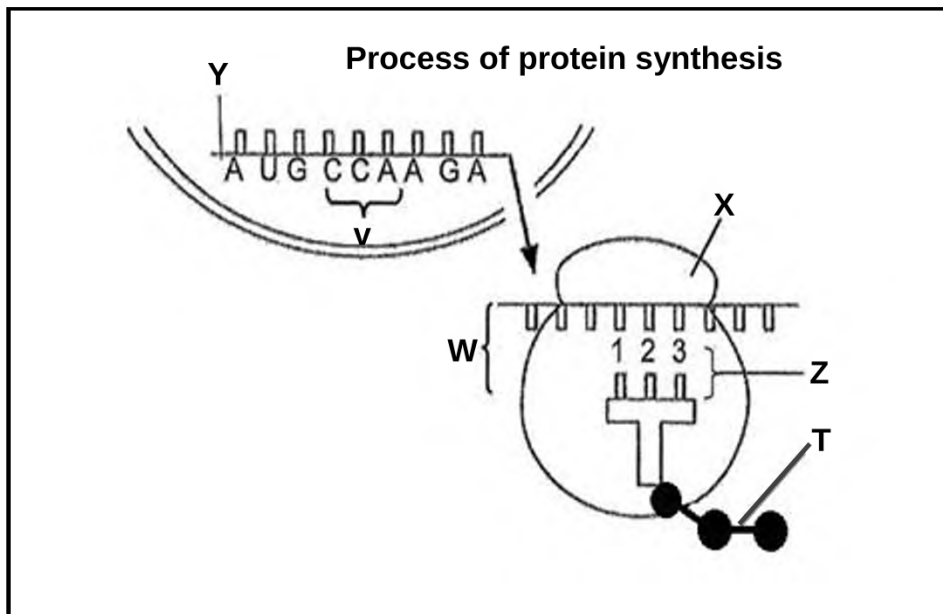
(7 x 1) **(7)**

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 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Different pairs of alleles of a gene which separate independently during gamete formation	A	Genetic variation
		B	Mendel's law of segregation
1.3.2	One set of chromosomes	A	Triploid
		B	Diploid
1.3.3	Gonosomes present	A	Gametes
		B	Somatic cells

(3 x 2) (6)

1.4 The diagram below shows the process of protein synthesis.



1.4.1 State the TWO organelles in the cell that are directly involved in the process mentioned above. (2)

1.4.2 How many codons are present in molecule Y? (1)

1.4.3 Name the bond represented by T. (1)

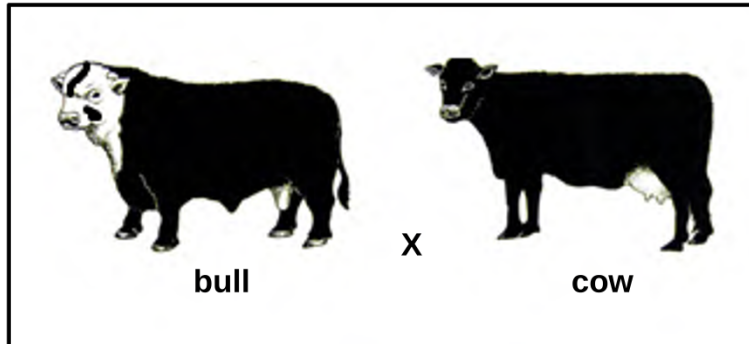
1.4.4 Give the anticodon represented by Z. (1)



(5)

- 1.5 In a certain breed of cattle, the head colour may be white, black or black and white. The alleles controlling the inheritance of the colour of the hair on the head is **W** (white hair) and **B** (black hair).

A black and white-headed bull mates with a black-headed cow.



- 1.5.1 Name the type of inheritance shown above. (1)
- 1.5.2 Give the genotype of the bull. (1)
- 1.5.3 Give the phenotypic ratios of all possible offspring. (2)
- (4)**
- 1.6 In the breeding season, male anole lizards court females by bobbing their heads (moving up and down) while displaying a colourful throat patch. The ability of anoles to bob their heads fast (**B**) is dominant over slow-bobbing heads (**b**).

The allele for red throat patches (**R**) is dominant over yellow throat patches (**r**).

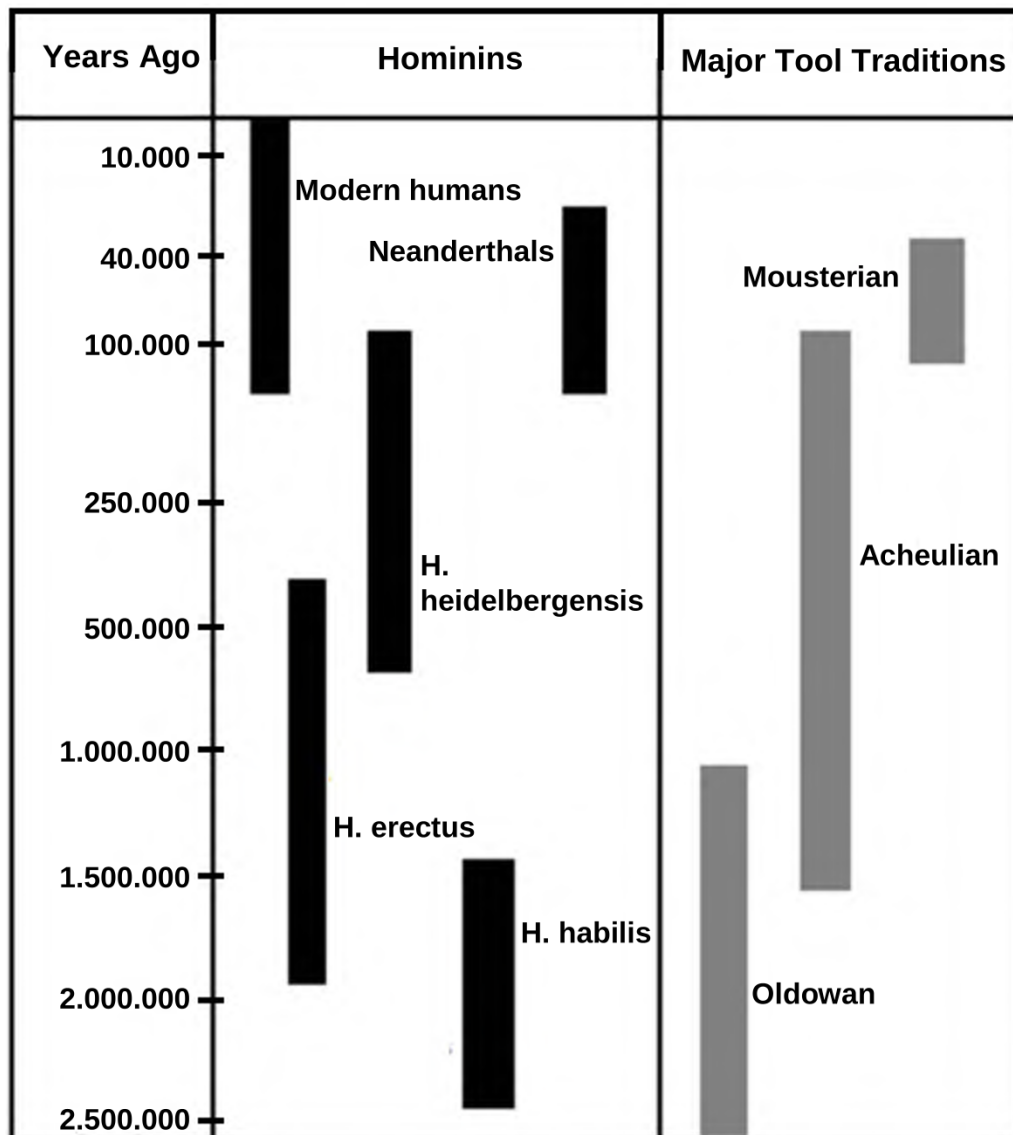
A male lizard heterozygous for head bobbing and homozygous for the red throat patch mates with a female that is also heterozygous for head bobbing but has a yellow throat patch.



