basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE



GRADE 12

LIFE SCIENCES P2

Stanmorephysics.com

NOVEMBER 2024

MARKS: 150

TIME: 2½ hours

This question paper consists of 14 pages.

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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, 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.

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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 Which ONE of the following organelles is the site of protein synthesis?

A Ribosomes
B Chloroplasts
C Mitochondria
D Centrosomes

1.1.2 In humans, the gonosomes determine the gender.

Which combination below shows the CORRECT gonosomes for males and females?

	MALE GONOSOMES	FEMALE GONOSOMES
A	XY	YY
B	YY	XY
C	XY	XX
D	XX	XY

1.1.3 An organism has the genotype TT.

The CORRECT term which describes this organism's genotype is ...

A heterozygous dominant.
B heterozygous recessive.
C homozygous dominant.
D homozygous recessive.

1.1.4 Down syndrome is a genetic disorder where an individual has an extra copy of chromosome 21.

Which ONE of the following may lead to Down syndrome?

A Failure of chromosomes to replicate during mitosis
B Failure of chromosome pairs to separate during meiosis
C Failure of chromosomes to form pairs during fertilisation
D Failure of chromosome pairs to cross over during meiosis

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1.1.5 A gradual change in the characteristics of a species over time is known as ...

A punctuated equilibrium.
B genetic engineering.
C speciation.
D biological evolution.

1.1.6 Which ONE of the following is a reproductive isolation mechanism?

A Adaptation to the same pollinator
B Species-specific courtship behaviour
C Production of fertile offspring
D Breeding at the same time of the year

1.1.7 Analysis of mitochondrial DNA is an example of this line of evidence:

A Fossil evidence
B Modification by descent
C Biogeography
D Genetic evidence

1.1.8 Which option in the table below shows the CORRECT comparison between mitosis and meiosis?

	MITOSIS	MEIOSIS
A	Produces four daughter cells	Produces two daughter cells
B	Produces genetically different cells	Produces genetically identical cells
C	The chromosome number remains the same	The chromosome number is halved
D	Two divisions occur	Four divisions occur

1.1.9 Which ONE of the following scientists discovered the fossil Taung Child?

A Lee Berger
B Ron Clarke
C Raymond Dart
D Robert Broom

1.1.10 Which ONE of the following is produced at the end of translation?

A A DNA molecule
B A messenger RNA molecule
C A protein
D An amino acid (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 1.2.9) in the ANSWER BOOK.

1.2.1 A nucleic acid that carries hereditary information

1.2.2 The chromosome condition of a cell that has a single set of chromosomes

1.2.3 The structure that holds the two chromatids of a chromosome together

1.2.4 The type of RNA that carries specific amino acids to the site of protein synthesis

1.2.5 The analysis of DNA samples to identify individuals or relationships between individuals

1.2.6 A representation of the number and structure of all the chromosomes that occur in the nucleus of a somatic cell

1.2.7 A group of similar organisms that are able to interbreed to produce fertile offspring

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1.2.8 The phase of meiosis where paired chromosomes are arranged at the equator

