



education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2021

MARKS: 150

TIME: 2½ HOURS

This question paper consists of 17 pages.

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

SECTION A

QUESTION 1

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

1.1.1 The theory of punctuated equilibrium was relatively recently proposed by ...

- A Eldredge and Gould.
- B Darwin and Lamarck.
- C Broom and Clark.
- D Franklin and Wilkins.

1.1.2 Which of the following is a reproductive isolating mechanism?

- A Absence of geographic barrier
- B Same pollinators of different species of plants
- C Breeding at different times of the year
- D Cloning

QUESTIONS 1.1.3 TO 1.1.4 ARE BASED ON THE TABLE BELOW:

1.1.3 The table below shows the number of each type of nitrogenous base that occurs in some nucleic acid molecules. The letters W, X, Y and Z represent each of the four types of nitrogenous bases.

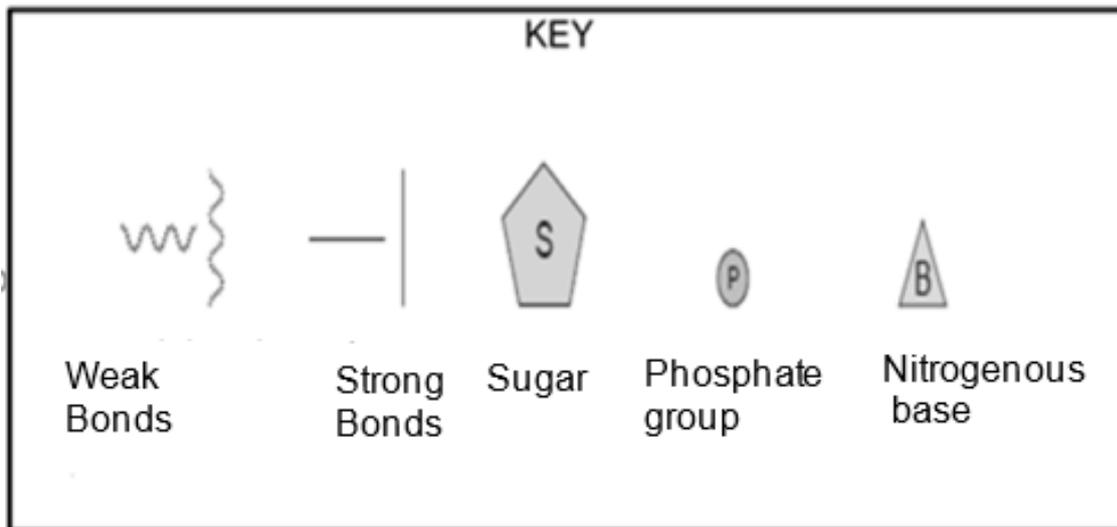
	W	X	Y	Z
Molecule 1	98	76	54	108
Molecule 2	715	523	523	715
Molecule 3	78	95	95	87
Molecule 4	103	89	89	103

Which ONE of the following combinations correctly refers to the type of nucleic acid represented by the molecules numbered 1 to 4?

