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**PROVINSIALE VOORBEREIDENDE EKSAMEN/
PROVINCIAL PREPARATORY EXAMINATION**

GRAAD/GRADE 12

**LIFE SCIENCES
PAPER 2
SEPTEMBER 2024**

PUNTE/MARKS: 150

TYD/TIME: 2½ uur/hours

**Hierdie vraestel bestaan uit 14 bladsye./
This question paper consists of 14 pages.**



INSTRUCTIONS AND INFORMATION

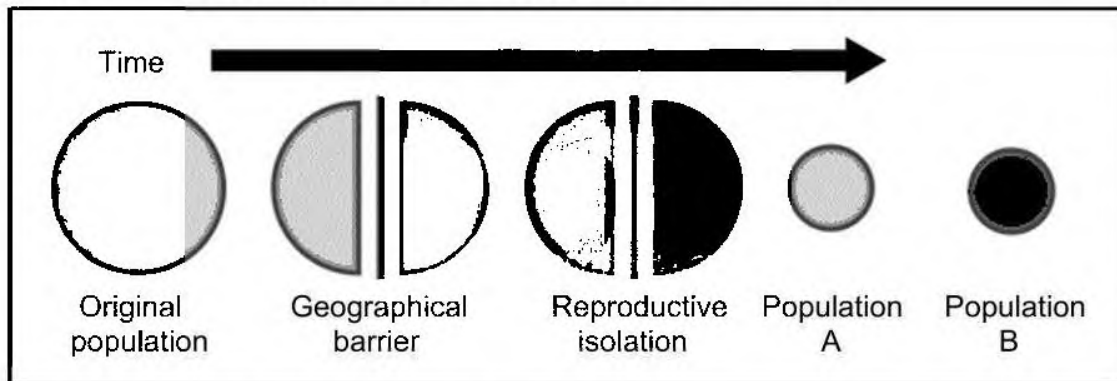
Read the following instructions carefully before answering the questions.

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. 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.

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 1.1.9) in the ANSWER BOOK, e.g. 1.1.10 D.
- 1.1.1 The nitrogenous bases of a DNA molecule are held together by a ... bond.
- A weak hydrogen
 - B weak peptide
 - C strong hydrogen
 - D strong peptide
- 1.1.2 The phase during meiosis I when the spindle fibres start to form
- A Prophase I
 - B Metaphase I
 - C Anaphase I
 - D Telophase I
- 1.1.3 The complementary DNA strand of template GATCAA is ...
- A CUAGUU.
 - B CTAGTT.
 - C AGCTGG.
 - D AGCUGG.
- 1.1.4 A benefit of cloning is that it ...
- A will reduce the variation within a population.
 - B produces genetically identical individuals with desirable characteristics.
 - C will enable offspring to survive under any unfavourable conditions.
 - D is the only scientific technique which is accepted by all religions.
- 1.1.5 The genotype for blood group A is ...
- A $I^A I^A$ only.
 - B $I^A I^A$ or $i i$.
 - C $I^A i$ only.
 - D $I^A I^A$ or $I^A i$.

1.1.6 The diagram below shows a process in evolution.



This diagram illustrates ...

- A natural selection.
- B variation.
- C punctuated equilibrium.
- D speciation.

1.1.7 The following are possible causes of Down syndrome:

- (i) An example of trisomy
- (ii) Chromosomal mutation
- (iii) Two chromosomes at position 21 in the karyotype
- (iv) Error takes place during Prophase I

Which ONE of the following applies to Down syndrome?

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

1.1.8 In humans, colour-blindness is a sex-linked disorder. A mother who is a carrier for colour-blindness has two children: a colour-blind boy and a girl without colour-blindness. This means that ...

- A the father is colour-blind.
- B the father is colour-blind and carried the disorder over to his son.
- C all her sons will be colour-blind.
- D the allele for colour-blindness is recessive and is carried on the X-chromosome.