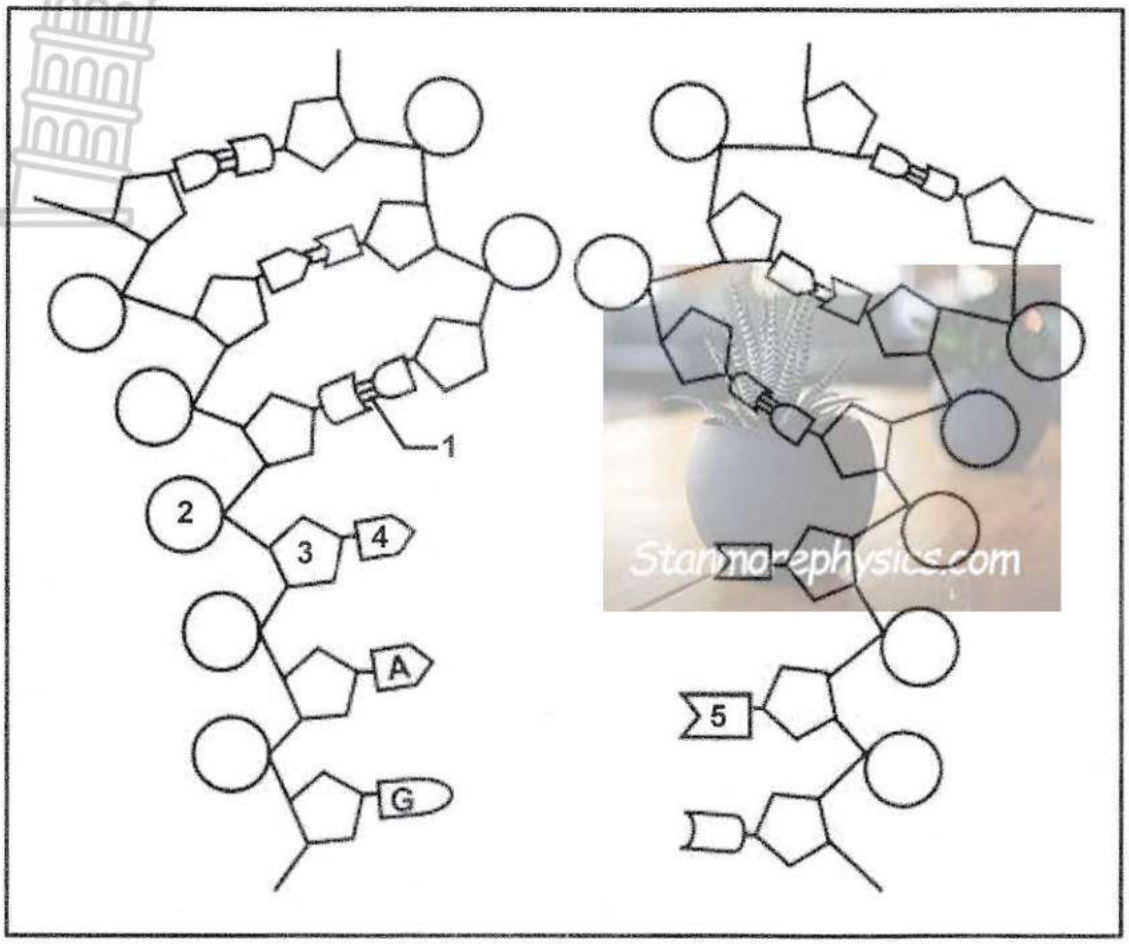
1.2.9 The biotechnological process that produces genetically identical organisms (9 x 1) **(9)**

1.3 Indicate whether each of the descriptions in COLUMN I apply 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	A source of variation in populations	A: Random fertilisation B: Random mating
1.3.2	Discovery of the structure of the DNA molecule	A: Franklin and Wilkins B: Lamarck and Darwin
1.3.3	Occurs during meiosis	A: Karyokinesis B: Cytokinesis

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

1.4 The diagram below represents a DNA molecule undergoing an important biological process.



1.4.1 Identify the:

(a) Process shown in the diagram (1)

(b) Chemical bond labelled **1** (1)

1.4.2 Give the:

(a) Collective name for the parts labelled **2**, **3** and **4** (1)

(b) Full name of the nitrogenous base labelled **5** (1)

1.4.3 During which phase of the cell cycle does this process take place? (1)

1.4.4 Where in the cell does this process occur? (1)
(6)

1.5 In a certain species of butterfly, one gene controls wing-spot colour and another controls eye colour. The wing-spot colour can be red spots (**R**) or grey spots (**r**), while eye colour can be black (**E**) or brown (**e**).

Butterflies that are heterozygous for both genes were crossed.

1.5.1 Name the type of cross represented above. (1)

1.5.2 Give the dominant characteristic of EACH gene. (2)

1.5.3 The table below shows the phenotypes and all the possible genotypes of the offspring.

PHENOTYPES	ALL POSSIBLE GENOTYPES
Red spots, brown eyes	**(X)**
(Y)	RrEe
Grey spots, brown eyes	rree

Give:

(a) ALL the possible genotypes at **X** (4)

(b) The phenotype at **Y** (1)

(c) The genotype of the gametes produced by a butterfly with grey spots and brown eyes (1)
(9)

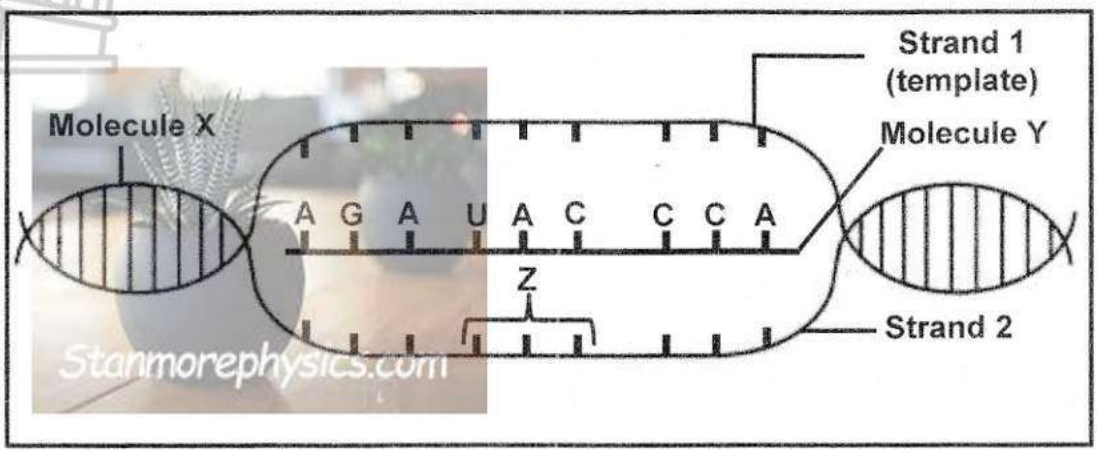
TOTAL SECTION A: 50

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SECTION B

QUESTION 2

2.1 The diagram below represents a certain stage of protein synthesis. (The sequence of bases is read from left to right.)



2.1.1 Identify molecule **Y**. (1)

2.1.2 Describe the process that resulted in the formation of molecule **Y**. (6)

2.1.3 Give ONE structural difference between molecule **X** and molecule **Y**. (2)

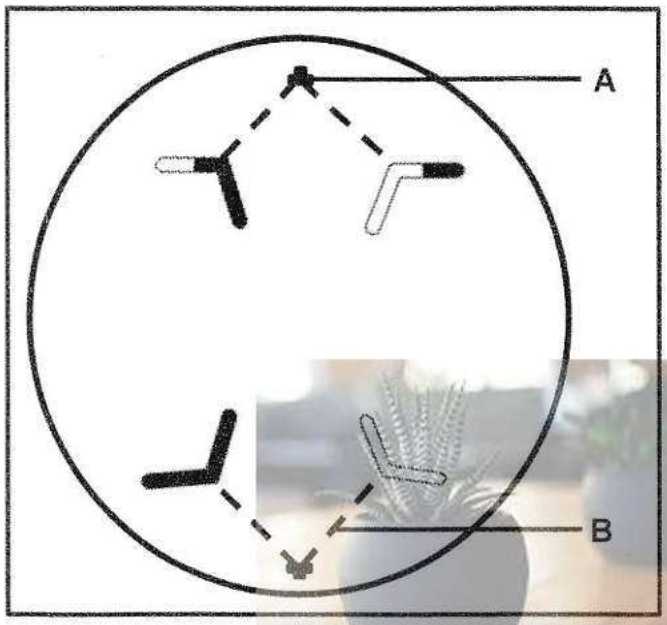
2.1.4 Give the sequence of bases at triplet **Z** on strand **2**. (1)

2.1.5 The table below shows some amino acids coded for by codons on molecule **Y**.

CODON	AMINO ACID
AGA	Arginine
UCU	Serine
CCA	Proline
UAC	Tyrosine
GGU	Glycine

Identify the first and last amino acids coded for by this section of molecule **Y**. (2)
(12)

2.2 The diagram below represents a phase of meiosis **II**.



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2.2.1 Identify the phase of meiosis shown. (1)

2.2.2 State ONE difference between the phase shown in the diagram above and the same phase in meiosis **I**. (2)

2.2.3 Identify structure:

(a) **A** (1)

(b) **B** (1)

2.2.4 Describe the role of structure **B** during cell division. (2)

2.2.5 Draw a labelled diagram representing the cell above as it would have appeared in metaphase **II**.

NOTE: The diagram should show the correct shading and include labels (exclude labels for **A** and **B**). (5)
(12)