- 1.6.1 State the type of genetic cross represented above. (1)
- 1.6.2 Give the:
- (a) Genotype of the female lizard (2)
- (b) Possible gametes produced by the male lizard (2)
- 1.6.3 State the reproductive isolation mechanism illustrated in this example. (1)
- (6)**

- 1.7 Hominins are a group that consists of modern humans, extinct human species, and all of their immediate ancestors.

Evidence of tools that were used by hominins that has been found is classified into three tool traditions: Oldowan, Acheulian and Mousterian.



- 1.7.1 Name the type of evidence for evolution that is represented by tool traditions. (1)
- 1.7.2 Give the scientific name of modern humans. (1)
- 1.7.3 Which hominin(s) used the oldest tool tradition? (2)
- 1.7.4 Which tool tradition is associated with *H. heidelbergensis*? (1)
- 1.7.5 Suggest which tool tradition was the most advanced. (1)

(6)

TOTAL SECTION A: 50

P.T.O.

SECTION B

QUESTION 2

2.1 Four soldiers are missing from an army unit. The unit finds the body of one of the missing soldiers who has been killed in an explosion. There are no identifiable features on the body and the identification tags are missing.

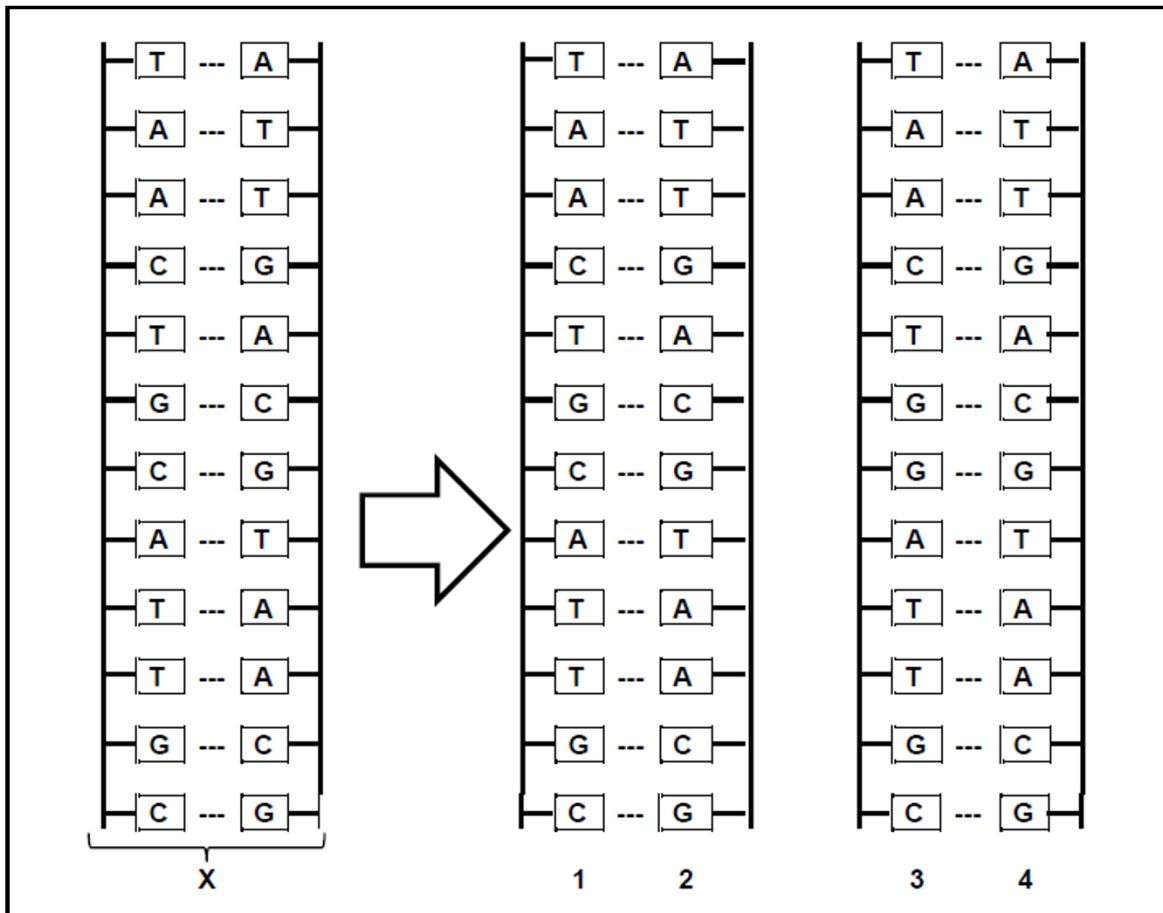
The army asks the parents of the four missing soldiers for a DNA sample so that they can compare the DNA profiles of the parents with the DNA profile of the soldier that was killed.

