



Education and Sport Development

Department of Education and Sport Development
Departement van Onderwys en Sportontwikkeling
Lefapha la Thuto le Tlhabololo ya Metshameko

NORTH WEST PROVINCE

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2018

MARKS: 150

TIME: 2½ hours

This question paper consists of 15 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 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.

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 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 A trait that has a range of phenotypes is an example of ...
- A complete dominance.
 - B discontinuous variation.
 - C continuous variation.
 - D codominance.
- 1.1.2 A genetic cross where two pairs of contrasting characteristics on different homologous chromosomes are investigated, is called a ...
- A dihybrid cross.
 - B monohybrid cross.
 - C heterozygous cross.
 - D codominance.
- 1.1.3 If two animals are heterozygous for a particular characteristic and are mated, what will the probable ratio of the phenotypes of the F₁ generation be?
- A 2 : 3
 - B 4 : 1
 - C 3 : 1
 - D 1 : 2
- 1.1.4 Which ONE of the following statements below is an acceptable explanation based on the theory of punctuated equilibrium?
- A Unicellular organisms became more complex as the environment changed.
 - B Gradual evolutionary changes in phenotype result in speciation.
 - C Species constantly change, new species are formed and others become extinct.
 - D There are long periods in the fossil records where species remained unchanged.
- 1.1.5 Which ONE of the following serves as evidence of cultural evolution in early *Homo* species?
- A Drawings and carvings on rocks
 - B Animal remains found close to a *Homo* skeleton
 - C Male and female skeletons found in the same area
 - D More than one *Homo* skeleton found in the same area

- 1.1.6 Similar structures with the same body plan that perform different functions in different animals are ...
- A heterozygous.
 - B analogous.
 - C homozygous.
 - D homologous.
- 1.1.7 The evidence of the idea that all living organisms have a common ancestor, because their molecular composition is very similar:
- A Comparative embryology
 - B Genetics
 - C Comparative biogeography
 - D Palaeontology
- 1.1.8 In a family of four children, each child has a different blood group with respect to the ABO blood group system of humans. The genotypes of the parents must be ...
- A $I^A i$ and $I^B i$.
 - B $I^A I^B$ and ii .
 - C $I^B i$ and $I^A I^B$.
 - D $I^B i$ and ii .
- 1.1.9 Study the following statements:
- (i) Organisms in a population show a great deal of variation
 - (ii) Characteristics are passed on from parents to offspring
 - (iii) If an organism uses an organ frequently, it becomes more developed
 - (iv) A large number of offspring are produced, but only few survive
- Which ONE of the following combinations refers to observations upon which Darwin based his theory?
- A (i), (ii), (iii) and (iv).
 - B (i), (ii) and (iii) only.
 - C (i), (ii) and (iv) only.
 - D (i), (iii) and (iv) only.
- 1.1.10 In humans, brown eye colour is dominant over blue eye colour. A mother with blue eyes had two children, a boy with brown eyes and a girl with blue eyes. The eye colour of the father is ...
- A brown, because the allele for brown eye colour is sex-linked.
 - B brown, because at least one of the parents must have brown eyes.
 - C blue, because at least two other members of the family have blue eyes.
 - D blue, because at least one of the parents must be heterozygous for eye colour.

(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 1.2.6) in the ANSWER BOOK.