2.3 The table below shows the percentage of blood donors for each of the blood groups in South Africa for 2018.

BLOOD GROUP	% DONORS
O	48
A	38
B	10
AB	4

2.3.1 According to the data, which is the most common blood group among the donors? (1)

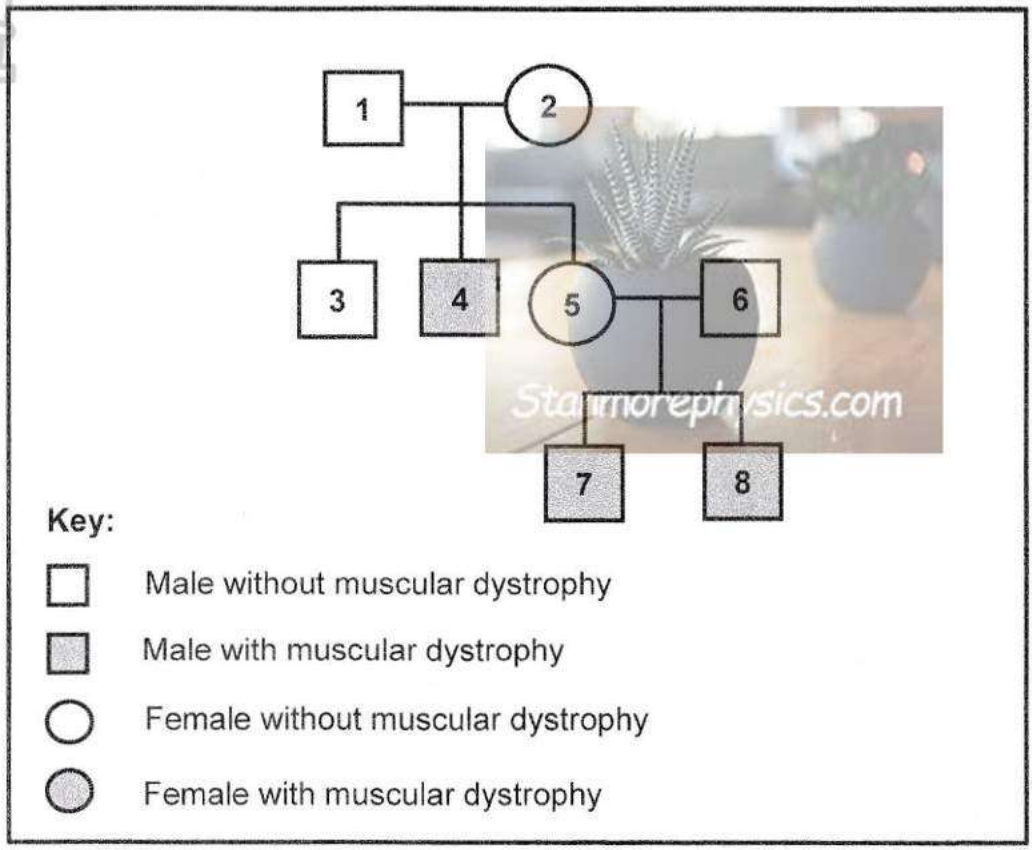
2.3.2 Name the type of dominance shown by the inheritance of blood group **A**. (1)

2.3.3 Explain how it is possible for a man with blood group **A** and a woman with blood group **AB** to have a child with blood group **B**. (5)

2.3.4 Plot a bar graph to represent the data in the table. (6)
(13)

2.4 Muscular dystrophy is a genetic condition that causes muscles to weaken over time. It is caused by a recessive allele on the X chromosome (X^d). The dominant allele (X^D) results in normal muscle formation.

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



2.4.1 How many offspring do individuals **1** and **2** have? (1)

2.4.2 Give the:

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

(b) Genotype of individual **2** (1)

2.4.3 Explain why more males than females are likely to have muscular dystrophy. (4)

2.4.4 Parents **5** and **6** plan to have another child.

Use a genetic cross to show the percentage chance of having a child with muscular dystrophy. (6)
(13)
[50]