Soldier	Parents		Parents		Parents		Parents	
	A	B	C	D	E	F	G	H
█				█	█	█	█	█
█	█	█	█		█		█	
█		█	█		█	█		
█		█	█	█				█
█	█			█				█
█	█		█		█	█		
█	█			█		█		
█		█		█		█		█
█		█	█				█	

- 2.1.1 Which set of parents are the parents of the dead soldier? (1)
- 2.1.2 Explain your answer to QUESTION 2.1.1. (2)
- 2.1.3 Mention ONE other use of DNA profiling. (1)



2.2 The diagram below represent DNA replication.



- 2.2.1 Name the phase of the cell cycle during which DNA replication takes place. (1)
- 2.2.2 Identify the type of error that occurred in strand 3. (1)
- 2.2.3 Give the base pair showing the error referred to in QUESTION 2.2.2. (1)
- 2.2.4 Describe the consequences of the error during DNA replication. (2)
- 2.2.5 Tabulate TWO differences between DNA replication and transcription. (5)
- (10)**

2.3 Table 1 shows the DNA base triplets that code for different amino acids.

Table 1

Amino acid	Base triplet of DNA template
Proline	GGG
Phenylalanine	AAA
Glycine	CCT
Lysine	TAT
Tryptophan	CGT
Alanine	TTA

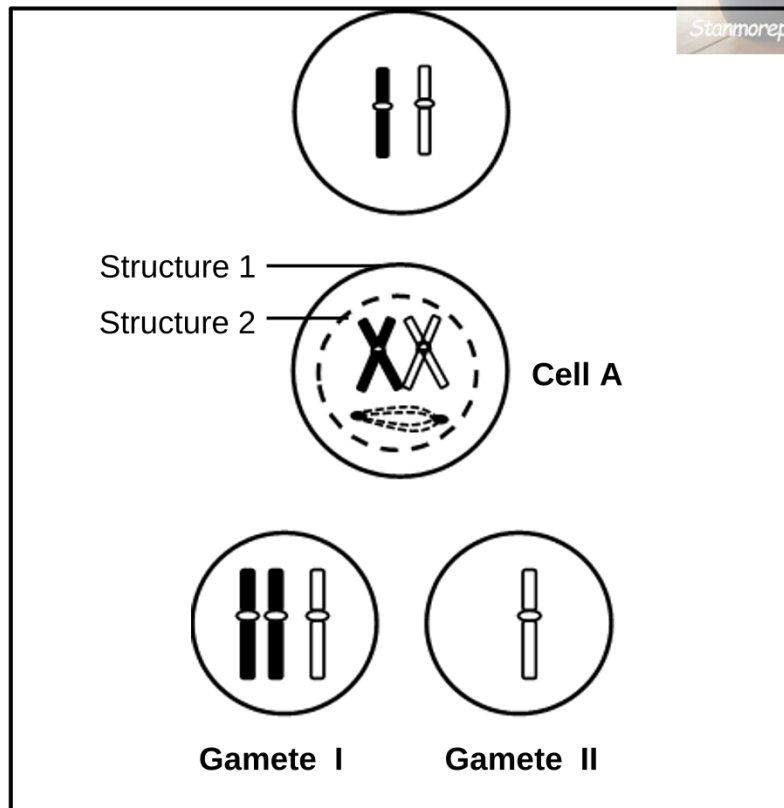
Table 2 shows a part of the sequence of anticodons that code for a polypeptide.

Table 2

AMINO ACID	1	2	3	4
ANTICODON	UUA	CCU	AUA	UUA

- 2.3.1 Identify, using the tables above, amino acids **2** and **4**. (2)
- 2.3.2 How many amino acids will be coded for by the anticodons in Table 2? (1)
- 2.3.3 Name and describe the process that uses anticodons to make proteins. (5)
- (8)**

2.4 The diagram below shows an error that occurred during meiosis in humans.



- 2.4.1 According to the diagram, during which phase of meiosis did the error mentioned occur? (1)
- 2.4.2 (a) Which structure (**1** or **2**) in Cell **A** is the nuclear membrane? (1)
 (b) How many chromosomes are shown in the diagram? (1)
- 2.4.3 State the origin of the chromosomes in Cell **A**. (2)
- 2.4.4 Draw a diagram of the phase in Cell **A** before the error occurred. (4)
- 2.4.5 In humans, how many chromosomes would be present in Gamete **II**? (1)
- (10)**

2.5 The table below shows the frequency of different blood groups in the world.

Blood Group	Frequency (%)
A	33,5
B	16,0
O	45,0
AB	5,5

[Source: <https://www.worldatlas.com>]

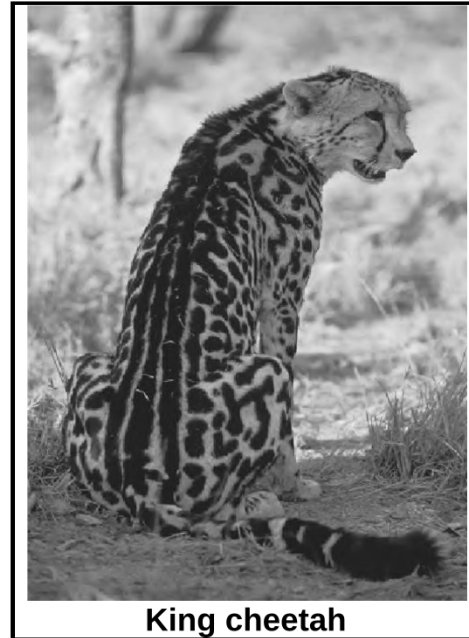
2.5.1 How many alleles ...

- (a) control blood group inheritance? (1)
(b) are passed on from mother to offspring? (1)

2.5.2 Based on the table, which is the least frequent of the blood groups? (1)

2.5.3 Plot a pie chart using the data above. (6)
(9)

- 2.6 Cheetahs, *Acinonyx jubatus*, are carnivores found in the dry grasslands and woodlands of Southern Africa. Cheetahs normally have spotted fur. However, the king cheetah is a rare variety of *A. jubatus* that has inherited striped fur markings.



With declining cheetah populations in the wild, a breeding programme was started to increase the number of cheetahs to introduce into the wild. Using two breeding pairs, eight cubs were born. The first breeding pair produced four cubs and from the second pair, four cubs were also born.

The results of the two matings are shown in the table below:

Breeding pair	Parents	Offspring
1	Spotted fur x spotted fur	3 with spotted fur 1 with striped fur
2	Spotted fur x striped fur	2 with spotted fur 2 with striped fur

2.6.1 Using the alleles **N** and **n**, state the possible genotypes of the:

- (a) Striped fur cheetah (1)
 (b) Spotted fur parent in the second cross (1)

