GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA



PREPARATORY EXAMINATION

2022

10832

LIFE SCIENCES

PAPER 2

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TIME: **2½ hours**

MARKS: **150**

21 pages

LIFE SCIENCES: Paper 2

10832E

X05

P.T.O.

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.

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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 1.1.8) 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 ...

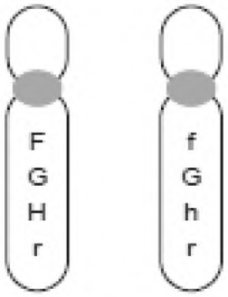
A polydactyly.
B albinism.
C Down syndrome.
D haemophilia.

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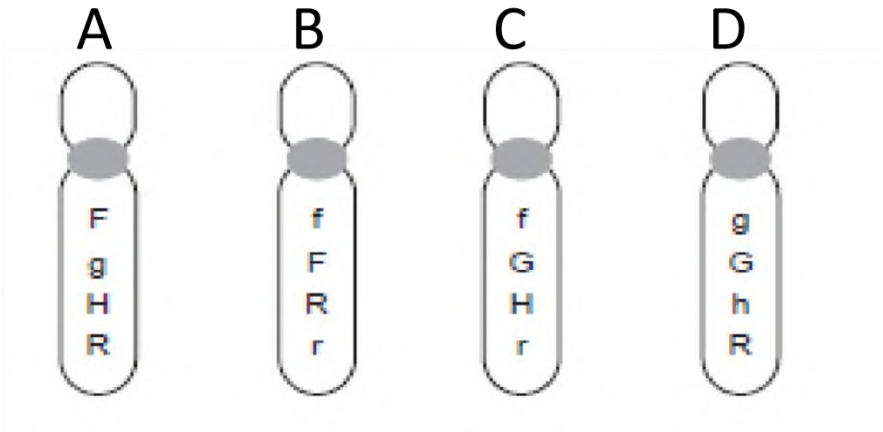
1.1.5 Which process will result in genetic variation in gametes at the end of meiosis?

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)**

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

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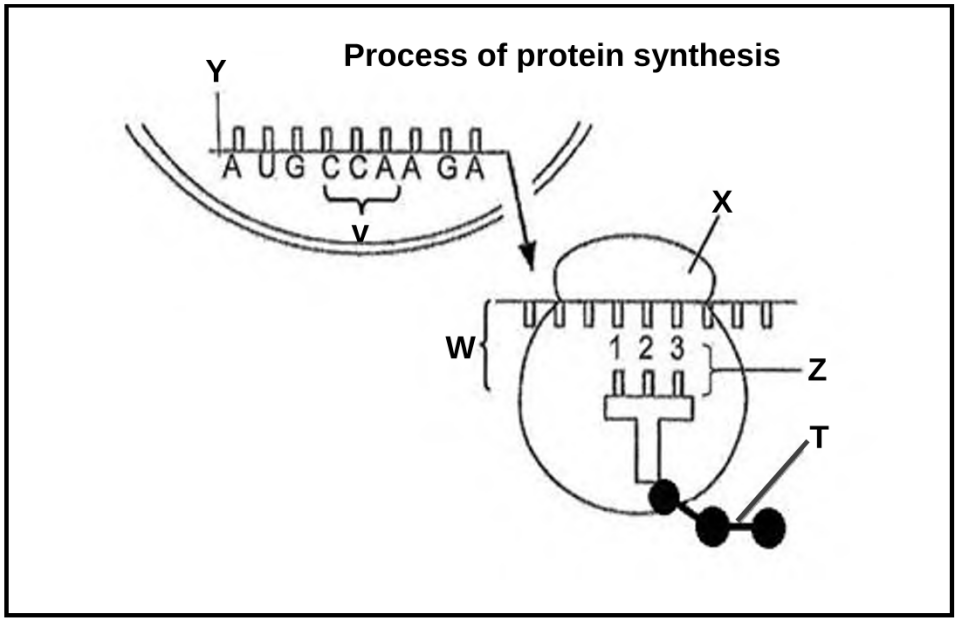
(7 x 1) **(7)**

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)