1.2.1 The study of animal and plant distribution as a form of evidence for evolution

1.2.2 A sudden change in the genetic make up of an organism

1.2.3 A characteristic that is not expressed in a heterozygous individual

1.2.4 A cell condition in which the nucleus contains a full set of chromosomes

1.2.5 Organisms that share the same gene pool and that can breed to produce fertile offspring

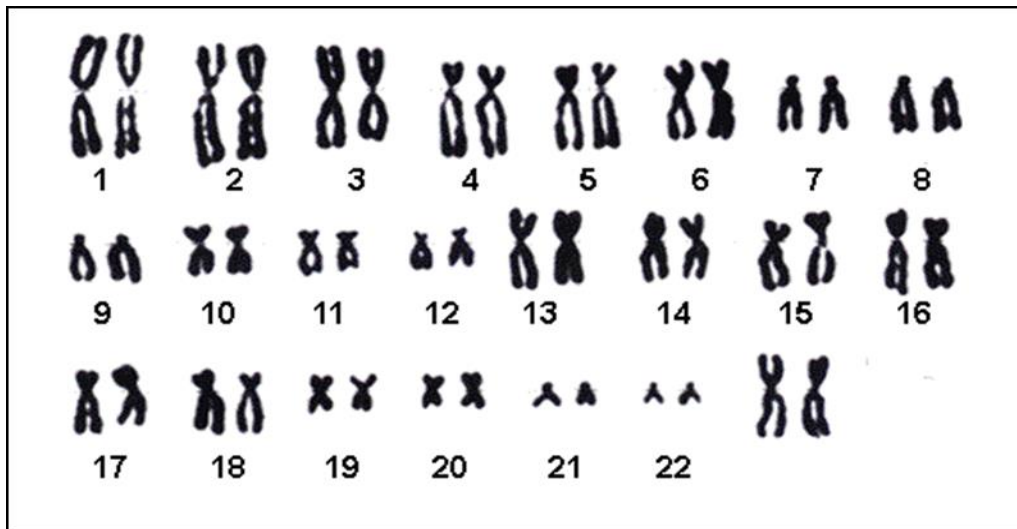
1.2.6 The phenomenon in which one gene has more than two alleles
(6 x 1) **(6)**

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 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	A characteristic that humans share with other primates	A:	Opposable thumb
		B:	Binocular vision
1.3.2	Inheritance of acquired characteristics	A:	Lamarck
		B:	Darwin
1.3.3	<i>Australopithecus africanus</i> fossil skull found in the Sterkfontein Caves	A:	Lucy
		B:	Mrs Ples

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

1.4 Study the diagram below.



[Adapted from <http://www.guam.net>]

- 1.4.1 State is the scientific term used to name the above diagram. (1)
- 1.4.2 Does the above diagram belong to a male or a female? (1)
- 1.4.3 Give ONE reason for your answer in QUESTION 1.4.2. (1)
- 1.4.4 Give ONE reason why the diagram above represents the chromosomes of a human. (1)
- 1.4.5 Name the phase of meiosis during which the above chromosomes were possibly photographed. (1)
- (5)**

1.5 The coat colour in guinea pigs is controlled by two alleles. The allele for black hair (B) is dominant over white (b) and rough hair (R) is dominant over smooth (r).

The Punnet square below shows a part of the cross between two heterozygous guinea pigs. Genotypes marked with X has been left out.

Gametes	BR	Br	bR	br
BR	BBRR	BBRr	BbRR	BbRr
Br	BBRr	X	BbRr	Bbrr
bR	BbRR	BbRr	bbRR	bbRr
br	BbRr	Bbrr	bbRr	bbrr

Give the:

1.5.1 Genotype of the parents (2)

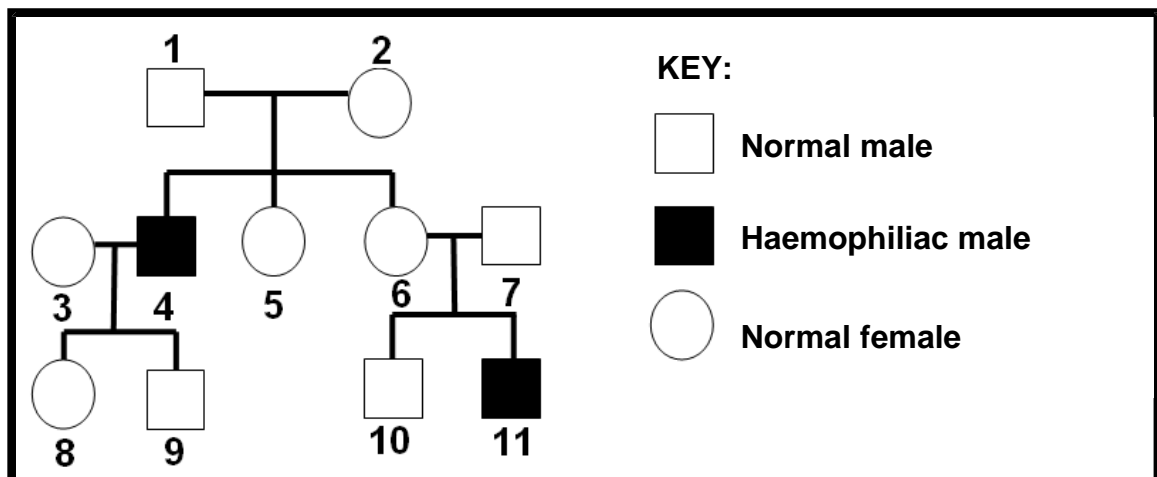
1.5.2 Phenotypes of:

(a) **bbRr** (1)

(b) **bbrr** (1)

1.5.3 Genotype of the offspring marked as X (2)
(6)

1.6 The pedigree diagram below shows how the sex linked disorder haemophilia is inherited in a family. Study the diagram below. Use the symbols H for normal and h for the recessive allele.



1.6.1 Give the possible genotypes of individuals:

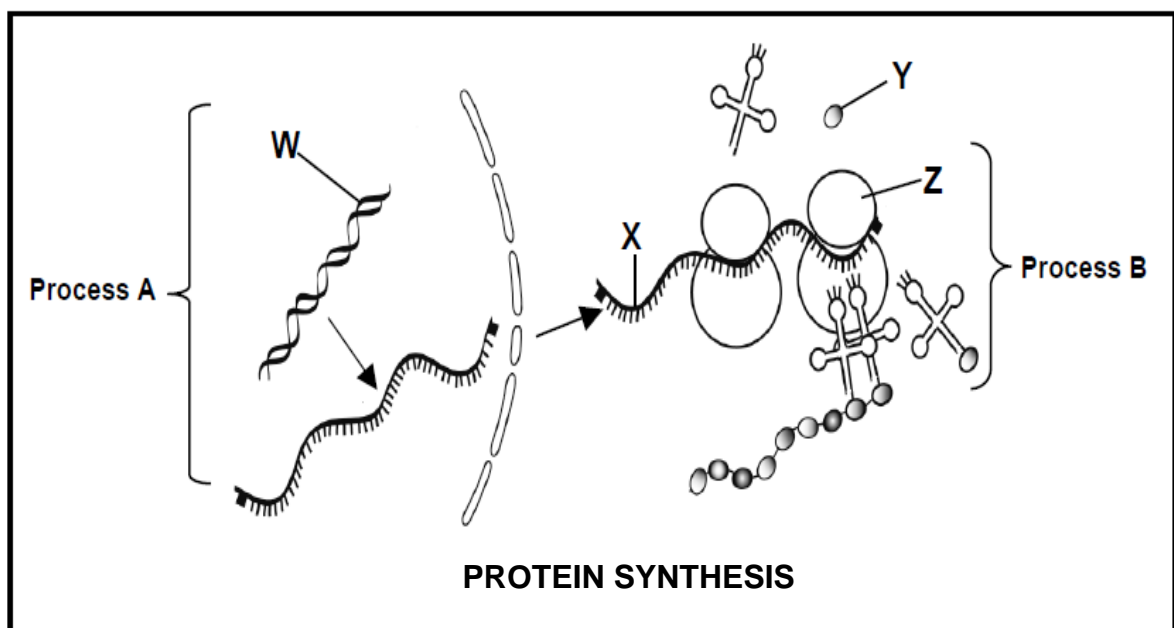
(a) 1 (1)

(b) 2 (1)