1.1.9 The probability that two heterozygous parents will produce a homozygous dominant offspring, is ...

- A 75%.
- B 50%.
- C 25%.
- D 100%.

(9 x 2) (18)



- 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 The inability of homologous chromosome pairs to separate during meiosis
 - 1.2.2 An inherited disorder in which blood fails to clot properly
 - 1.2.3 The position of a gene on a chromosome
 - 1.2.4 The organ where meiosis takes place in human females
 - 1.2.5 The type of DNA present in plant cells only
 - 1.2.6 A cell condition in which the nucleus contains only a single set of chromosomes
 - 1.2.7 The organelle in a cell where proteins are formed
 - 1.2.8 Cell division that results in two identical daughter cells
 - 1.2.9 The type of dominance which results in an intermediate phenotype in the heterozygous condition (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	The breeding of organisms over many generations to achieve a desirable phenotype	A:	Cloning
		B:	Artificial selection
1.3.2	Influences the inheritance of blood groups	A:	Codominance
		B:	Multiple alleles
1.3.3	The physical and functional expression of a gene	A:	Genotype
		B:	Phenotype

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

- 1.4 The table below shows the mRNA codons and their corresponding amino acids.

TABLE 1

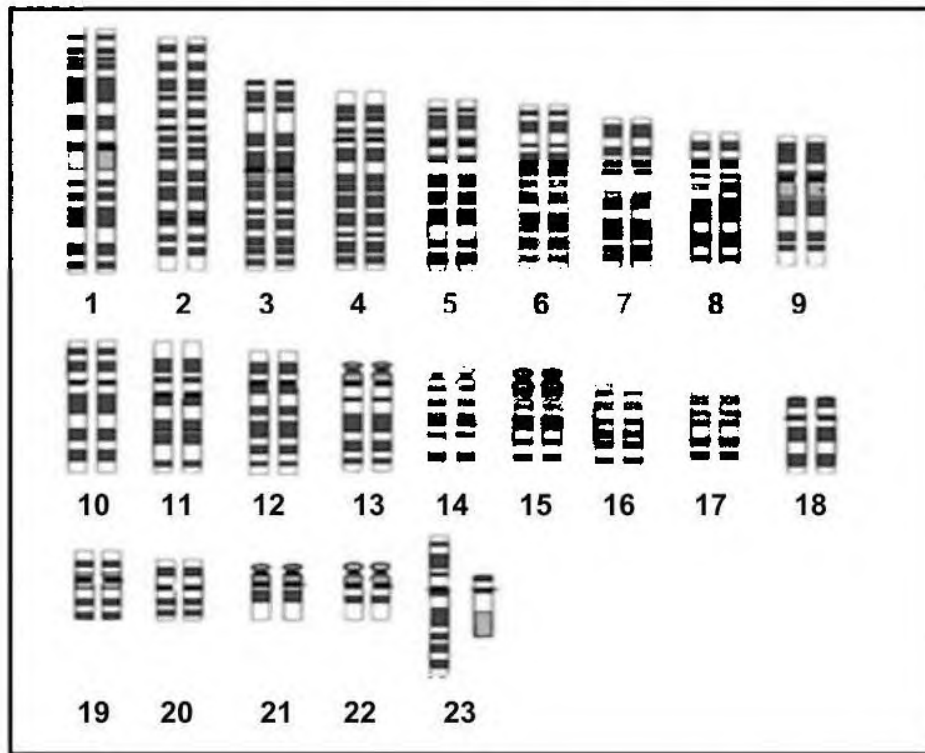
CODONS OF mRNA	AMINO ACIDS
GGU, GGC	Glycine
GCU, GCC, GCA, GCG	Alanine
CGU, CGA, CGC, CGG	Arginine
AAU, AAC	Asparagine
UGG	Tryptophan
UAU, UAC	Tyrosine

DIAGRAM 1 (DNA molecule)