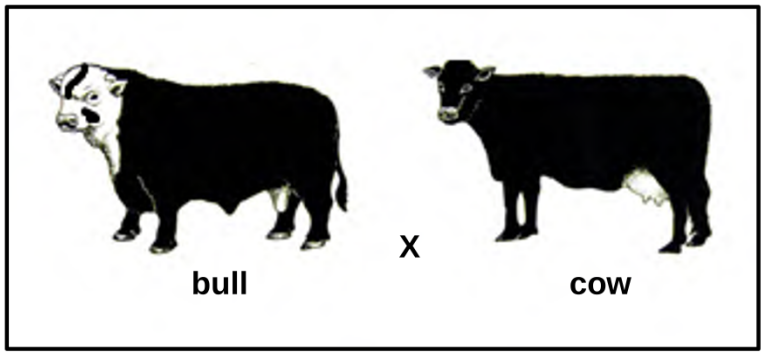
1.4.3 Name the bond represented by **T.** (1)

1.4.4 Give the anticodon represented by **Z**. (1)
(5)

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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)

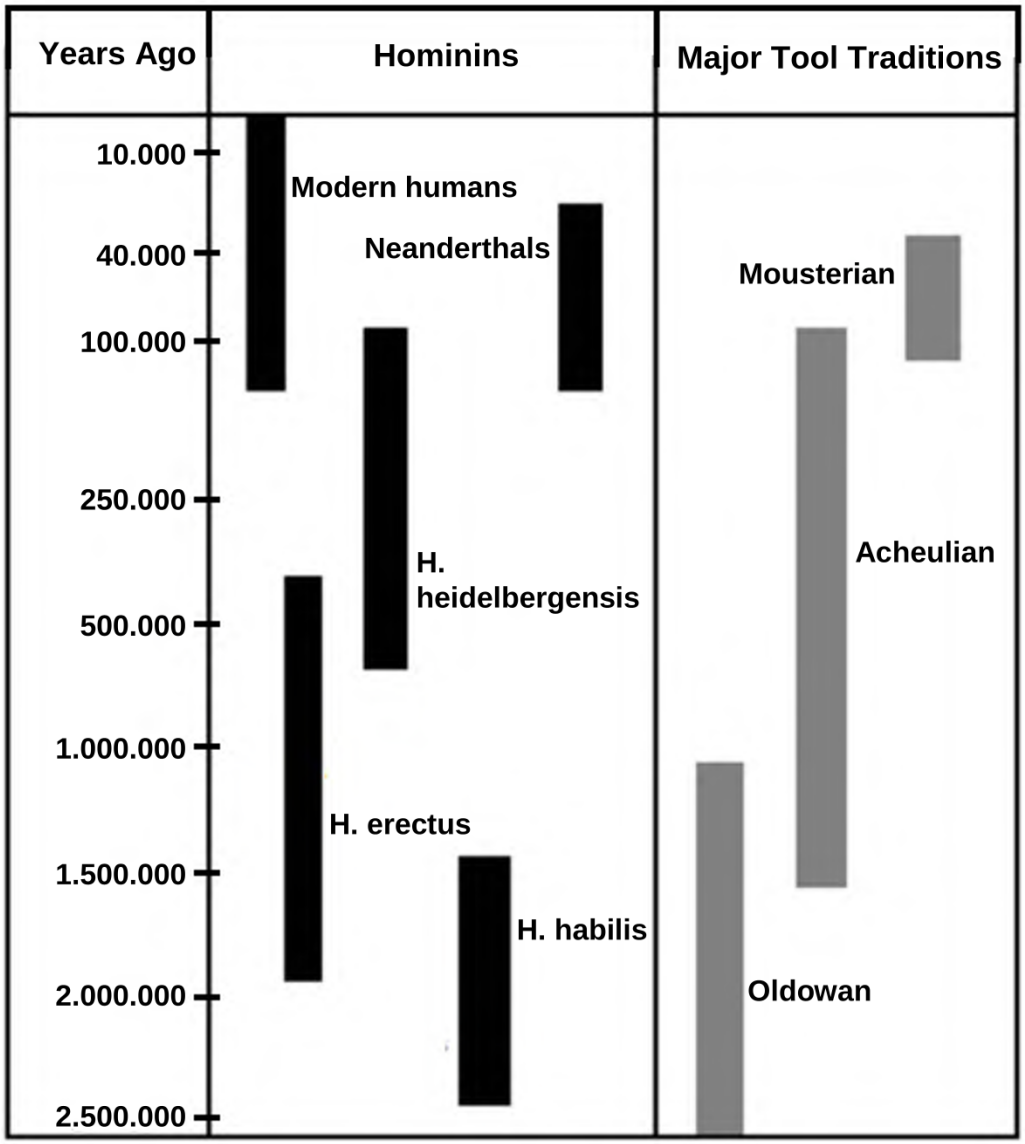
1.6.2 Give the:

(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)

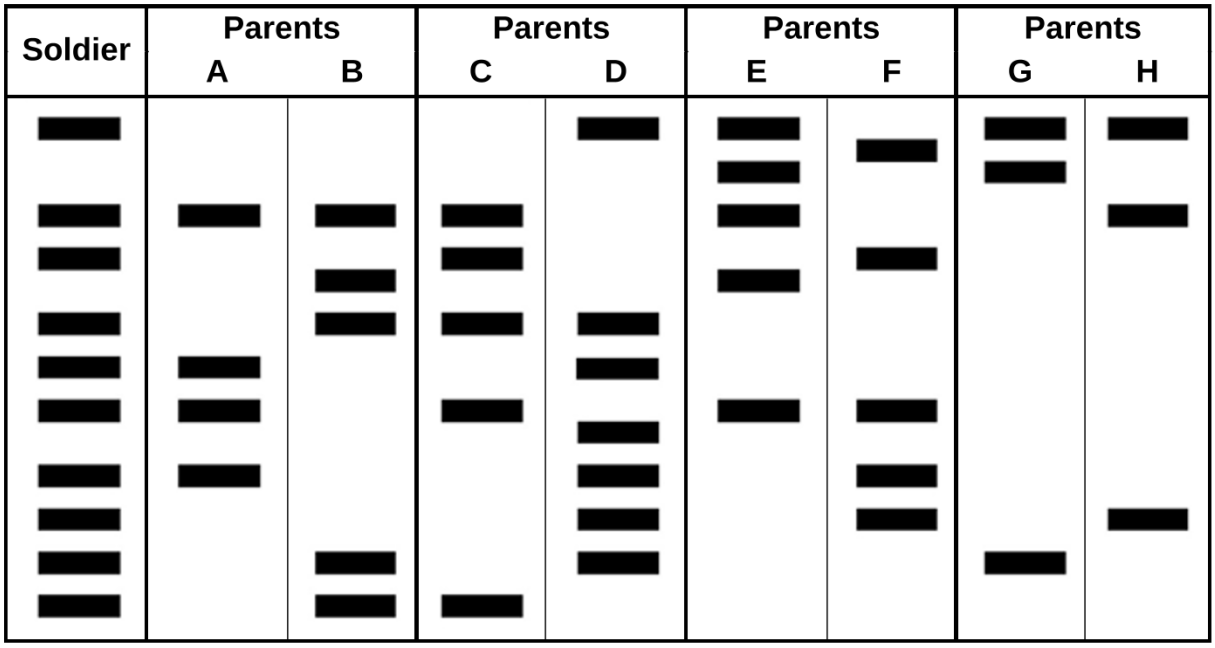
TOTAL SECTION A: 50

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.