- 1.6.2 Give the phenotypes of individuals:
- (a) **2** (1)
- (b) **4** (1)
- 1.6.3 The person labelled **11** marries a carrier female. Give the percentage chance of their sons being haemophiliacs. (2)
- 1.6.4 Name **ONE** example of a sex-linked disorder other than haemophilia. (1)
- (7)**
- TOTAL SECTION A: 50**

SECTION B**QUESTION 2**

2.1 The diagram below shows the process of protein synthesis.



- 2.1.1 Name the part of the protein synthesis indicated by process **A**. (1)
- 2.1.2 Identify:
- (a) Molecule **X** (1)
- (b) Molecule **Y** (1)
- (c) Organelle **Z** (1)

- 2.1.3 Describe the role of molecule **W** during process **A**. (4)
- 2.1.4 Name AND describe process **B**, which takes place at organelle **Z**. (3)
- 2.1.5 Name the type of bond that joins two amino acids together. (1)
(12)

2.2 The table below shows the triplets of bases on a template of DNA for some amino acids.

AMINO ACIDS		DNA TRIPLETS
Glutamic acid	(glu)	CTT CTC
Histidine	(his)	GTA GTC
Leucine	(leu)	GAA GAG GAT GAC
Proline	(pro)	GGA GGG GGT GGC
Threonine	(thr)	TGA TGG TGT TGC
Valine	(val)	CAA CAG CAT CAC

The diagram below shows the base sequence in DNA and mRNA for the first seven amino acids in a polypeptide of haemoglobin.

DNA

CAC	A	GAC	TGA	GGA	CTC	E
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mRNA

GUG	CAG	CUG	B	CCU	GAG	GAG
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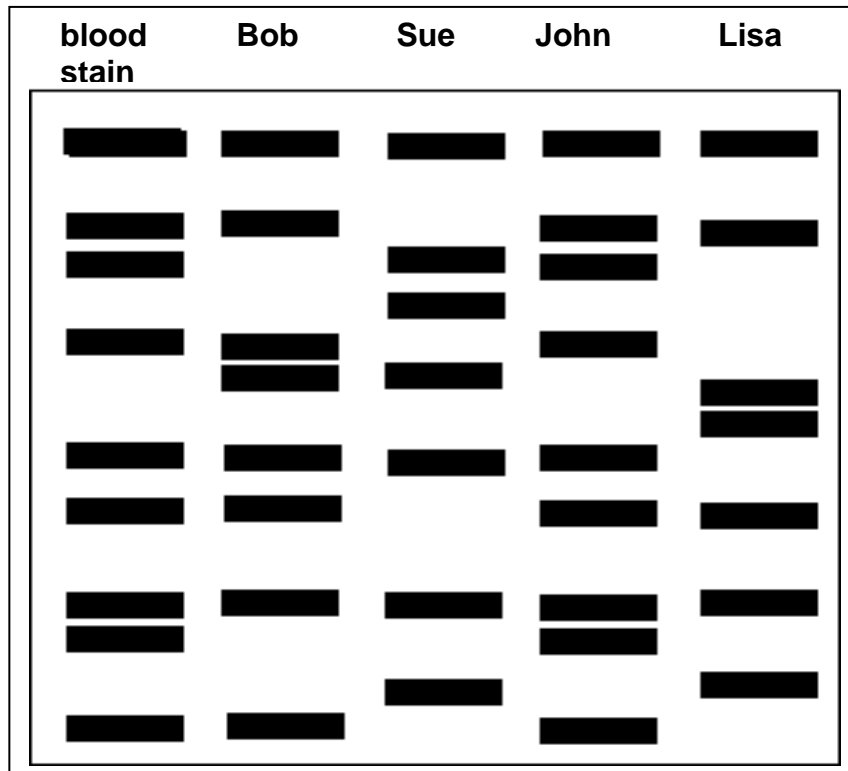
Polypeptide chain of haemoglobin

val	his	C	thr	pro	glu	D
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- 2.2.1 Use the table to determine:
- (a) **A** (1)
- (b) **B** (1)
- (c) **C** (1)
- (d) **D** (1)
- 2.2.2 Explain how a change in a single base of the sixth DNA triplet may lead to the production of a different protein. (2)
(6)