GCG — ATA — ACC

- 1.4.1 Identify the tRNA sequence (from left to right) for **Diagram 1**. (3)
- 1.4.2 Select the correct sequence of amino acids from **Table 1** required by the DNA in **Diagram 1**. (3)
(6)
- 1.5 In mice, the ability to run in a straight line is dominant. A mouse with this trait is called a running mouse (**R**). The recessive trait causes the mice to only run in circles. A mouse with this trait is called a waltzing mouse (**r**). Dark fur (**D**) is dominant over light fur (**d**).
- A light-furred heterozygous running mouse is crossed with a waltzing mouse which is heterozygous for fur colour.
- 1.5.1 Identify the genotypes of both parents. (4)
- 1.5.2 Give ALL the possible gametes that the **running mouse** (used in the crossing) can produce. (2)
(6)

1.6 The diagram below represents a human karyotype.



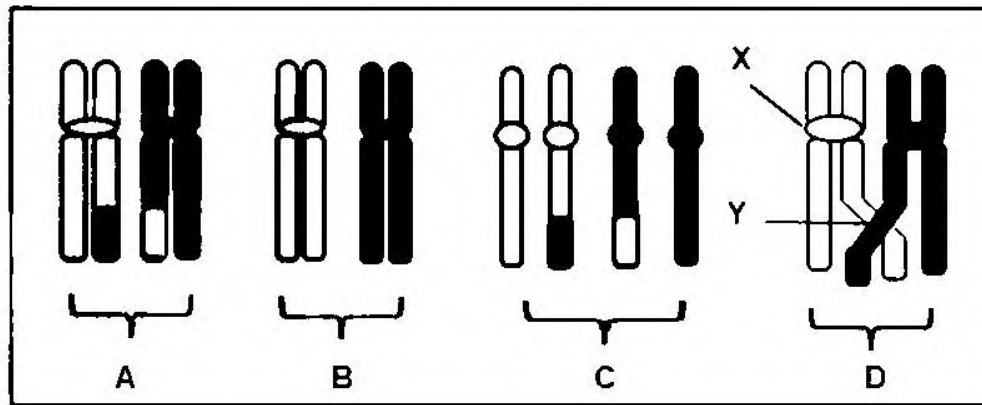
- 1.6.1 Give the number of diploid chromosomes in this cell. (1)
- 1.6.2 What is the collective term for chromosomes numbered 1 to 22? (1)
- 1.6.3 Identify the gender of this person. (1)
- 1.6.4 Give ONE visible reason for the answer to QUESTION 1.6.3. (2)
- (5)

TOTAL SECTION A: 50



SECTION B**QUESTION 2**

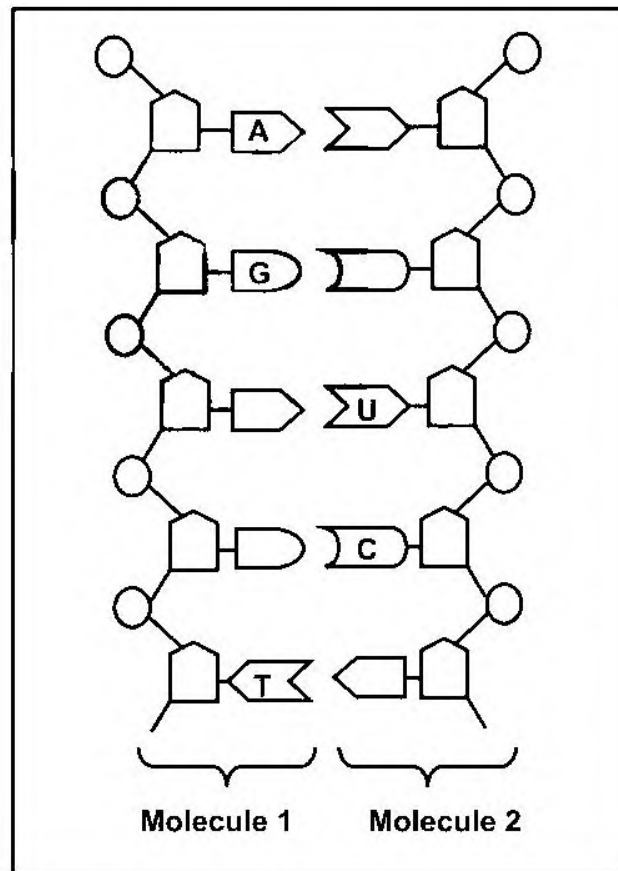
- 2.1 The diagrams below illustrate the appearance of chromosomes in a cell during meiosis. Each LETTER (**A** to **D**) represents a particular phase of meiosis.