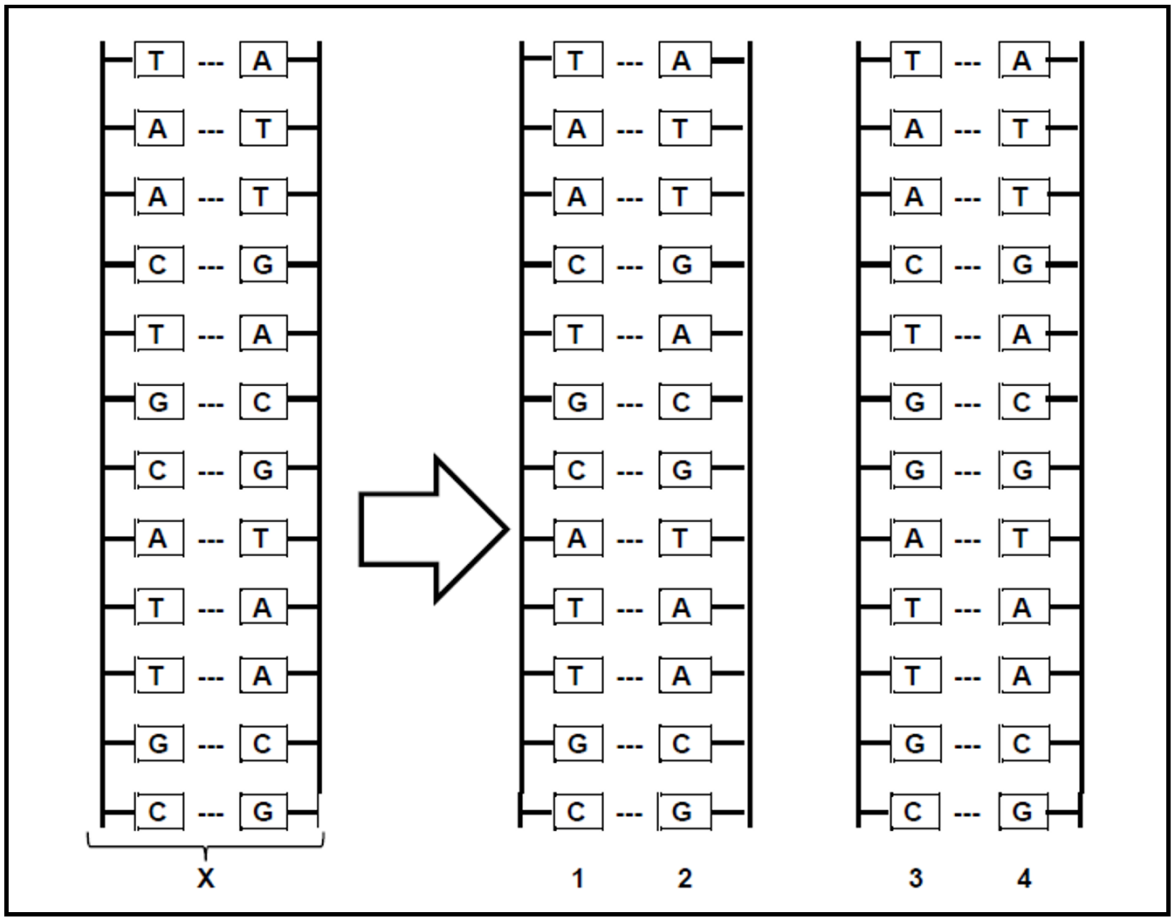
2.1.1 Which set of parents are the parents of the dead soldier? (1)

2.1.2 Explain your answer to QUESTION 2.1.1. (2)

2.1.3 Mention ONE other use of DNA profiling. (1)
(4)

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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