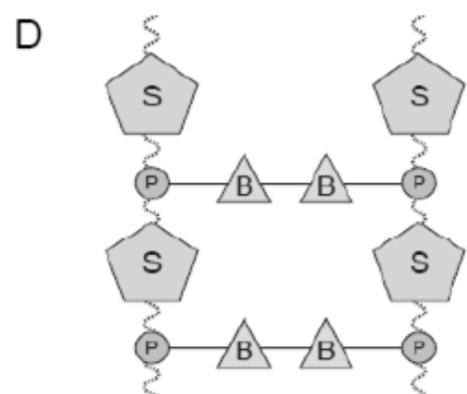
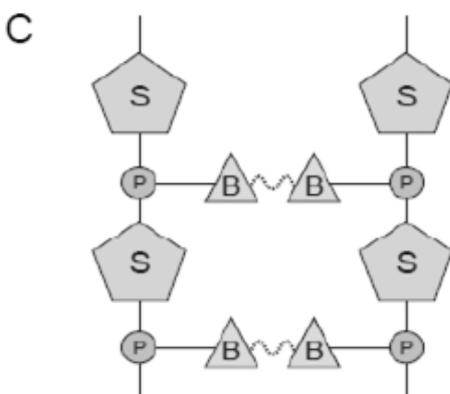
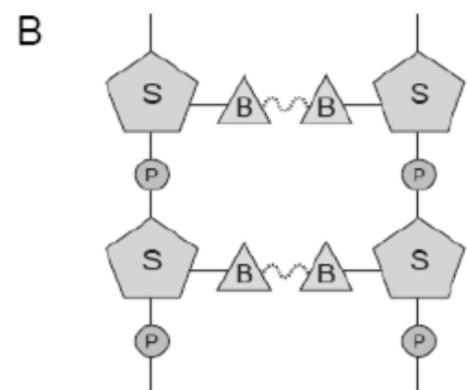
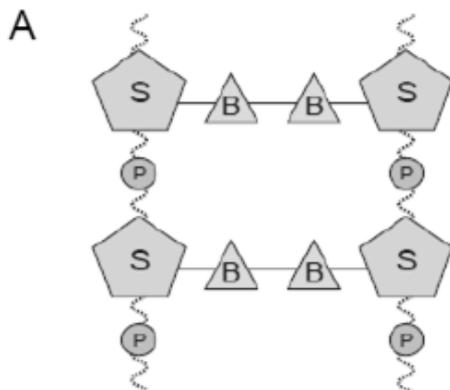
	Molecule 1	Molecule 2	Molecule 3	Molecule 4
A	RNA	RNA	DNA	DNA
B	DNA	DNA	RNA	RNA
C	RNA	DNA	RNA	DNA
D	DNA	RNA	RNA	DNA

- 1.1.4 Which ONE of following is the correct reason for your answer to QUESTION 1.1.3?
- A In molecule 1 and 3 there is an equal number of base pairs that can join with each other
 - B In molecule 2 and 4 there is an equal number of base pairs that can join with each other
 - C In molecule 3 and 4 there is an equal number of base pairs that can join with each other
 - D In molecule 1 and 2 there is an equal number of base pairs that can join with each other
- 1.1.5 Darwin made most of his observations about evolution on the ...
- A Islands of Hawaii.
 - B Indonesian Islands.
 - C Galapagos Islands.
 - D Phi Phi Islands.

1.1.6 The nucleic acid DNA is made of a number of components.
The diagram below shows the main components of a DNA molecule and the strength of the bonds that hold them together



Which one of the following diagrams shows the correct combination of components of the DNA molecule?



- 1.1.7 Four different blood groups are possible in the children if the parents blood groups are ...
- A AB and O.
 - B A and B.
 - C B and AB.
 - D O and B.
- 1.1.8 A mother has blood group AB and a father has blood group O. What is the percentage chance of them having a child with blood group O?
- A 100 %
 - B 75 %
 - C 0 %
 - D 25 %
- 1.1.9 Which ONE of the following refers to the current-day distribution of species in the world?
- A Biogeography
 - B Biochemistry
 - C Palaeontology
 - D Archaeology
- 1.1.10 Which ONE of the following resulted from Gregor Mendel's experiments with pea plants?
- A The 'law' of inheritance of acquired characteristics
 - B The principle of independent assortment
 - C The 'law' of use and disuse
 - D The theory of evolution

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

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.10) in the ANSWER BOOK.

- 1.2.1 The type of cell division that produces identical daughter cells
- 1.2.2 The change in the genetic composition of populations of a living organism over several generations
- 1.2.3 A sex-linked disorder that affects the photoreceptors in the eye
- 1.2.4 Similar body structures that perform different functions in different animals and are evidence of a common ancestor
- 1.2.5 The theory involving the inheritance of acquired characteristics
- 1.2.6 Organelle outside the nucleus of animal cells that contain DNA
- 1.2.7 A genetic cross involving only one characteristic
- 1.2.8 An opening in the skull through which the spinal cord passes
- 1.2.9 The two parts of a chromosome that are held together by a centromere
- 1.2.10 A tentative explanation of a phenomenon that can be tested