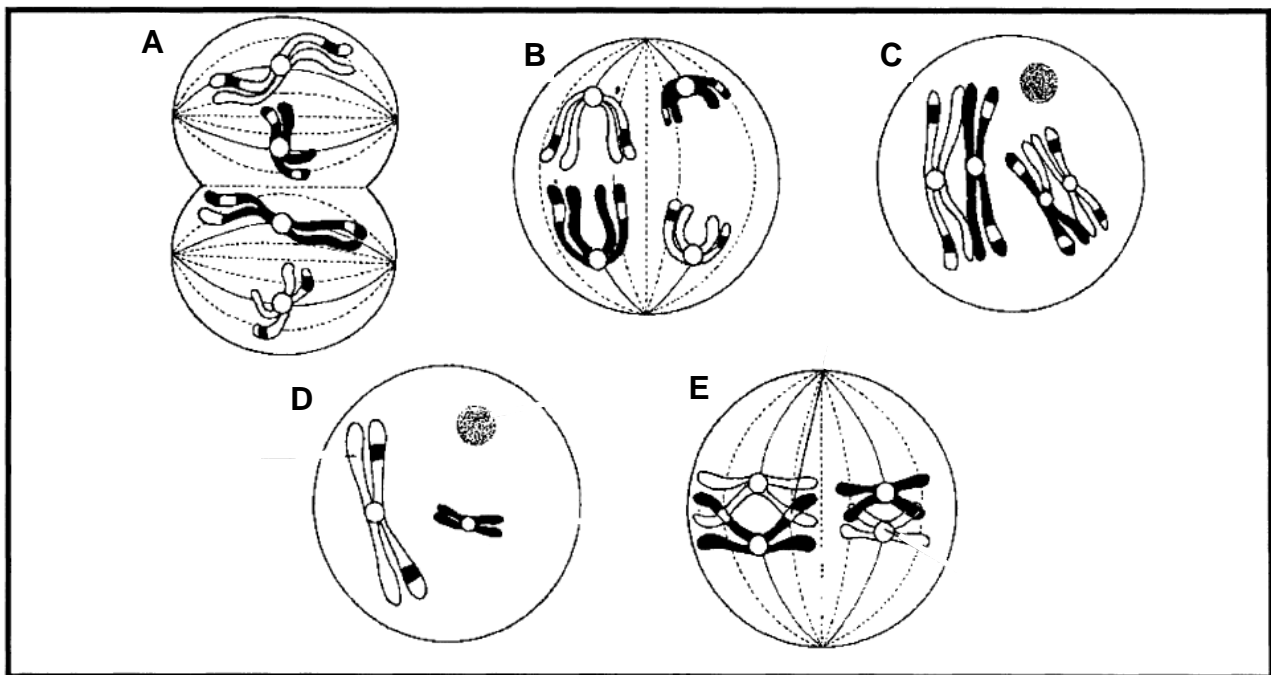
2.3 Mrs Gill had baked a birthday cake for her sister Annamarie and kept it in a tin on the kitchen table. When she returned from shopping, all that was left in the cake tin was a few crumbs and a smudge of blood where the thief had snagged his/her finger on the sharp edge of the tin.

Study the DNA profile of her four children given below.



- 2.3.1 Define the scientific term *DNA profile*. (2)
 - 2.3.2 Which ONE of Mrs Gill’s children is most probably the suspect from the description given above? Give a reason for your answer. (2)
 - 2.3.3 Describe how DNA profiling can be used for paternity tests. (2)
 - 2.3.4 Do you think that saliva could also be used as sample material in this type of investigation? Motivate your answer. (2)
- (8)**