2.6.2 Which law of Mendel is demonstrated in the above investigation? (1)

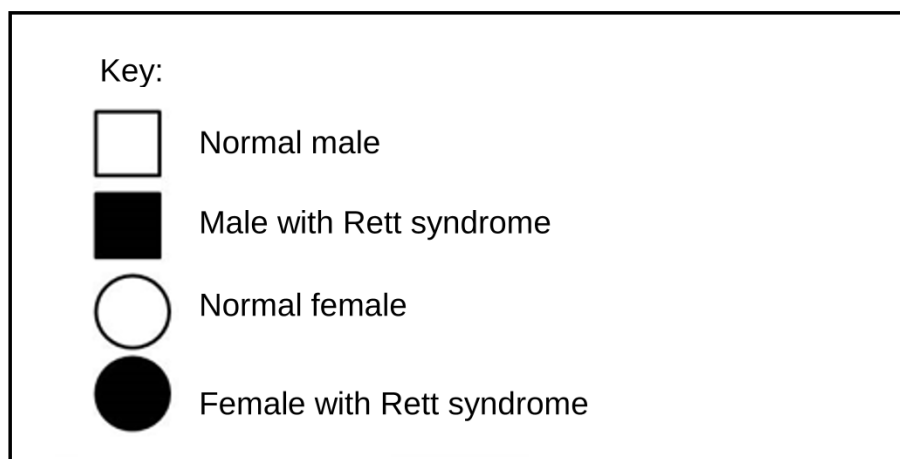
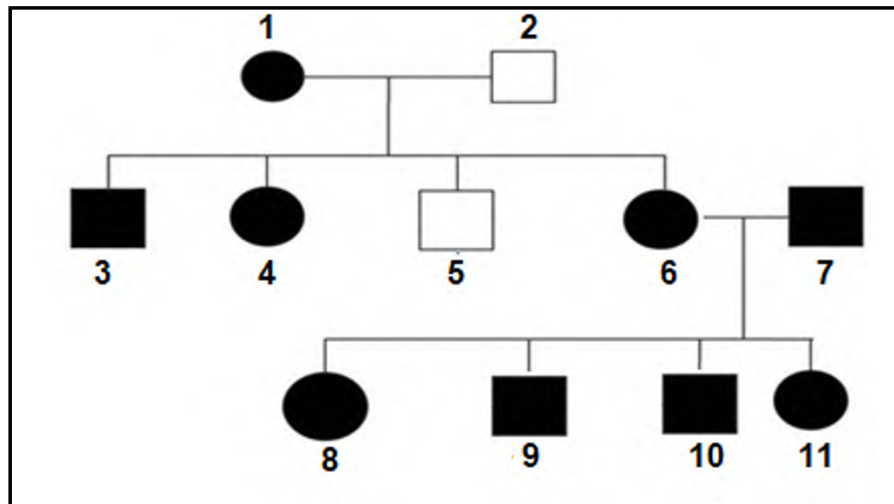
2.6.3 Use a genetic cross to show the genotype and phenotype ratio of the offspring produced by breeding pair 2. (6)
(9)

[50]

P.T.O.

QUESTION 3

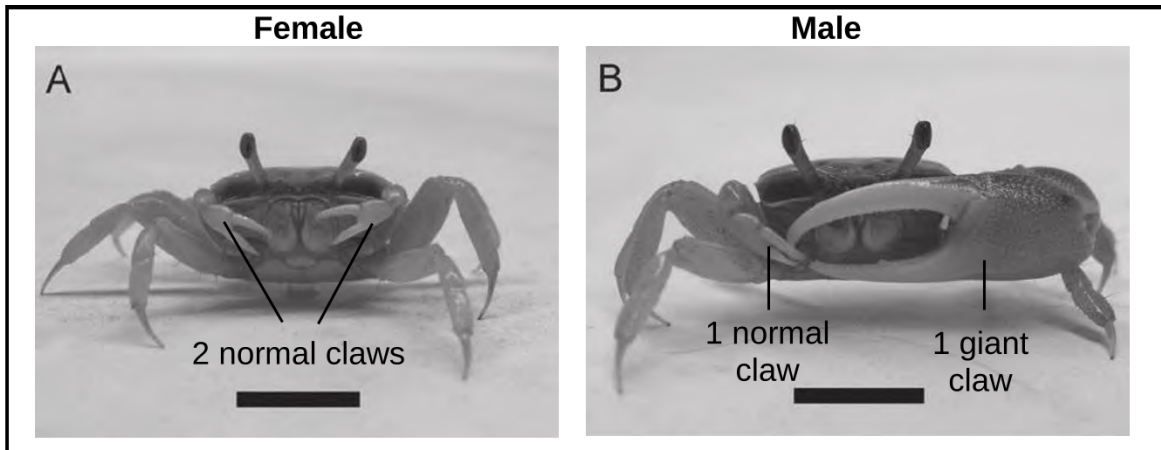
- 3.1 The pedigree diagram below traces the inheritance of a genetic disorder known as Rett syndrome resulting in extreme mental disability. It is caused by a dominant allele carried on the X chromosome (X^R).



- 3.1.1 Give evidence from the diagram which suggests that Rett syndrome is caused by a dominant allele. (1)
- 3.1.2 How many females in the family are affected by Rett syndrome? (1)
- 3.1.3 Explain why males are less likely than females, to be affected by Rett syndrome. (4)
- 3.1.4 Individual 9 marries an unaffected female.
- (a) What is the percentage probability of having affected daughters? (1)
- (b) Give the daughters' genotype. (1)
- (8)**

- 3.2 The male fiddler crab has one normal sized claw and one giant sized claw (Photograph **B**). Female fiddler crabs have two small claws that are the same size (Photograph **A**).

There is a range of sizes of giant claws in the male fiddler crab population. The male waves the giant claw to attract females during mating season.

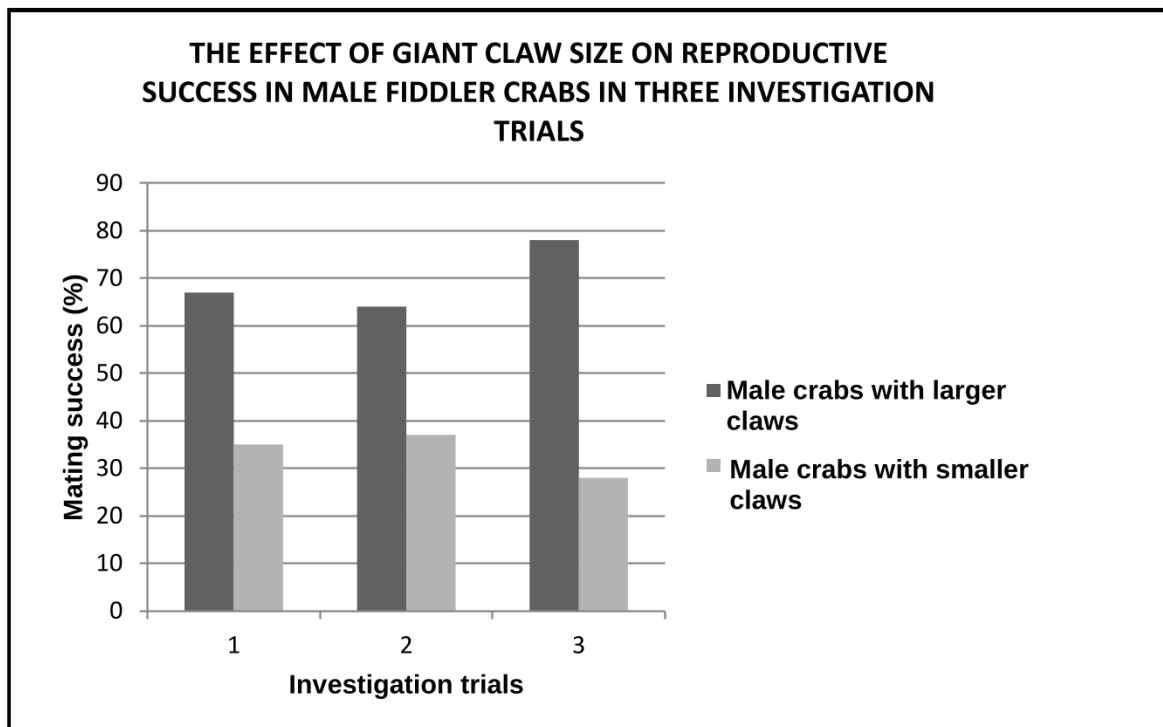


A researcher investigated the importance of the claw size of males for successful mating during three trials.