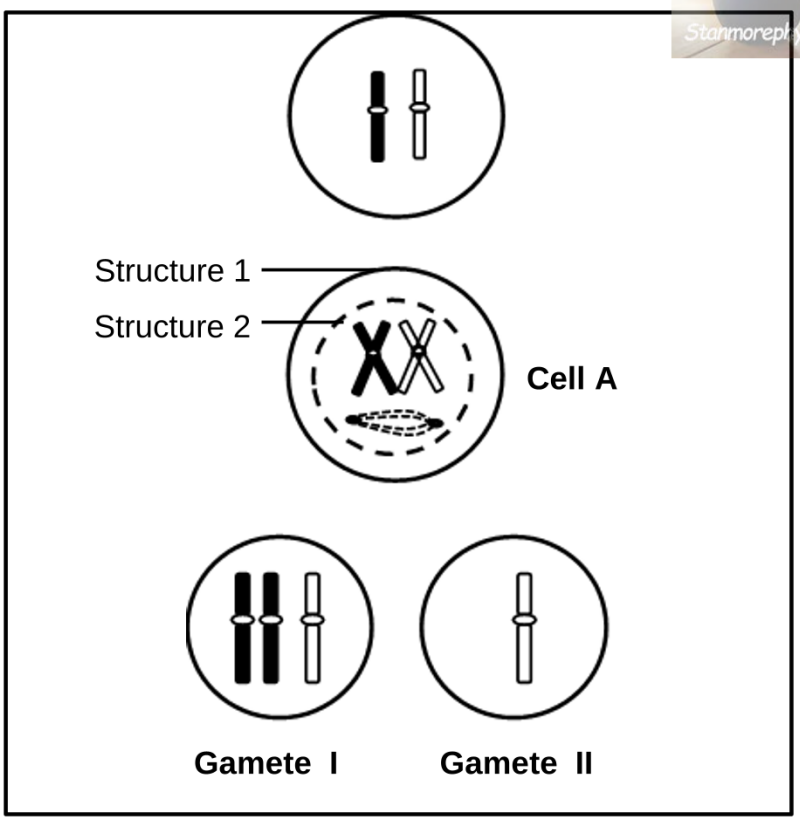
AMINO ACID	**1**	**2**	**3**	**4**
ANTICODON	UUA	CCU	AUA	UUA

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)

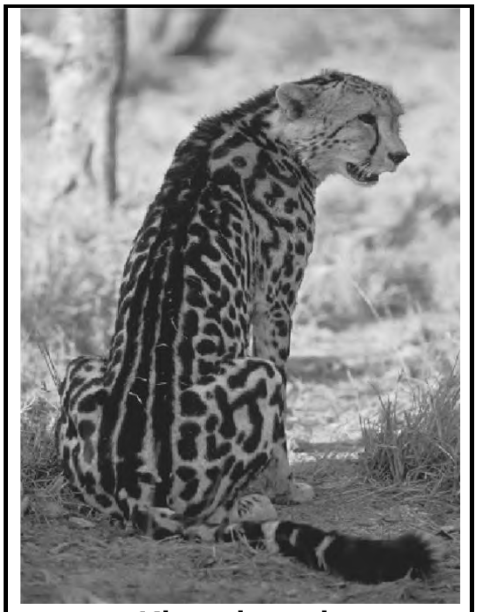
2.5.2 Based on the table, which is the least frequent of the blood groups? (1)

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.



Cheetah with spots



King cheetah

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)

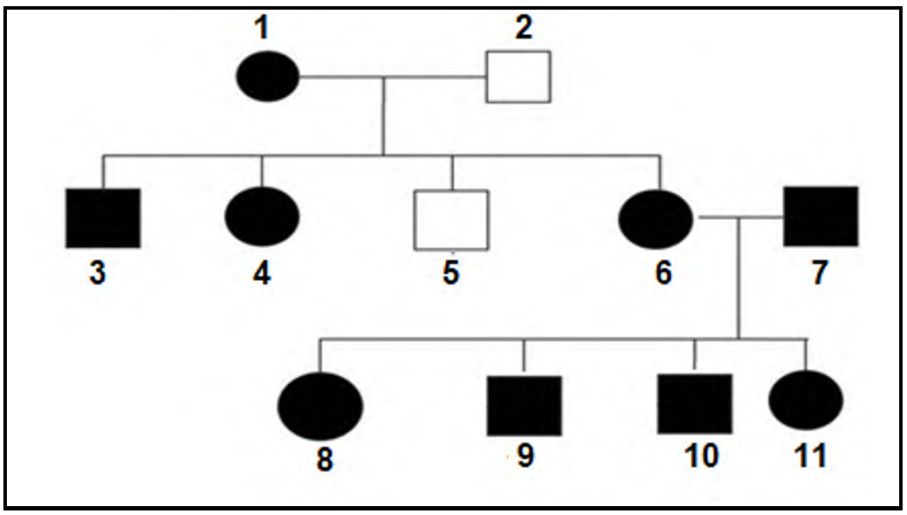
2.6.3 Use a genetic cross to show the genotype and phenotype ratio of the offspring produced by breeding pair **2**. (6)
(9)