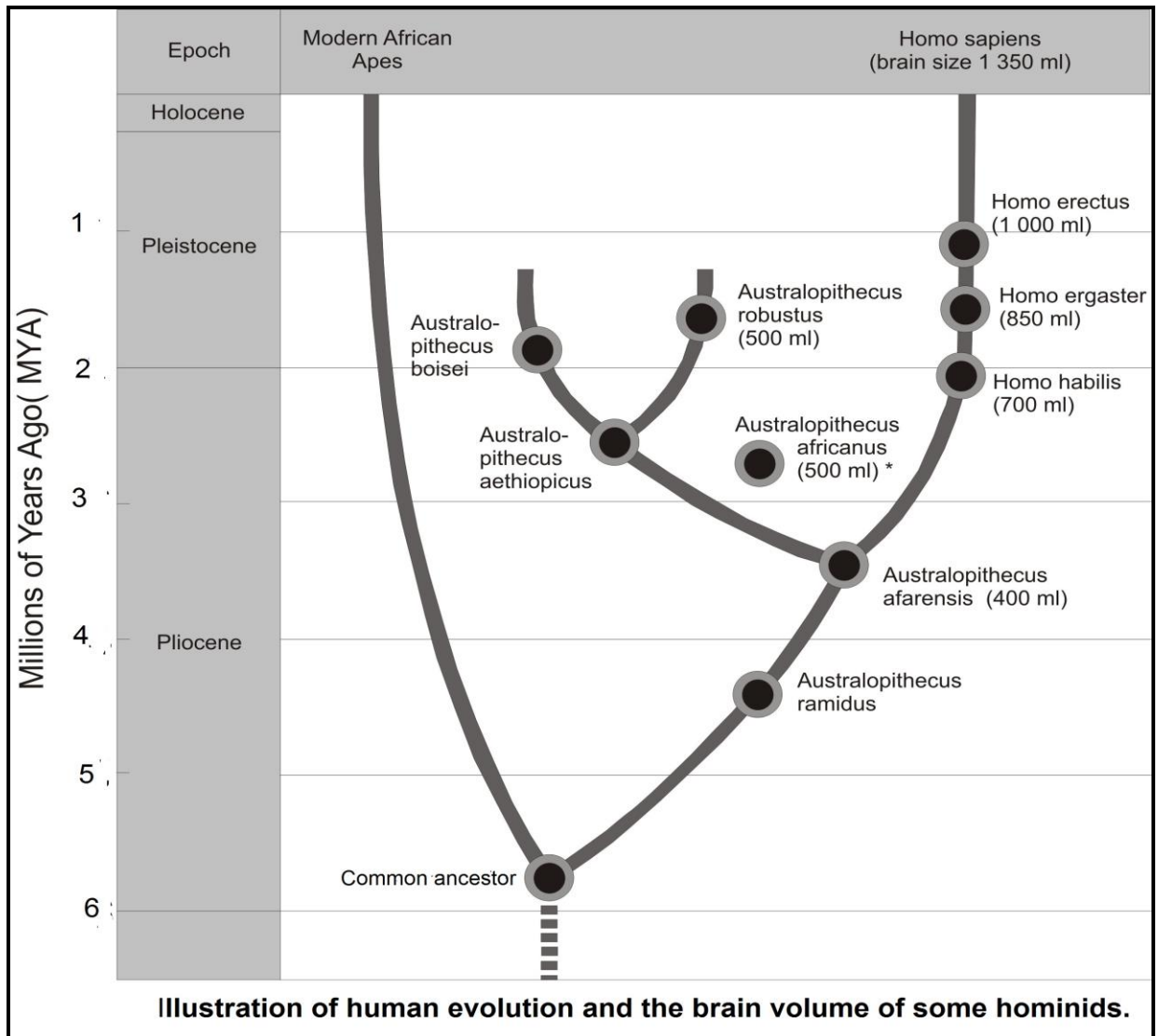
2.4 Study the following representation of phases during cell division.