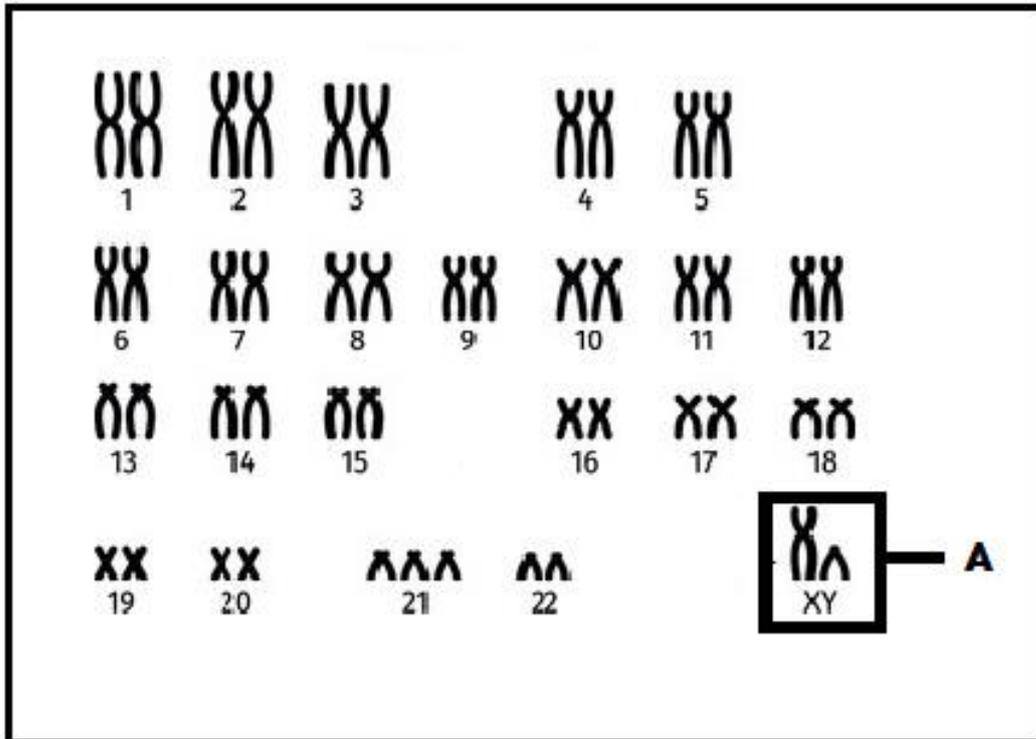
(10 x 1) (10)

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 number (1.3.1 – 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Structure that gives rise to spindle fibres during cell division	A: Ribosome B: Centriole
1.3.2	Inheritance of height in humans	A: Continuous variation B: Discontinuous variation
1.3.3	Used in paternity testing	A: Blood grouping B: DNA profiling

(3 x 2) (6)

1.4 The diagram below shows a karyotype within a somatic cell of a human.



1.4.1 Give the definition of a *karyotype*. (2)

1.4.2 Give the number of autosomes in each cell of this individual. (1)

1.4.3 Name:

(a) The type of chromosomes label **A** (1)

(b) The disorder that is represented in this diagram (1)

(c) The process that is responsible for the disorder mentioned in QUESTION 1.4.3 (b) (1)

(6)

- 1.5 A rooster with white feathers (W) and a forked comb (F) is crossed with a hen with black feathers (w) and a forked comb (F).

The F1- generation consists of 12 chickens – they all have white feathers (W); however, 9 have forked combs (F) and 3 have unforked combs (f). Use the symbols W and w for feathers colours and F and f for combs.

1.5.1 How many characteristics are being studied in this cross? (1)

1.5.2 Give:

(a) The genotype of the rooster. (2)

(b) The phenotype of the recessive characteristics. (2)

(c) All the possible genotypes of the F1- generation (3)