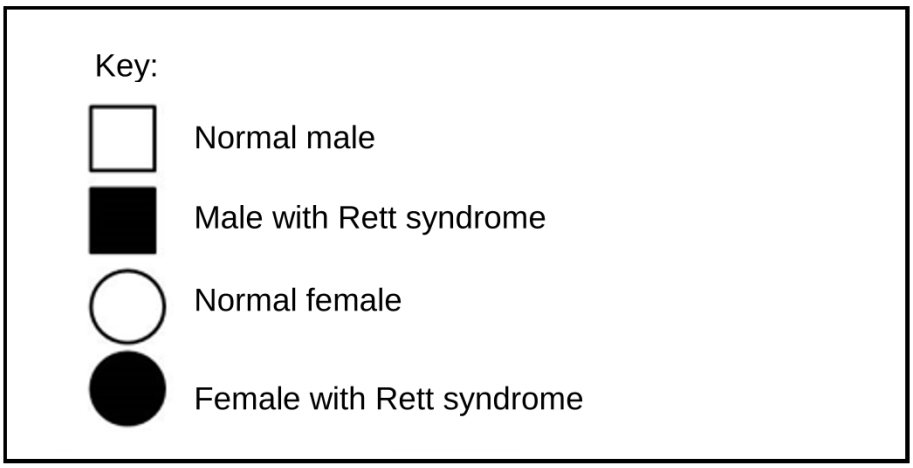
[50]

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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)

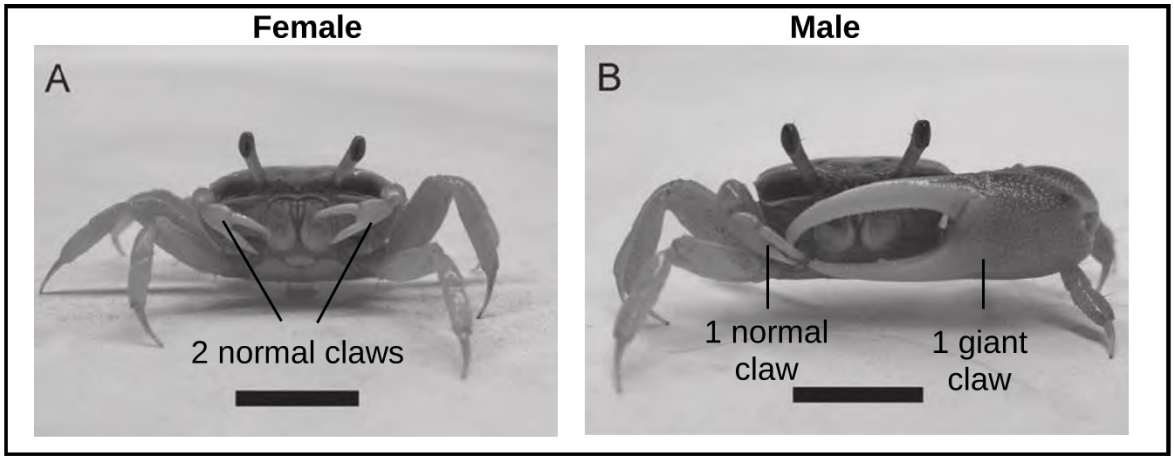
3.1.3 Explain why males are less likely than females, to be affected by Rett syndrome. (4)

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.