- 2.4.1. Identify the type of cell division represented above. Give ONE reason for your answer. (2)
- 2.4.2 Identify phase E. (1)
- 2.4.3 Use only the LETTERS (A to E) to place the phases shown above in the correct sequence. (2)
- 2.4.4 Describe how a chromosome mutation may lead to Trisomy 21. (4)
- 2.5 Tabulate TWO differences between natural selection and artificial selection. (5)
- (14)**
[40]

QUESTION 3

3.1 The diagram below illustrates the evolution of humans and the brain volume of some hominids.



- 3.1.1 Name the type of diagram shown above. (1)
 - 3.1.2 State TWO reasons why the increase in brain size might have been beneficial to humans. (2)
 - 3.1.3 Which organism was the direct ancestor of *Homo habilis*? (1)
 - 3.1.4 The 'Out of Africa' hypothesis states that *Homo sapiens* originated in Africa and spread from here to the rest of the world. (6)
- Name and discuss TWO proofs of evidence which support this hypothesis. (10)

3.2 Study the extracts and the graph given below.

Zika-fever is a mosquito-borne viral disease caused by the Zika virus which is suspected of leading to the birth of deformed babies. The virus is transmitted to humans when an infected *Aedes* mosquito stings a person. Direct human to human transmission through sex has also been reported.

[Adapted from <https://theconversation.com>]

Company A produces an insect repellent, called PICARDIN, that has been tested and proved affective against the *Aedes* mosquito species which transmits the Zika-virus.

Company B produces a mosquito repellent, called PERMETHRIN.

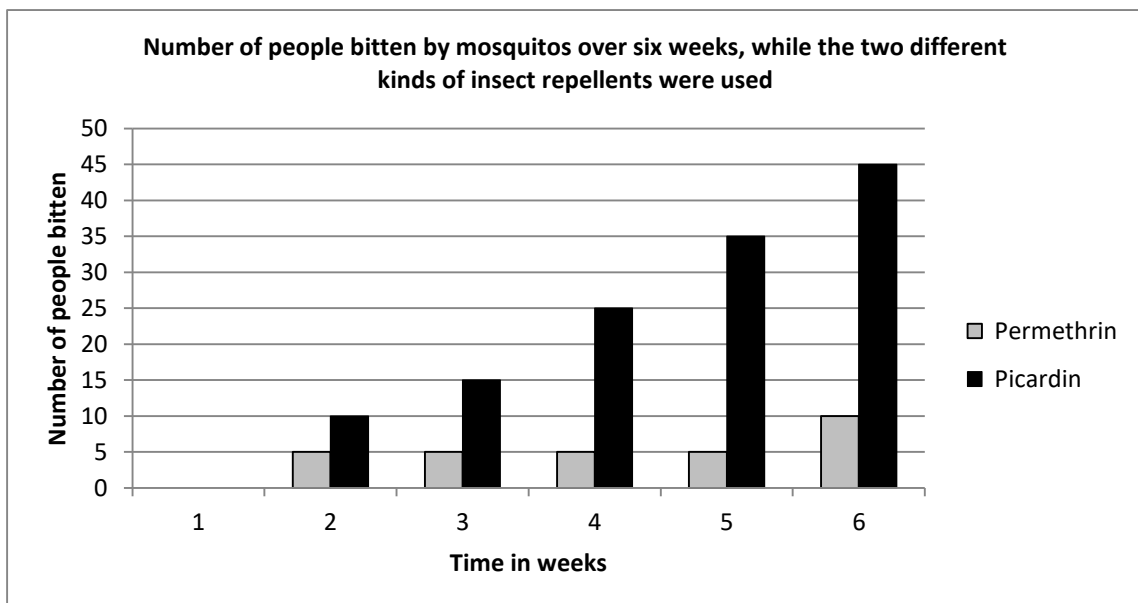
Both of them are designed for use on clothing and gear and may last for six weeks of washings.

[Adapted from <https://Google.com>]

The graph below represents the results of an investigation conducted by a group of learners to test the long term effectiveness of the two types of insect repellents mentioned above.