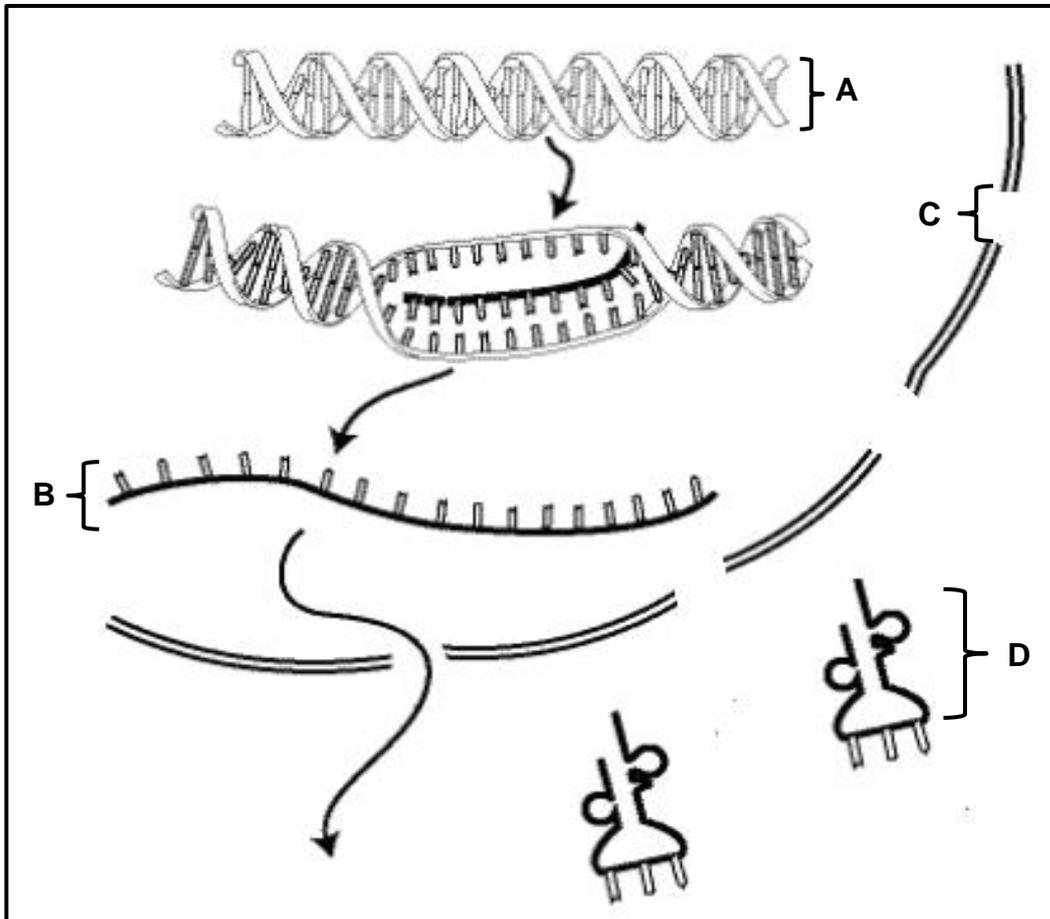
(8)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Study the diagram below of protein synthesis.



2.1.1 Identify

(a) Structure **C** (1)

(b) Molecule **D** (1)

2.1.2 Name molecule:

(a) **A** (1)

(b) **B** (1)

2.1.3 Tabulate TWO differences between the monomers of the two molecules in QUESTION 2.1.2 (a) and (b) (5)

2.1.4 Describe the role of molecule **A** in transcription. (2)

(11)

2.2 The diagram below shows the sequence of bases(codons) in a short segment of mRNA:

AUG	GCC	UCG	AUC	ACG	GCC	AUC	AUG
-----	-----	-----	-----	-----	-----	-----	-----

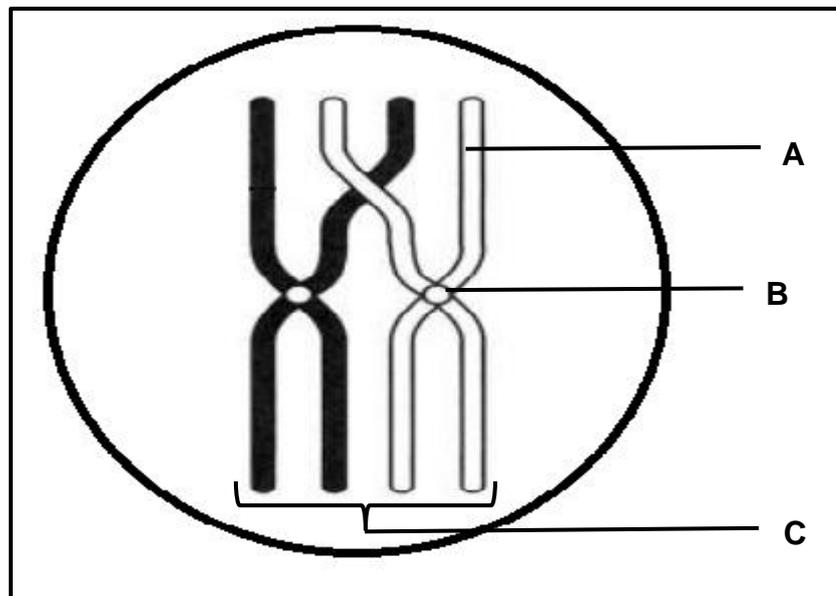
2.2.1 State how many different types of tRNA molecules would be used to produce a polypeptide from this mRNA. (1)