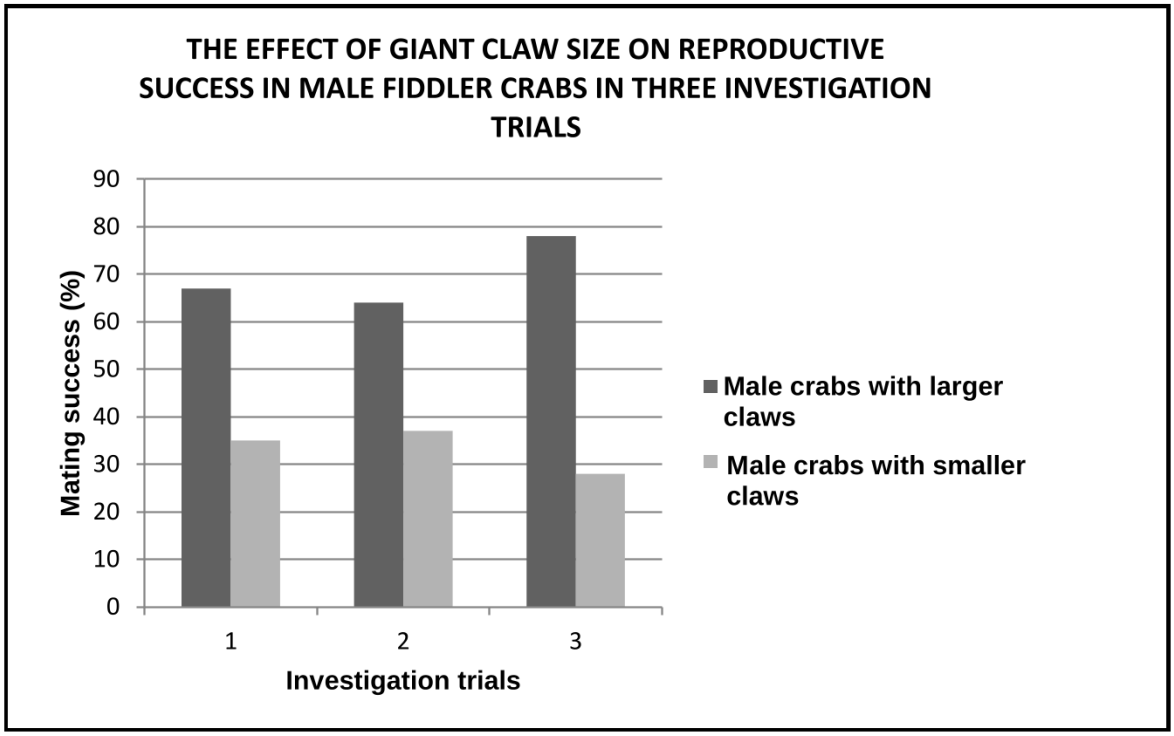


A researcher investigated the importance of the claw size of males for successful mating during three trials.

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)

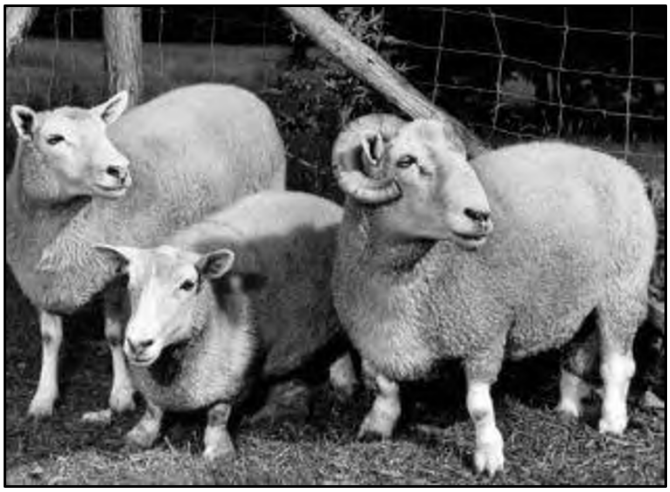
3.2.4 Explain ONE precautionary measure that the researcher would need to take for this investigation. (2)

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)

