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CONTROL TEST: May 2023

SUBJECT: Life Science

Grade 12

DNA and Protein Synthesis

EXAMINER:	J. J. Hanneman	MARKS:	60
MODERATOR:	C. van de Venter (Durban Girls College)	TIME:	60 minutes

NAME & CLASS:

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1. This question paper consists of 12 pages and 6 questions.
 2. Answer ALL the questions in the answer book provided.
 3. Read the questions carefully.
 4. Start each question on a new page.
 5. Number your answers as the questions are numbered.
 6. Calculators may be used.
 7. It is in your own interest to write legibly and to present your work neatly.
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QUESTION 1

- 1.1 Four multiple-choice questions are asked below. Choose the most correct answer to each question and write the letter of your choice in the table below.

1.1.1	1.1.2	1.1.3	1.1.4

- 1.1.1. Which of the following is NOT found in a DNA molecule? (1)

- A. Cytosine
- B. Uracil
- C. Adenine
- D. Guanine

- 1.1.2. Between which types of molecules in a double-stranded DNA strand must the bonds break before replication takes place? (1)

- A. Phosphate-bases
- B. Sugar-phosphate
- C. Nitrogen bases
- D. Sugar-bases

- 1.1.3. If the code for an amino acid is ATG on the DNA molecule, what will the code for the corresponding anti-codon be? (2)

- A. CAU
- B. TAC
- C. UAC
- D. AUG

- 1.1.4. Which statement does not apply to RNA: (1)

- A. The tRNA carries the amino acid to the ribosomes.
- B. The ribosome moves along the mRNA, interpreting the code.
- C. The anticodons of mRNA act as templates for the building blocks of proteins.
- D. Codons and anticodons of RNA are made up of triplet nucleotide bases.

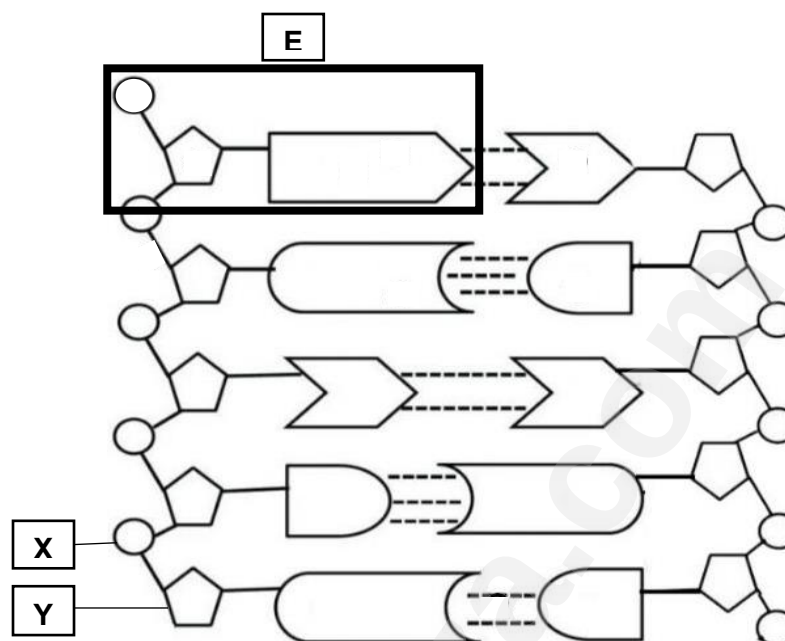
[5 MARKS]

1.2. Supply the correct term for each of the following definitions:

Term	Definition
	Enzyme responsible for controlling the transfer of the code from DNA to RNA.
	Type of RNA that carries the genetic code from the DNA in the nucleus to the ribosomes of the cytoplasm.
	Sugar molecule found in the nucleotide of an RNA base.
	Larger group of the nitrogen bases, composed of two rings.

[4 MARKS]

QUESTION 2



2.1 Identify the type of nucleic acid in the image above.

(1)

2.2 Give TWO visible reasons for your answer.

(2)

2.3 Label the structures named E, X and Y.

(3)

E: _____

X: _____

Y: _____

2.4 Describe the role of the nucleic acid in transmitting hereditary information?

(2)

[8 MARKS]

QUESTION 3

A group of scientists calculated the average mass of DNA found in five different cells of female rats. Their results are shown in the table below. Use the given data, as well as your knowledge of Life Sciences, to answer the questions that follow.

Type of cell	Average mass of DNA ($\times 10^{-12}$ g)
Liver	6.6
Muscle	6.6
Red blood cell	0
Ovum	3.3
Skin cell	6.6