2.2.2 Give the DNA triplet base sequence for the last codon of this segment of mRNA. (2)

2.2.3 Name the nitrogenous base represented by **G** in the first codon. (1)
(4)

2.3 Describe DNA replication. (6)

2.4 The diagram below represents a process taking place during meiosis



2.4.1 Identify part:

(a) **A** (1)

(b) **B** (1)

(c) **C** (1)

2.4.2 Describe the process in meiosis illustrated in the diagram. (6)

2.4.3 Draw a diagram of part **C** to show its appearance immediately after the process named in QUESTION 2.4.2 (3)
(12)

2.5 Read the extract below.

GENETICALLY MODIFIED PIG BRED WITH 'GOOD FAT'

Omega-3 fatty acids have many health benefits like preventing heart disease and improving intelligence. These fatty acids are normally found in some fish species like salmon, mackerel and fresh tuna.

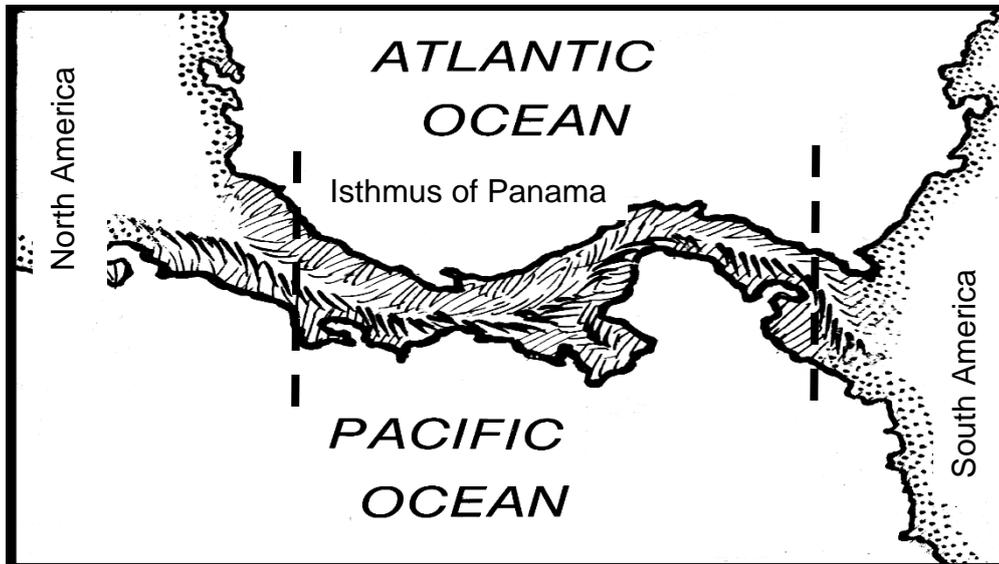
Scientists have genetically modified pig embryos using the genes from the fish. They implanted 1 800 of the modified embryos into 114 female pigs. Ten live offspring were born. These genetically modified pigs were capable of converting less useful omega-6 acids into omega-3 fatty acids.

[Adapted from: *Cape Argus*, 27 March 2006]

- 2.5.1 Name the type of fatty acid that is usually found in pigs. (1)
- 2.5.2 Calculate the percentage success that scientist have with the implanted embryos in forming genetically modified pigs capable of producing omega-3 fatty acids. Show ALL working. (3)
- 2.5.3 Give TWO reasons why some people may support the use of genetically modification in pigs that produce omega-3 fatty acids. (2)
- 2.5.4 The gene that produces omega-3 fatty acids is inserted into the pig embryos to create genetically modified pigs.
- Describe the steps in forming and introducing many copies of the desirable gene into pig embryos by using bacteria (4)
- (10)**

2.6

The Isthmus of Panama is a narrow strip of land that joins North and South America. Scientists believe that this strip of land formed 2.8 million years ago. Snapping shrimps, genus *Alpheus*, can be found on either side of the land bridge. However, when the males and the females from either side of the land bridge were brought together, they snapped aggressively at each other and would not mate. They are now considering to be two different species.