He placed:

- 15 male fiddler crabs with different sized giant claws into a cage
- 15 female fiddler crabs into the same cage

The bar graph below shows the percentage of male crabs with different giant claw sizes that successfully mated during the three investigations.



3.2.1 Identify the:

(a) Independent variable

(1)

(b) Dependent variable

(1)

3.2.2 Describe how the researcher ensured the reliability of the investigation.

(1)

3.2.3 Give TWO ways in which the researcher ensured that the results were valid.

(2)

3.2.4 Explain ONE precautionary measure that the researcher would need to take for this investigation.

(2)

3.2.5 Discuss how Lamarck would have explained the presence of the one giant claw in male fiddler crabs.

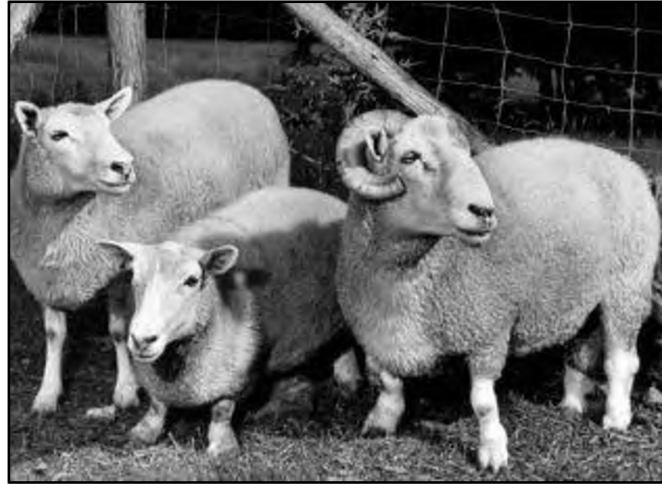
(4)

(11)



- 3.3 Ancon sheep were a domesticated sheep that were bred from a single affected lamb, born with a recessive dwarf mutation.

They had very short legs that were considered an advantage for farmers because they were unable to jump over ordinary stone walls or fences.



[Source: <https://answersingenesis.org/genetics/mutations/ancon-sheep-just-another-loss-mutation/>]

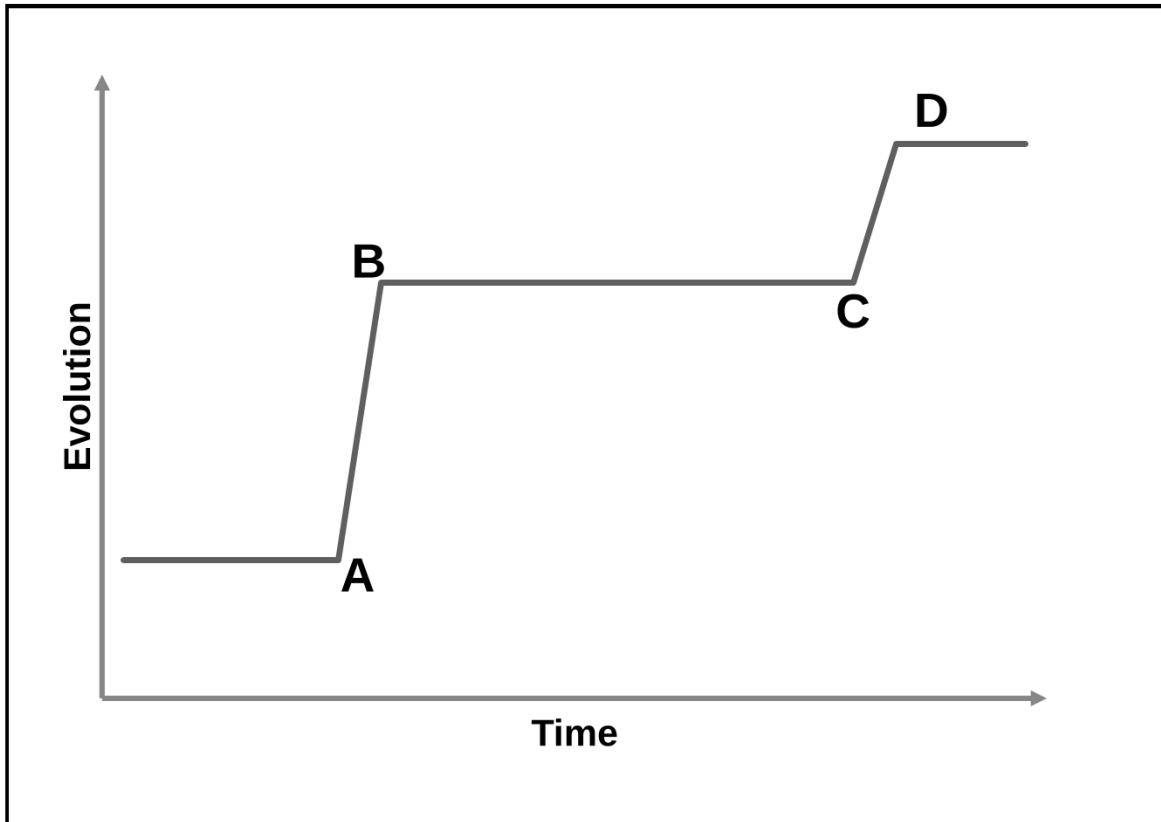
- 3.3.1 According to the text, what caused the short legs in this breed of sheep? (1)
- 3.3.2 (a) Suggest a reason why the normal legged sheep would be a problem for farmers. (1)
(b) Explain ONE benefit for the farmer keeping these Ancon sheep. (2)
- 3.3.3 Farmers used artificial selection to breed herds of Ancon sheep. Give the definition of *artificial selection*. (2)
- (6)**

- 3.4 Eastern tiger snakes (*Notechi scutatus*) living on islands off mainland Australia have longer jaws than the mainland populations of snakes. The diet of island snakes includes large prey, such as seagull chicks, while the diet of the mainland snakes consists of small prey, such as frogs and mice.