- 60 people were given Permethrin to spray on their clothes
- 60 people were given Picardin to spray on their clothes

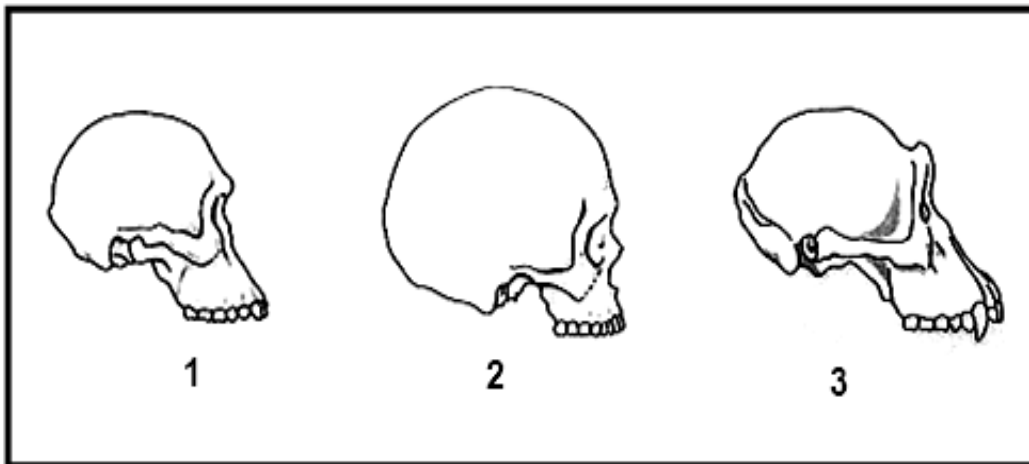
Both insect repellents were sprayed at the start of the investigation. Both these groups had to wear these clothes for 6 weeks, the duration of the investigation.



3.2.1 Formulate a hypothesis for this investigation.

(2)

- 3.2.2 State the independent variable. (1)
- 3.2.3 What percentage of people who participated in the survey were bitten by mosquitos during week 6? Show all calculations. (3)
- 3.2.4 State TWO ways in which the learners could have improved the validity of the investigation. (2)
- 3.2.5 *Aedes* mosquitos may develop resistance towards Picardin and Permethrin. Explain this phenomenon in terms of evolution in present times. (5)
- (13)**
- 3.3 Study the following diagrams of three hominid skulls and answer the questions that follow.



- 3.3.1 Which ONE of the above skulls belongs to a bipedal organism? (1)
- 3.3.2 Give ONE observable reason to support your answer in QUESTION 3.3.1. (1)
- 3.3.3 Explain ONE advantage of bipedalism to the organism referred to in QUESTION 3.3.1. (2)
- (4)**

3.4 In Croton plants, green leaves are dominant over variegated leaves (leaves with white and green). A plant which is heterozygous for green leaves, is crossed with one with variegated leaves.

Use the symbol **G** for green leaves and **g** for variegated leaves and answer the questions that follow.

- 3.4.1 Give the percentage of the F₁ generation that will have variegated leaves. (2)
- 3.4.2 The plant with green leaves is self-pollinated and 128 seedlings were obtained.

Draw a genetic cross to indicate the genotypes of the F₂ generation. (6)
- 3.4.3 According to the genetic cross in QUESTION 3.4.2, how many plants:
- (a) Have variegated leaves? (1)
- (b) Are heterozygous for green leaves? (1)
- (c) Are homozygous dominant? (1)
- 3.4.4 State Mendel's Principle of Independent Assortment. (2)
- (13)**
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

During Darwin's voyage on the HMS Beagle, he observed thirteen different species of finches on the Galapagos Islands, each with different types of beaks. Darwin also noticed that finches on the Galapagos Islands were different to those on the mainland of South America, 1 000 km away. He suggested that the different species of finches might have evolved from a common ancestor.

Describe how speciation occurred in the original finch population. Also describe how meiosis can lead to variation within a species and list other possible causes of variation.

Content: (17)
Synthesis: (3)

NOTE: NO marks will be awarded for answers in the form of flow charts, diagrams or tables.

TOTAL SECTION C: 20
GRAND TOTAL: 150