- 2.1.1 Label the part:
- X** (1)
 - Y** (1)
- 2.1.2
- Does this diagram represent a human cell? (1)
 - Explain your answer to QUESTION 2.1.2(a). (2)
- 2.1.3 Using only the LETTERS (**A** to **D**), arrange the phases in the correct sequence. (2)
- 2.1.4 Explain how meiosis contributes to genetic variation. (4)
- 2.1.5 Draw a diagram that will represent this cell during Anaphase II. (4)
- (15)**

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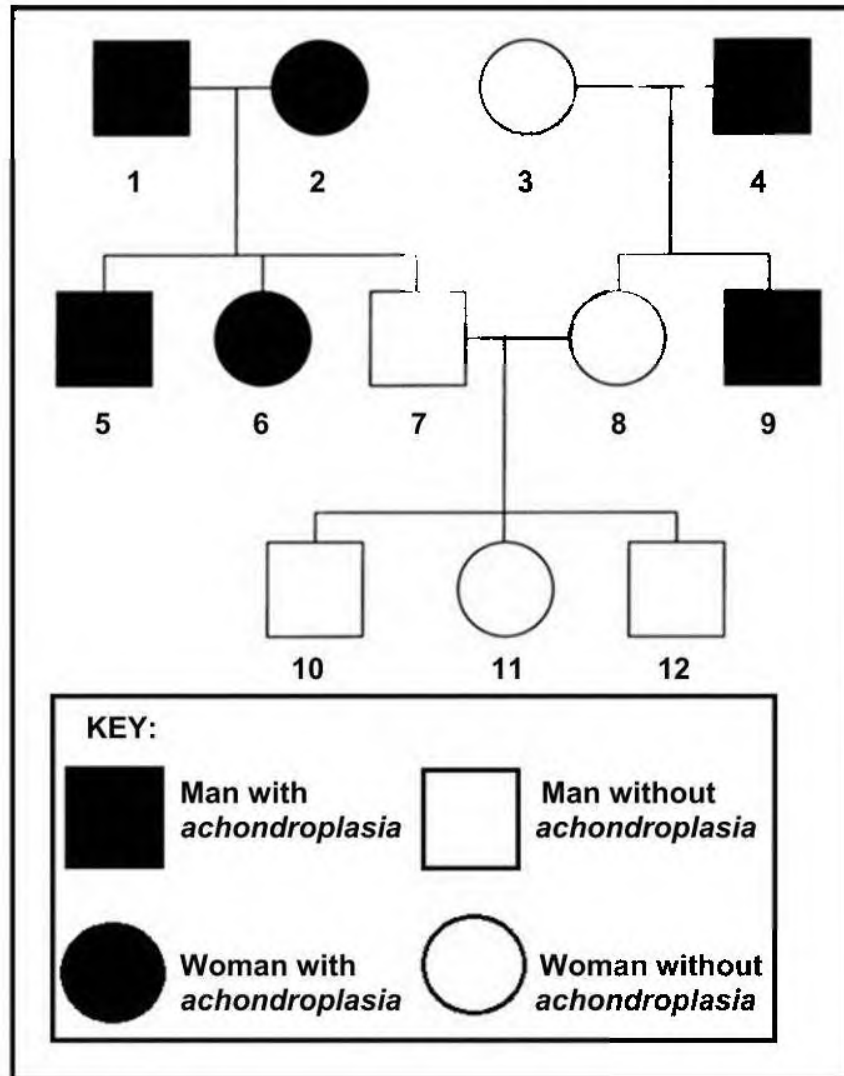
- 2.2 The diagram below shows two different nucleic acid molecules during protein synthesis.