QUESTION 3

3.1 Read the passage below.

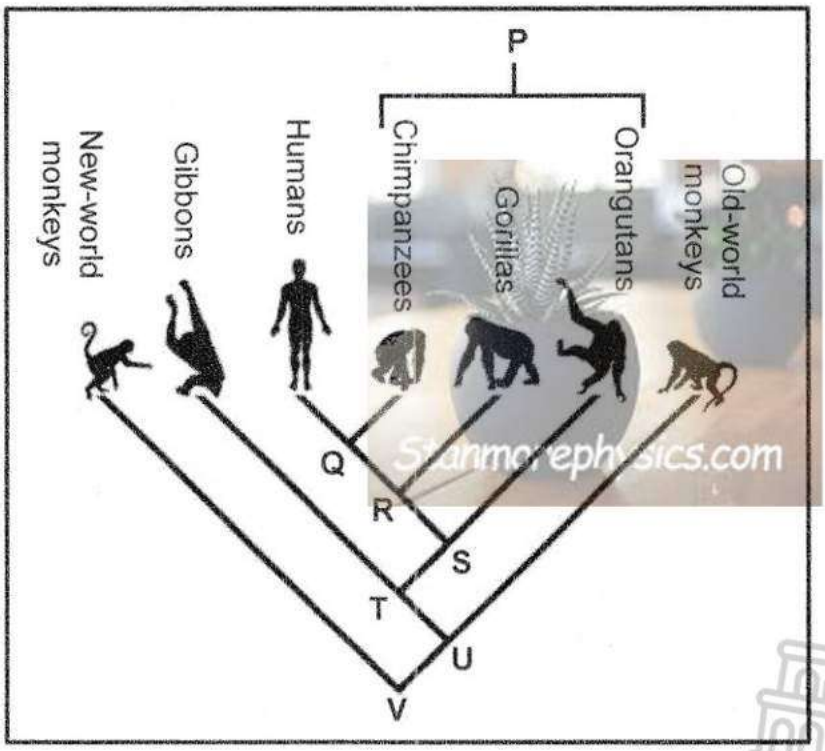
GENETICALLY MODIFIED MAIZE

The bacterium *Bacillus thuringiensis* produces a toxin, called Bt, that kills insects. This bacterium is used to genetically modify maize to contain the Bt toxin. This Bt maize is toxic to insects.

3.1.1 Describe how the Bt maize is genetically modified to be insect resistant. (3)

3.1.2 Explain TWO reasons why farmers might want to grow Bt maize. (4)
(7)

3.2 The phylogenetic tree below shows the evolutionary relationship between some species.



3.2.1 Give the LETTER representing the common ancestor for ALL the species shown in the phylogenetic tree. (1)

3.2.2 Identify the species that is most closely related to Old-world monkeys. (1)

3.2.3 Give a reason for your answer to QUESTION 3.2.2. (1)

3.2.4 Identify THREE species that share the common ancestor **R**. (3)

3.2.5 State THREE characteristics of the upper limbs that humans share with group **P**. (3)
(9)

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3.3 A group of researchers conducted an investigation to determine the influence of the type of milk on the height of children drinking the milk. (The investigation was conducted over a period of 7 years from age 3 to age 10).

They:

- Selected 4 146 healthy 3-year-old children of the same race and gender
- Divided the children into two equal groups:
  - One group was given 1 litre of cow's milk to drink daily
  - The other group was given 1 litre of soy milk to drink daily
- Ensured that each group had:
  - The same additional diet
  - Similar daily activities
  - Similar living conditions
- Provided the milk from the same supplier
- Measured the children's height at the end of the investigation and calculated the average

The table below shows the results at the end of the investigation compared to the expected average height of 10-year-olds.

EXPECTED AVERAGE HEIGHT OF CHILD (cm)	AVERAGE HEIGHT OF A CHILD ON COW'S MILK (cm)	AVERAGE HEIGHT OF A CHILD ON SOY MILK (cm)
149,86	151,4	147,4

3.3.1 Identify the:

(a) Independent variable (1)

(b) Dependent variable (1)

3.3.2 Name the type of variation displayed by the height of a person. (1)

3.3.3 State TWO planning steps that the researchers had to consider at the beginning of this investigation. (2)

3.3.4 State THREE ways in which the validity of this investigation was ensured. (3)

3.3.5 State ONE factor that could have negatively affected the validity of this investigation. (1)

3.3.6 How did the researchers ensure the reliability of the results? (1)

3.3.7 State the conclusion for this investigation. (2)
(12)

3.4 The passage below describes *Homo erectus* fossils.

> Evidence from fossils of *Homo erectus* shows that they appeared in Africa about 2 million years ago. They spread to many parts of Asia. *Homo erectus* is the oldest known species to be fully bipedal and have a human-like body. Their brain size was smaller than that of humans today. A prominent brow ridge was present over their eye sockets.

3.4.1 Describe how the fossils of *Homo erectus* are used to support the 'Out-of-Africa' hypothesis. (3)

3.4.2 Describe how all OTHER fossil evidence is used to support the 'Out-of-Africa' hypothesis. (4)

3.4.3 Use the information in the passage regarding *Homo erectus* and tabulate TWO differences between the features of *Homo erectus* and *Homo sapiens*. (5)

3.4.4 What observation of the skull of *Homo erectus* would have led scientists to conclude that *Homo erectus* was bipedal? (1)
(13)

3.5 Read the passage below.

> **NATURAL SELECTION IN WOLVES**
>
> In 1986 there was a huge radioactive disaster in Chernobyl and all humans immediately left the area because of the deadly high radiation. Animals exposed to this high radiation developed cancer or died. Almost 40 years later, scientists have been studying the wolves that live in this highly radioactive environment where they are exposed to high radiation. They found that these wolves have a mutation that makes them immune to cancer.

3.5.1 What is a *mutation*? (1)

3.5.2 What effect does exposure to high radiation have on animals? (1)

3.5.3 Use Darwin's theory of natural selection to explain the development of immunity to cancer in these wolves. (7)
(9)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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