2.6.1 Why is the inability to mate sufficient evidence to call the two groups different species?

(1)

2.6.2 Explain how the shrimps become TWO different species.

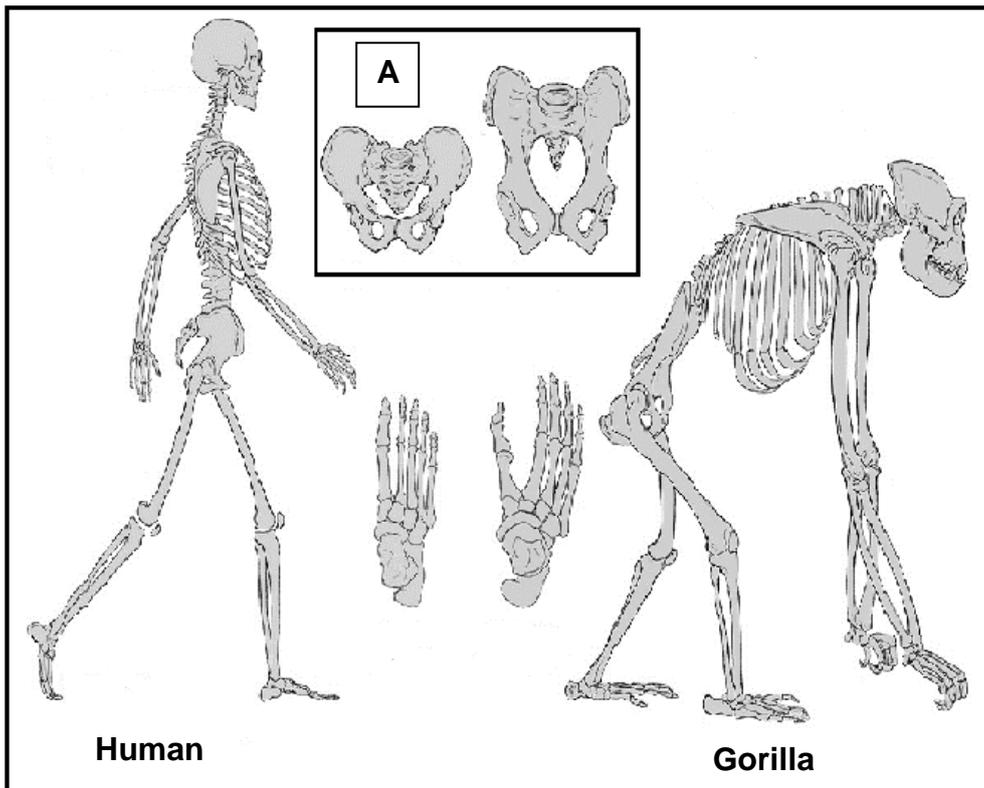
(6)

(7)

[50]

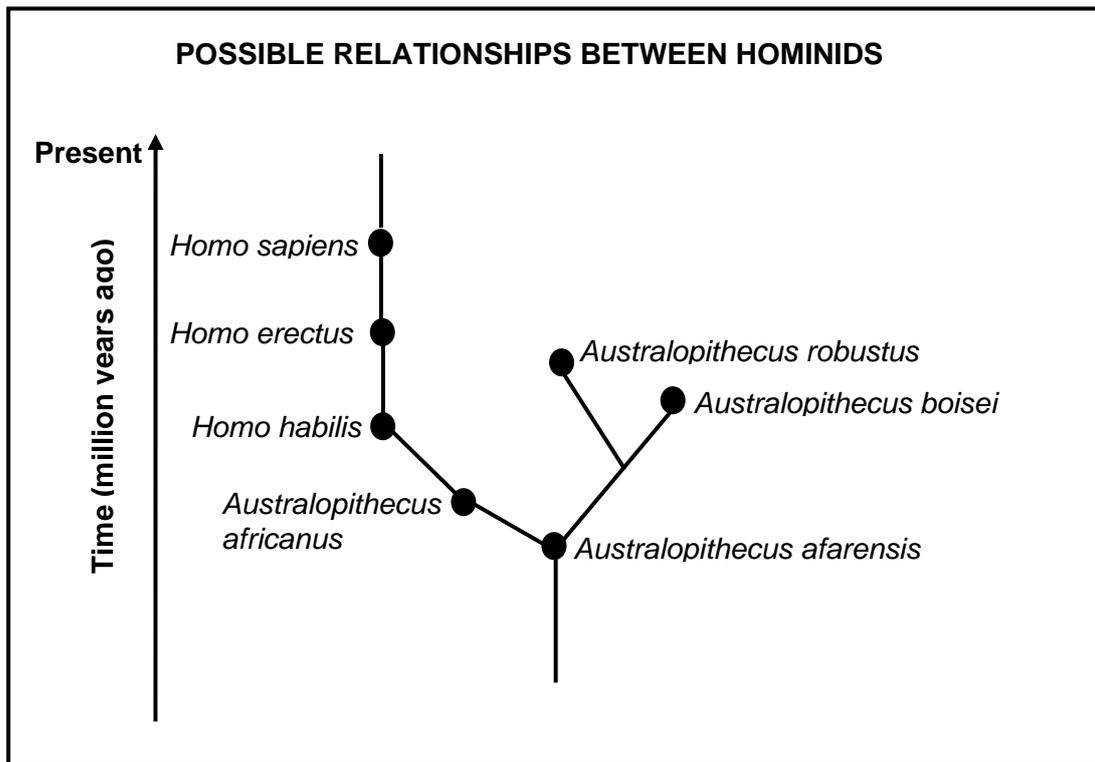
QUESTION 3

3.1 The skeletal structures of a human and a gorilla are shown below.



- 3.1.1 State THREE characteristics of the upper limb that are the same in both species. (3)
- 3.1.2 From diagram A explain the significance of ONE visible change in the skeleton to improved bipedalism over time. (3)
- 3.1.3 Name TWO *Australopithecus* fossils that were found in South Africa. (2)
- 3.1.4 Explain how genetic evidence support the idea that all living humans have common ancestors. (4)
- (12)**

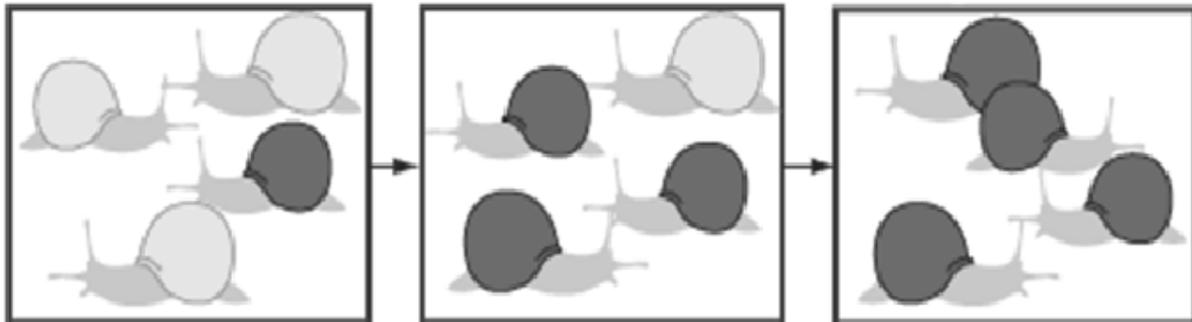
3.2 The diagram below shows possible relationships between members of the family *Hominidae*



[Adapted from: <http://www.ideacentre.org>]

- 3.2.1 Give the name of the type of diagram above. (1)
- 3.2.2 State how many of each of the following are represented in the diagram:
- (a) Genera (1)
 - (b) Species (1)
- 3.2.3 Explain why *A. robustus* and *A. boisei* are more closely related than *A. boisei* and *A. afarensis*. (2)
- 3.2.4 Give the scientific name of the species that were first to use tools. (1)
- 3.2.5 Explain how the location AND the age of *Homo* fossils are used as evidence for the 'Out of Africa' hypothesis. (4)
- (10)**