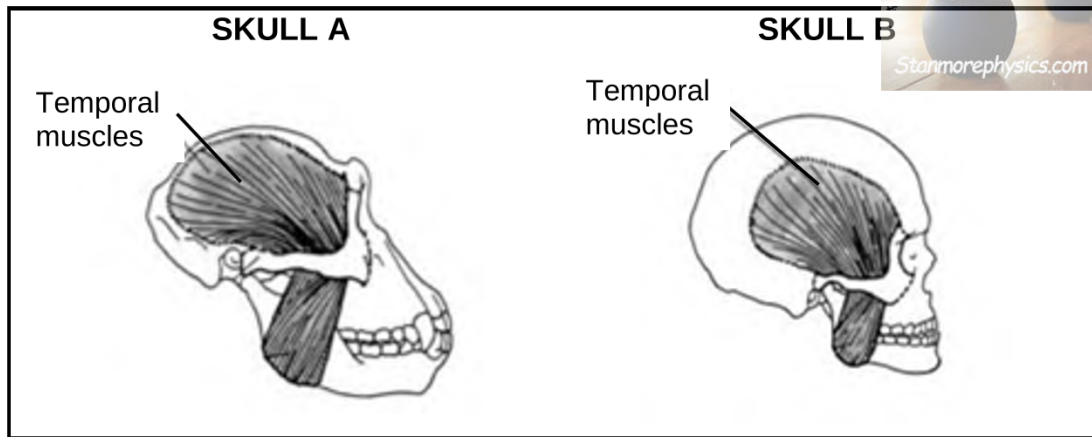
- 3.4.1 (a) Describe the jaw of the island snakes. (1)
(b) What is the staple diet of the mainland snakes? (1)
- 3.4.2 (a) Give the definition of a *species*. (2)
(b) Describe how island and mainland snakes could have evolved into different species. (7)
- (11)**

- 3.5 The graph below shows the change in the number of species as a result of punctuated equilibrium.



- 3.5.1 Give the definition of *punctuated equilibrium*. (4)
- 3.5.2 Using the letters from the graph, indicate the period of time where the environment would be stable. (1)
- 3.5.3 Are transitional fossils associated with punctuated equilibrium? (1)
- (6)

- 3.6 The diagram below shows the size of the temporal muscle in a human and an ape. Temporal muscles attach the lower jaw to the skull in both apes and humans. These muscles help to open and close the jaw when chewing food.



[Source: <https://www.pathwayz.org/Tree/Plain/APE+VS.+HOMININ+SKULLS>]

- 3.6.1 Explain how skull **A** is better adapted to eating a diet of raw food than skull **B** with respect to:
- (a) Temporal muscle and jaw size (2)
 - (b) Dentition (2)
- 3.6.2 Which skull (**A** or **B**), represents a human? (1)
- 3.6.3 State THREE other characteristics that humans share with African apes. (3)

(8)

[50]

TOTAL SECTION B: 100

TOTAL: 150

END



PREPARATORY EXAMINATION 2022

MARKING GUIDELINES

LIFE SCIENCES PAPER 2 (10832)

14 pages

PRINCIPLES RELATING TO THE MARKING OF LIFE SCIENCES

1. **If more information than marks allocated is given**
Stop marking when maximum number of marks is 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 whole process is given when only part of it is required**
Read all and credit relevant part.
4. **If comparisons are asked for and 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 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 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, 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 memo discussion meeting.

14. **If only letter is asked for and only name is given (and vice versa)**
No credit.
15. **If units are not given in measurements**
Candidates will lose marks. Memorandum 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 appears in any official language other than the learners' 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.

SECTION A

QUESTION 1

1.1	1.1.1	B ✓✓		
	1.1.2	B ✓✓		
	1.1.3	C ✓✓		
	1.1.4	D ✓✓		
	1.1.5	A ✓✓		
	1.1.6	C ✓✓		
	1.1.7	A ✓✓		
	1.1.8	C ✓✓	(8 x 2)	(16)
1.2	1.2.1	Incomplete ✓dominance		
	1.2.2	Chiasma ✓/chiasmata		
	1.2.3	Nucleotide ✓		
	1.2.4	Foramen magnum ✓		
	1.2.5	Colour-blindness ✓		
	1.2.6	Homozygous ✓		
	1.2.7	Karyotype ✓ /Karyogram	(7 x 1)	(7)
1.3	1.3.1	B only ✓✓		(2)
	1.3.2	None ✓✓		(2)
	1.3.3	Both A and B ✓✓		(2)
				(6)
1.4	1.4.1	Nucleus ✓ Ribosome ✓		(2)
	1.4.2	Three✓/3		(1)
	1.4.3	Peptide ✓ bond		(1)
	1.4.4	GGU ✓		(1)
				(5)

1.5	1.5.1	Codominance ✓	(1)
	1.5.2	BW ✓ /WB	(1)
	1.5.3	1 black and white : 1 black	
		Mark for correct phenotypes (P) ✓	
		Mark for correct ratio (R) ✓	
		Do not accept % – ratio asked	(2)
			(4)
1.6	1.6.1	Dihybrid ✓	(1)
	1.6.2	(a) Bbrr ✓✓	(2)
		(b) BR and bR ✓✓ / BR, BR, bR, bR	(2)
	1.6.3	Species-specific courtship behaviour ✓	(1)
			(6)
1.7	1.7.1	Cultural ✓evidence	(1)
	1.7.2	<u>Homo sapiens</u> ✓ (Learners must underline scientific name to get the mark. Capital 'H' for Homo genus and lower case 's' for sapien species)	(1)
	1.7.3	<i>Homo habilis</i> ✓ / <i>H. habilis</i> <i>Homo erectus</i> ✓ / <i>H. erectus</i>	(2)
	1.7.4	Acheulian ✓ / Mousterian	(1)
	1.7.5	Mousterian ✓	(1)
			(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 2.1.1 C and D ✓ (1)

2.1.2 The soldier inherits half of his DNA from his mother and half from his father. ✓
The DNA bars/black bands/black bars of the dead soldier are a combination of the DNA bars/black bands/black bars of parents C and D. ✓ (2)

- 2.1.3
- identification of criminals ✓/forensic evidence
 - identification of genetic disorders ✓
 - developing cures for genetic disorders ✓
 - tissue type for organ transplant ✓

Mark FIRST ONE only.