- 2.2.1 Identify molecules 1 and 2. (2)
- 2.2.2 Tabulate THREE differences between molecule 1 and 2. (7)
- 2.2.3 Name and describe this stage of protein synthesis. (6)
- (15)**

- 2.3 *Achondroplasia* is the most common type of short-limbed dwarfism. Over 80% of *achondroplasia* is a result of a gene mutation. *Achondroplasia* is normally inherited as an autosomal dominant gene.

The following diagram illustrates the inheritance of *achondroplasia* in a family.



- 2.3.1 Describe what is meant by a *gene mutation*. (2)
- 2.3.2 Name this type of diagram. (1)
- 2.3.3 How many individuals in the diagram have *achondroplasia*? (1)



September 2024

USE THE LETTERS A AND a TO ANSWER QUESTIONS 2.3.4 AND 2.3.5.

- 2.3.4 Identify the genotypes of individuals **3** and **4**. (2)
- 2.3.5 Use a genetic cross to show how individuals **1** and **2** were able to have child as individual **7** (a son without *achondroplasia*). (6)
- 2.3.6 According to statistics, there should be approximately 2 416 achondroplastic dwarfs in South Africa. Calculate how many cases of *achondroplasia* are **inherited** normally. Show all calculations. (3)
- (15)**

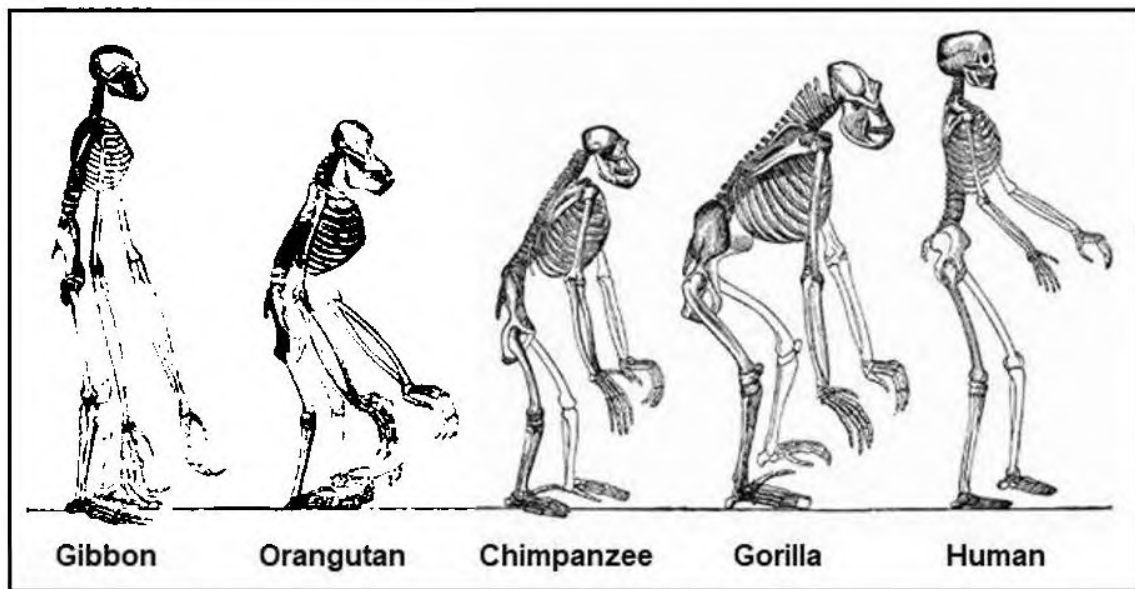
- 2.4 Read the information below, which describes FOUR examples of biotechnology.