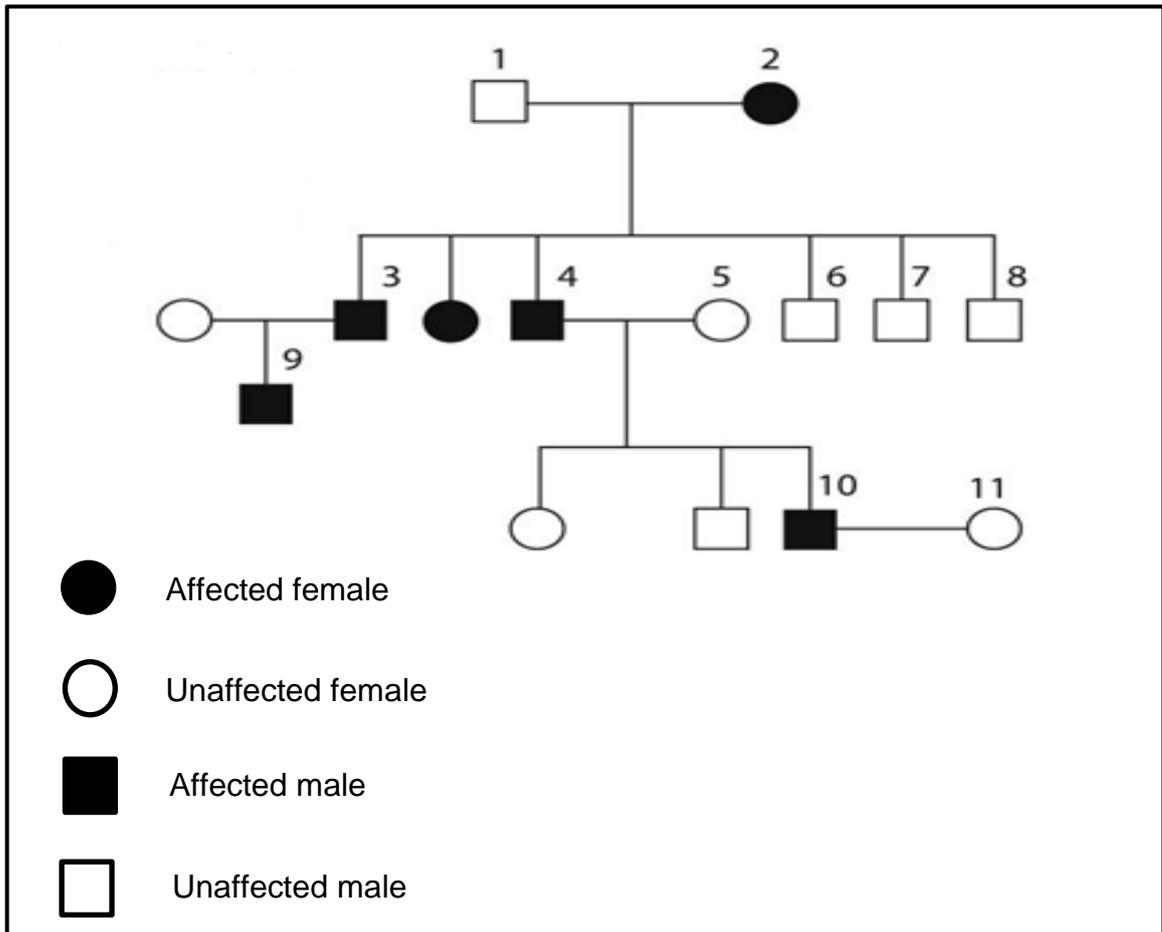
3.3. The snails in this population show variation of black shells and white shells because of mutations. The characteristics of shell colour allow them to survive better in their environment. Hence, they will reproduce to pass on these favourable characteristics to their offspring. This phenomenon is called natural selection.



- 3.3.1 Who identified this phenomenon first? (1)
 - 3.3.2 State the favourable characteristic for this snail population to survive. (1)
 - 3.3.3 Describe TWO different types of mutations that may cause variation in a population. (4)
 - 3.3.4 Tabulate THREE differences between natural selection and artificial selection (7)
- (13)**

- 3.4 Polydactyly is a medical term used to describe extra fingers on the hands and extra toes on the feet. It is caused by an autosomal dominant gene mutation. This characteristic is controlled by one gene with two alleles **D** and **d**.

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



- 3.4.1 Give the:
- (a) Phenotype of individual 5 (1)
 - (b) Genotype of individual 2 (2)
 - (c) Number of offspring of parents 1 and 2 (1)
- 3.4.2 Explain what is meant by 'Autosomal dominant gene mutation'? (4)
- 3.4.3 Using the letters **D** and **d** to represent a genetic cross to show the expected phenotypic ratio in the offspring of individuals 10 and 11. (7)

(15)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150