Candidates may not use identification of dead body OR paternity OR identification of relatives as these are in the question. (1)
(4)

2.2 2.2.1 Inter ✓ (phase) (1)

2.2.2 (Gene) Mutation ✓ (1)

2.2.3 G-G ✓ (1)


- 2.2.4
- incorrect nitrogenous base sequence results in different DNA strand ✓/ abnormal strand
 - will result in wrong genetic code ✓ for daughter cells formed/ wrong/nonsense/different proteins could be formed (2)

2.2.5 Table showing differences between DNA replication and transcription

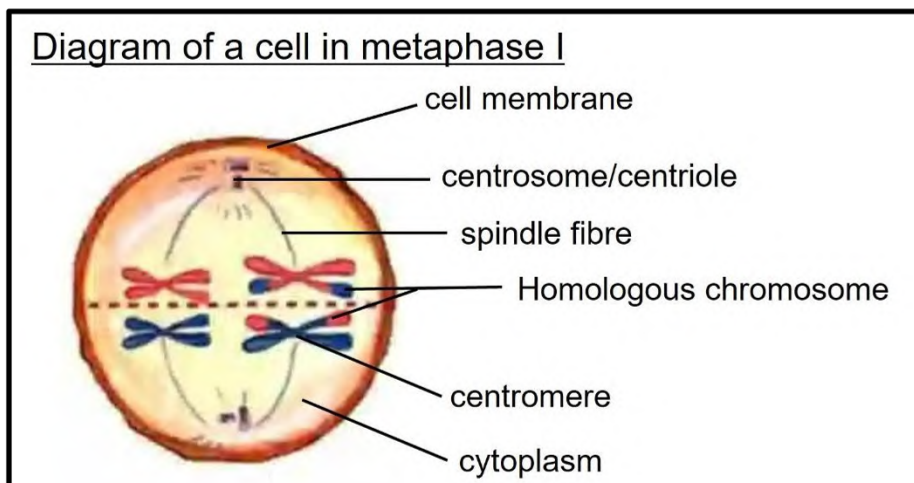
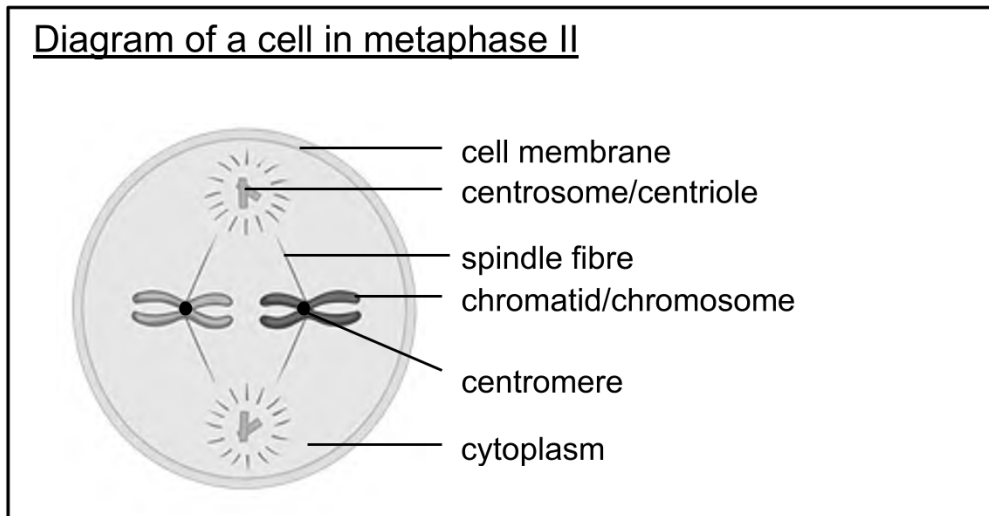
DNA replication	Transcription
A whole DNA molecule used ✓	A part (gene) of the DNA unwinds exposing the gene ✓
An (identical) DNA molecule is formed ✓ /double strand of DNA	An mRNA molecule is formed ✓ / single strand of RNA
Important for cell division/mitosis/meiosis ✓	Important for protein synthesis ✓
Both strands of DNA act as templates ✓	One strand of DNA acts as a template ✓
DNA nucleotides are used ✓	RNA nucleotides are used ✓
Adenine bonds with thymine ✓	Adenine bonds with uracil ✓

Any TWO comparisons + correct table format (T ✓) (5)
Mark first TWO only

(10)

2.3	2.3.1	2 – glycine ✓ 4 – alanine ✓		(2)
	2.3.2	Three ✓/3 OR four/4		(1)
	2.3.3	Translation ✓ *		
		<ul style="list-style-type: none"> – Each tRNA carries a specific amino acid ✓ – when the anticodon on the tRNA ✓ – matches the codon on the mRNA ✓ – then 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* + any 4	(5)
				(8)
2.4.	2.4.1	Anaphase ✓ I/1/II /2		(1)
	2.4.2	(a) 2 ✓ (b) Two ✓/2		(1)
				(1)
	2.4.3	Paternal ✓/father Maternal ✓/mother		(2)

2.4.4



Note: The diagram in 2.4.4 must correlate to the learner's answer in 2.4.1.
 If 2.4.1. anaphase I/1 then 2.4.4 diagram of metaphase I/1
 If 2.4.1. anaphase II/2 then 2.4.4 diagram of metaphase II/2

Criteria	Marks
Caption (C)	1
Correct drawing phase (P)	1
Any TWO labels (L)	2
TOTAL	4

(4)

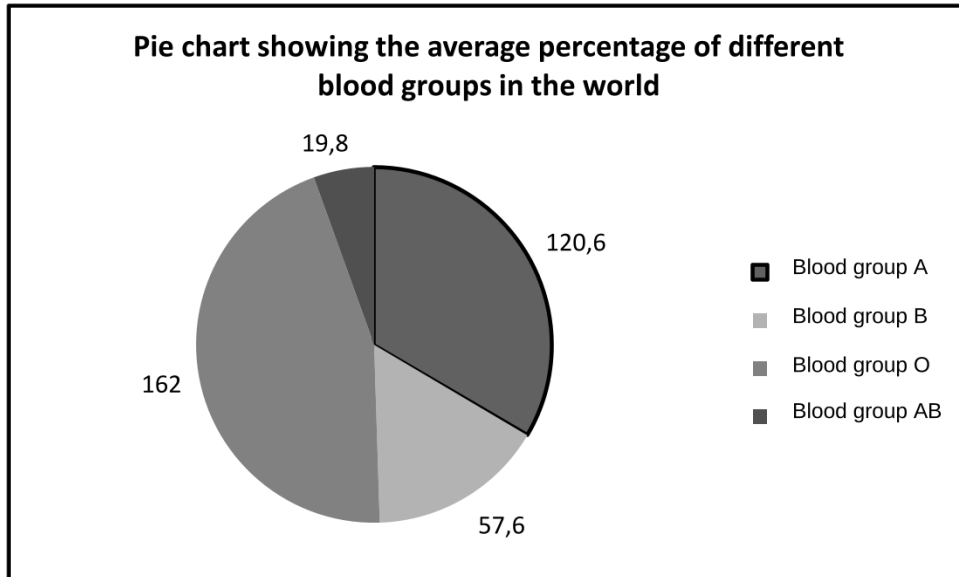
2.4.5 22 ✓
 Stanmorephysics.com

(1)
(10)

- 2.5 2.5.1 (a) Three ✓/3 (1)
 (b) One ✓/1 (1)

2.5.2 AB ✓ (1)

2.5.3



Calculations			
Total = 100			
Blood group A	Blood group B	Blood group O	Blood group AB
$= \frac{33,5}{100} \times 360$	$= \frac{16,0}{100} \times 360$	$= \frac{45,0}{100} \times 360$	$= \frac{5,5}{100} \times 360$
$= 120,6^\circ$	$= 57,6^\circ$	$= 162^\circ$	$= 19,8^\circ$

Rubric for the mark allocation of the pie chart

Heading: (H)	Both variables included	1
Type: (T)	Circle drawn with a compass and four segments shown by lines from centre to circumference	1
Plot: (P)	1 – 2 segments plotted accurately	1
	3 - 4 segments plotted accurately	2
Calculations: (C)	1 – 3 calculations correct	1
	All calculations correct	2
TOTAL		6

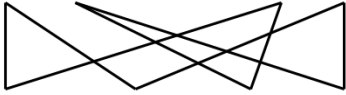
NOTE: If the wrong type of graph is drawn, marks will be lost for “correct type of graph” as well as for drawing the slices in correct proportions.