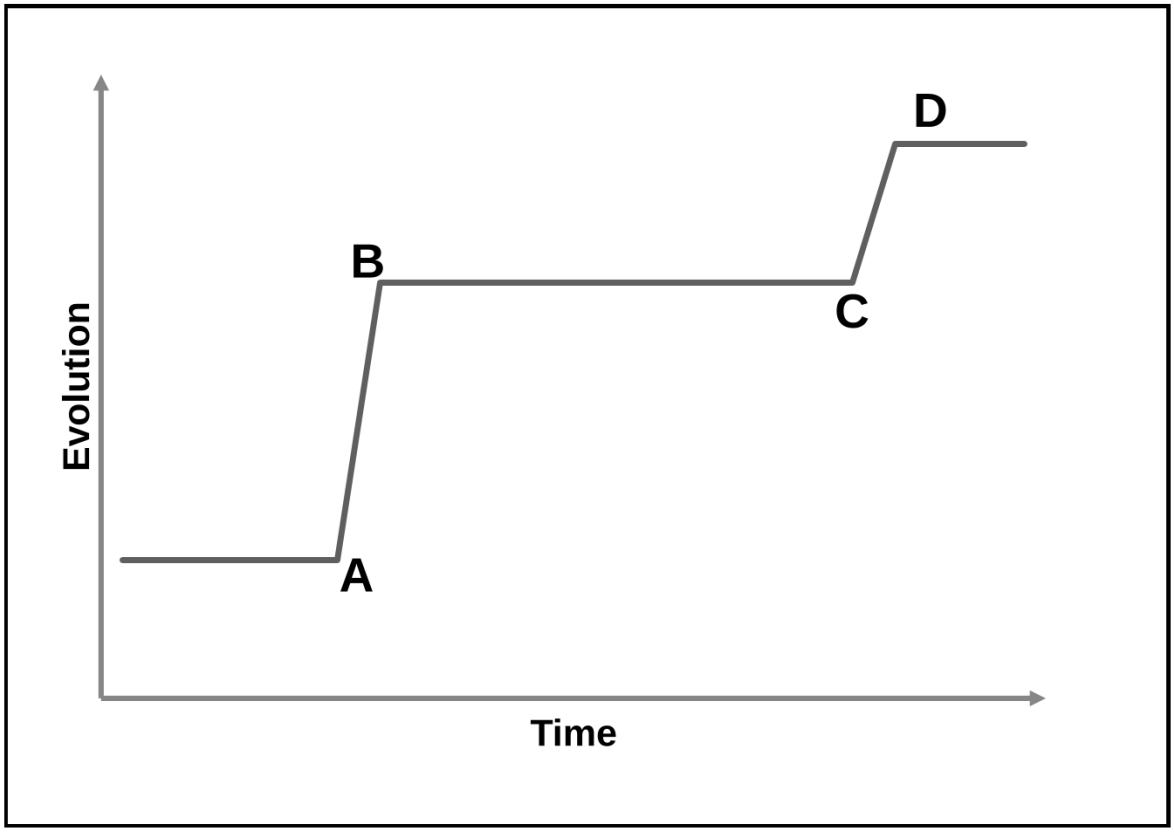
(b) What is the staple diet of the mainland snakes? (1)

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.

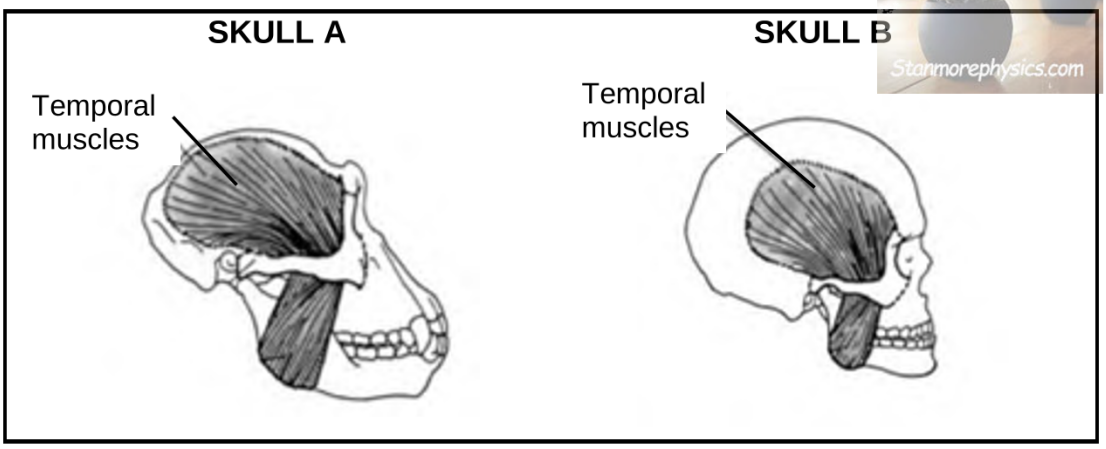


3.5.1 Give the definition of *punctuated equilibrium*. (4)

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