- Scientists have deleted the section of DNA that leaves pigs vulnerable to porcine reproductive and respiratory syndrome (PRRS).
- Male mosquitoes have been produced that carry a gene that, when they mate with females, their offspring cannot reach adulthood.
- Cows have been changed to produce milk that has a similar composition to that of human milk.
- Chickens have received an extra gene that interrupts the transmission of avian flu.

- 2.4.1 Identify the type of biotechnology that is described in the text above. (1)
- 2.4.2 Describe TWO ways in which biotechnology can satisfy human needs, according to the text. (4)
- (5)**
[50]

QUESTION 3

3.1 The diagram below shows the development of bipedalism.



- 3.1.1 List FOUR advantages of bipedalism. (4)
- 3.1.2 List FOUR ways in which the human skeleton is suitable for bipedalism. (4)
- 3.1.3 Give the scientific name of the bipedal organism shown in the diagram. (1)
- (9)



- 3.2 The table below shows the evolution of cranial capacity in different species.

SPECIES	PERIOD OF EXISTENCE (MILLION YEARS AGO)	AVERAGE CRANIAL CAPACITY (cm ³)
<i>Sahelanthropus</i>	7,0–6,0	450
<i>Australopithecus africanus</i>	3,0–2,0	480
<i>Homo habilis</i>	2,2–1,6	650
<i>Homo erectus</i>	2,0–0,4	900
<i>Homo neanderthalensis</i>	0,4–0,04	1 500
<i>Homo sapiens</i>	0,2–0	1 450

- 3.2.1 Name TWO fossils of *Australopithecus africanus* which were found in South Africa. (2)
- 3.2.2 Name TWO other lines of evidence for human evolution. (2)
- 3.2.3 Give ONE example of each line of evidence mentioned in QUESTION 3.2.2. (2)
- 3.2.4 Explain the significance of the evolution of cranial capacity. (2)
- 3.2.5 Use the information in the table and draw a bar graph to show the average cranial capacity of the different species. (6)
- (14)**
- 3.3 Read the information below.

Blond hair appeared in Europe around 11 000 years ago. Due to food shortages, many men died during their very long and dangerous hunting trips, resulting in more women than men surviving. Gene mutations gave rise to blond hair which became popular during reproduction.

- Describe the evolution of blond hair through natural selection. (8)
- 3.4 The giraffe (*Giraffa camelopardalis*) is presently the animal with the longest neck.
- 3.4.1 Explain how the giraffe got its long neck, according to Lamarck's theory of evolution. (6)
- 3.4.2 Explain why Lamarck's theory is rejected. (2)
- (8)**



- 3.5 An investigation was conducted by a scientist to determine if two plant populations belonged to the same species. The scientist collected seeds from both Population **A** and Population **B**.

The procedure was as follows:

- He planted 20 seeds from Population **A** and 20 seeds from Population **B** in two separate plots close to each other.
- The stamens (male **fertilising organs**) of **all** the flowers of Population **A** were removed.
- Only pollen from the **flowers** of Population **B** was used to pollinate the flowers of Population **A**.
- The scientist harvested **the seeds** of the plants in Population **A**.
- He planted these seeds **under** ideal conditions in a laboratory.

Result: NONE of the seeds germinated.

- 3.5.1 Give the definitions for

- | | |
|----------------|-----|
| (a) species | (2) |
| (b) population | (2) |

- 3.5.2 Explain why the stamens from the flowers of Population **A** were removed. (2)

- 3.5.3 State TWO factors that the scientist would have kept constant in the laboratory. (2)

- 3.5.4 Suggest ONE way in which the scientist could have increased the reliability of the results. (1)

- 3.5.5 What conclusion can be drawn at the end of the investigation? (1)

- 3.5.6 Give a reason for your answer to QUESTION 3.5.5. (1)
(11)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150