(6)
(9)

- 2.6 2.6.1 (a) nn ✓ (1)
 (b) Nn ✓ (1)

2.6.2 Law of dominance ✓ (1)

2.6.3 **P₁** Phenotype Spotted fur x striped fur ✓
 Genotype Nn x nn ✓
Meiosis
G/gametes N, n x n, n ✓
Fertilisation



F₁ Genotype Nn Nn nn nn ✓
 1 Nn : 1 nn ✓

F₁ Phenotype 2 spotted fur : 2 striped fur * ✓ OR
 1 spotted fur : 1 striped fur

*** Compulsory mark**
 P₁ and F₁ ✓
 Meiosis and fertilisation ✓
***Compulsory 1 + any 5**

OR

P₁ Phenotype Spotted fur x striped fur ✓
 Genotype Nn x nn ✓

Meiosis

Gametes	N	n
n	Nn	nn
n	Nn	nn

Fertilisation

1 mark for correct gametes ✓		
1 mark for correct genotypes ✓		

F₁ Genotype Nn Nn nn nn ✓
 1 Nn : 1 nn ✓

F₁ Phenotype 2 spotted fur : 2 striped fur * ✓ OR
 1 spotted fur : 1 striped fur

*** Compulsory mark**
 P₁ and F₁ ✓
 Meiosis and fertilisation ✓
***Compulsory 1 + Any 5**

(6)
 (9)
 [50]

QUESTION 3

3.1 3.1.1 Most of the family are affected ✓/have Rett syndrome / all females (1,4 and 6) have Rett syndrome / even the heterozygous are affected. (1)

3.1.2 5 ✓ (1)

3.1.3 **To explain the males probability:**



- Only have one X-chromosome ✓
- Either have the recessive allele thus unaffected ✓
- Or has dominant allele thus affected ✓
- Only a 50% chance of being affected ✓

Any TWO (2)

To explain the females probability:

- Have two X chromosomes ✓
- Have a 75% chance of being affected ✓
- Whether she is homozygous dominant ✓/ $X^R X^R$
- or heterozygous ✓/ $X^R X^r$

Any TWO (2)

3.1.4 (a) 100 ✓ (1)

(b) $X^R X^r$ ✓ (1)

(8)

3.2 3.2.1 (a) Claw size ✓ (1)

(b) Mating success ✓ (1)

3.2.2 Three investigations ✓were conducted./The investigation was repeated three times / used large sample size / used 15 crabs (1)

3.2.3 Use the same species/type of crab ✓
Same number of male and female crabs ✓
Same cage ✓
Mark first TWO only. (2)

3.2.4 Wear protective clothing ✓/gloves to protect against nipping from claws ✓
Provide appropriate habitat for crabs with sufficient food ✓/water/ shelter to ensure crab survival ✓
Mark first ONE only. (2)

3.2.5 According to the law of use and disuse ✓:

- All the male fiddler crabs had short claws ✓ originally
- The male fiddler crabs frequently waved ✓ their claws more,
- To attract females to reproduce ✓
- The claws eventually became bigger ✓
- The bigger claw acquired in this way was then passed on to the next generation ✓
- Eventually all the male fiddler crabs had a large claw. ✓

Any four

(4)
(11)

- 3.3. 3.3.1 Recessive dwarf mutation ✓ (must be full answer for mark allocation) (1)
- 3.3.2 (a) The sheep jumped over fences ✓ / got lost / ran away / loss of sheep / loss of revenue (1)
- (b) - Less damage to fences ✓ so reduces the need for tall fences ✓ / saves money / spends less on fence repairs.
- Short legs limited the sheep's ability to run, ✓ they were less active thus reducing the number of lost sheep. ✓
- Less money and time wasted, ✓ less need to locate sheep that jumped over the fences. ✓
- Sheep are safer, ✓ less stock loss to predators. ✓
- Cause and effect any ONE (1 x 2 = 2)** (2)
- 3.3.3 The intentional breeding of individuals ✓ by humans ✓ in a population to achieve a desirable phenotype ✓ / desirable trait. (2)
Any TWO (6)



- 3.4 3.4.1 (a) Longer ✓ jaw (1)
 (b) Frog ✓/mice/ small prey (1)
- 3.4.2 (a) A group of organisms with similar characteristics that can interbreed ✓ and produce fertile offspring. ✓ (2)
- (b) Possibility of how speciation could occur:
- The population of tiger snakes could become **separated by the sea** *✓
 - the population splits into two ✓
 - There will be no gene flow between the two populations. ✓
 - Since each population may be exposed **to different diets/prey sizes** *✓
 - natural selection could occur independently in each of the two populations ✓
 - such that the individual species of the two populations become very different from each other ✓
 - genotypically and phenotypically. ✓
 - Even if the two populations were to mix again, ✓
 - they will not be able to interbreed. ✓
 - The two populations are now different species.
- TWO compulsory marks*** Any other FIVE points (7)
(11)
- 3.5 3.5.1 – Evolution takes long periods of time ✓
 – where very little ✓/gradual/no change occurs (known as equilibrium).
 – This alternates with (is punctuated by) short periods of time ✓
 – where rapid change occurs. ✓
 – **through natural selection** ✓*
- 1 compulsory mark** + any 3 points (4)
- 3.5.2 B to C ✓ (1)
- 3.5.3 No ✓ (1)
(6)

- 3.6 3.6.1 (a) Larger ✓ (temporal muscle attaches to a larger jaw) which increases the ability to chew harder food ✓ /bite power (2)
- (b) Larger teeth ✓ /Canines increase the ability to rip and tear tough raw food ✓ (2)
- 3.6.2 (Skull) B ✓ (1)
- 3.6.3 Large brain ✓
 Eyes in front ✓
 Binocular vision ✓ /stereoscopic vision
 Eyes with cones ✓ / colour vision
 Freely rotating arms ✓
 Long/er upper arms ✓
 Rotation around elbow joints ✓
 Five fingers ✓ per hand
 Bare fingertips or nails instead of claws ✓
 Opposable thumb ✓
 Upright posture ✓
 Sexual dimorphism ✓
 Two mammary glands ✓

Mark FIRST THREE only

(3)
 (8)
 [50]

TOTAL SECTION B: 100

TOTAL: 150