3.1 Give a reason for why the mass of DNA for the red blood cell is 0. (1)

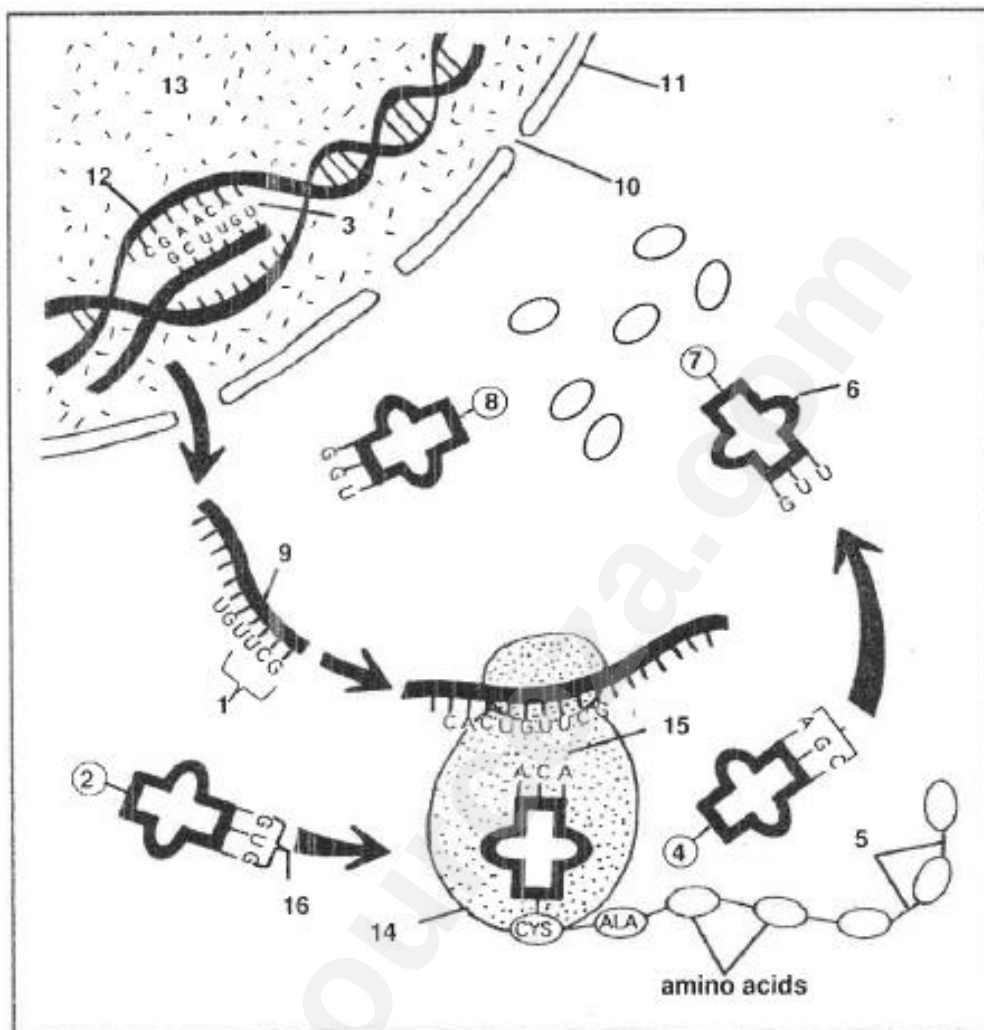
3.2 Criticize why the DNA content found in the ova cells is less than compared to the content of the liver, muscle, and skin cells. Describe why this is necessary. (2)

3.3 Which type of graph would you select to make the results easier to interpret? Give a reason for your choice. (2)

3.4 What is the independent variable in this investigation? (1)

[6 MARKS]

QUESTION 4



4.1 Name the process represented by the diagram above.

(1)

4.2 Provide labels for each of the parts labelled 10, 11, 13 and 14:

(4)

- 10: _____
 11: _____
 13: _____
 14: _____

4.3 Name the nucleic acid labelled 12.

(1)

4.4 Using the table provided on page 12, determine the amino acid that the structure numbered 4 would be carrying.

(2)

4.5 Name the processes that are occurring at:

(2)

3: _____

15: _____

4.6 Explain the role that the structure labelled as 10 plays, in the process identified in 4.1.

(2)

[12 MARKS]

QUESTION 5

You have been selected to form part of a crime scene investigation team. As a biologist, you have the responsibility of creating and interpreting DNA fingerprints. You have been called to the scene where a victim was attacked in his home. DNA was found at the scene. The police have four individuals that are currently suspects.

5.1. How many DNA samples will you have to process in your laboratory for fingerprinting? Explain why you have taken these samples. (3)

5.2. What specific types of DNA sequences will you use to create fingerprint profiles? (1)

5.3 Why are the sequences mentioned in 5.2 favourable to use for creating DNA profiles? (2)

Consider the DNA profiles below:

Crime Scene DNA							
Suspect A							
Suspect B							
Suspect C							
Suspect D							

5.4 Which suspect is most likely to be the attacker? Give a reason for your answer.

(2)

5.5 You are called into a courtroom to discuss the use of your DNA fingerprinting techniques. Think of two valid arguments that might be used for, and two valid arguments that would be used against the use of DNA fingerprints. (4)

[12 MARKS]

QUESTION 6

The table below highlights the series of events that allowed for the discovery of DNA structure and its role in genetic research. Study the information carefully before answering the questions that follow.

History of the discovery of DNA	
Year	Discovery event
1865	Gregor Mendel : Made use of pea plant experiments to discover that traits are passed from parent to offspring in the form of genes.
1874	Friedrich Miescher : Identified hereditary substance as DNA.
1928	Frederick Griffith : Determined that genes are made up of DNA, not proteins.
1944	Oswald Avery supported Frederick Griffith's observations that DNA is the "hereditary molecule".
1949	Erwin Chargraff determined Chargraff's rules , in that the adenine amount is always equal to thymine and the guanine amount is always equal to cytosine.
1952	Rosalind Franklin took an X-ray image of the structure of DNA. Maurice Wilkins shared this image to Watson and Crick.
1953	James Watson and Francis Crick formulated the double helix structure of DNA by making use of a 3-dimensional model.
1990	The Human Genome Project was established.
2003	Human genome was mapped.

6.1 How long after the identification of DNA, was an X-ray image taken of the structure? Show your calculations. (2)

6.2 What does the timeline above tell us about the nature of science? (1)

6.3 Provide TWO pieces of evidence from the table above to show that scientists base their own research on the findings of other scientists. (4)

6.4 Why do you believe the structure of DNA wasn't discovered before the 1990's?
(3)

6.5 Using Chargraff's rules, determine the percentage of adenine bases in an individual with 2000 total bases, if the number of cytosine bases are 400. Show all calculations.
(3)

[13 MARKS]

TOTAL: 60 MARKS

Amino acid determination table: