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GRADE 11 LIFE SCIENCES BLOCK TEST

DNA, RNA, Protein Synthesis and Mutations

50 MARKS



ST ANDREW'S COLLEGE

Setter: Dr IM Foster

Moderators: Life Sciences Department

NAME: _____

TEACHER'S INITIALS: _____

Instructions:

- Check that your test consists of 6 pages.
- Answer all questions in the spaces provided.
- Use the mark allocation to guide you in terms of how much to write.

Question 1

For questions 1.1 to 1.5 there is only one correct answer. Write your answer in the blocks provided below.

Question	1.1 (1 mark)	1.2 (2 marks)	1.3 (1 mark)	1.4 (1 mark)	1.5 (2 marks)
Answer					

[7]

1.1 Who used X-ray diffraction to study the structure of DNA?

- A James Watson
- B Francis Crick
- C Rosalind Franklin
- D Erwin Chargaff

1.2 A DNA molecule consists of 4000 nucleotides of which 20% contain the base adenine. How many of the nucleotides will contain guanine?

- A 800
- B 100
- C 1200
- D 1600

Questions 1.3 and 1.4 refer to the possible answers numbered in the following list:

- 1 DNA molecules
- 2 tRNA molecules
- 3 mRNA molecules
- 4 amino acids
- 5 ribosomes

- 1.3 Which of these must be present in the largest number for successful synthesis of a large protein molecule to occur?
- A 1
B 3
C 4
D 5
- 1.4 On which of these are anti-codons present?
- A 2
B 3
C 4
D 5
- 1.5 If each amino acid weighs 100 mass units, what is the weight (in mass units) of the protein molecule synthesized from a mRNA molecule that is 600 bases long?
- A 2000
B 6000
C 20 000
D 60 000

Question 2

- 2.1 Match the terms in column A with the descriptions in column B. Each term may only be used once. Write the letter of the most suitable term next to the appropriate description. [5]

Column A

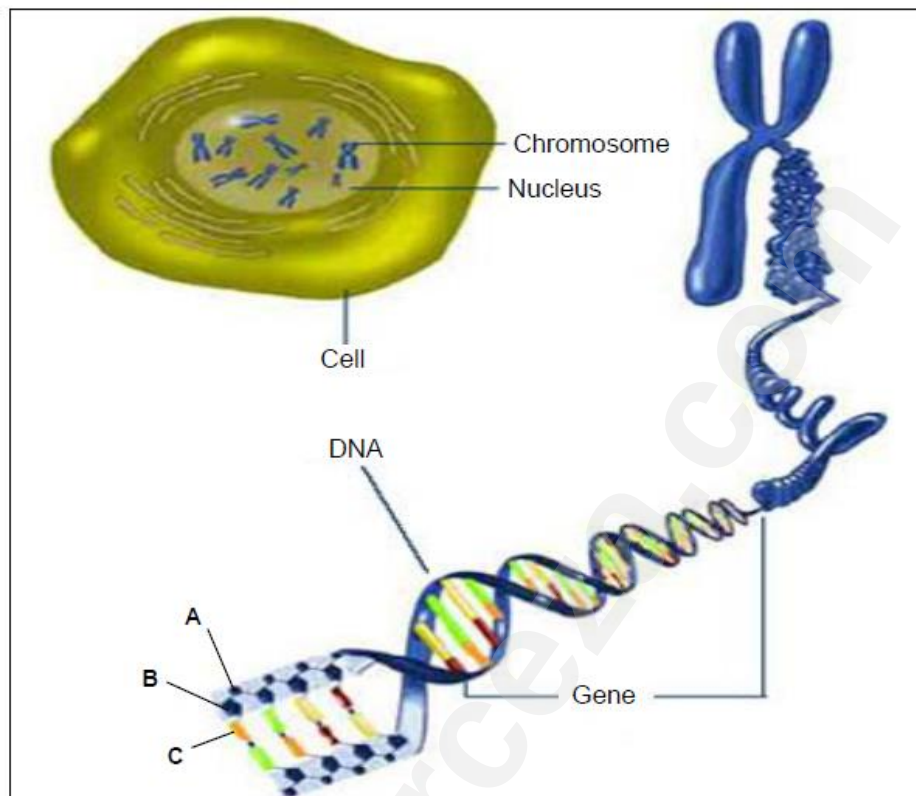
- [] Sub-cellular structure that is the site of protein synthesis
- [] Synthesis of mRNA
- [] Molecular language made up of 64 codons
- [] Chain of amino acids
- [] Strand of genetic material

Column B

- A genetic code
- B ribosome
- C polypeptide
- D chromosome
- E translation
- F Transcription
- G Nucleus

Question 3

3.1 Study the diagram and answer the questions that follow:



(IEB Supplementary Examination 2018)

3.1.1 Explain the relationship between chromosome, DNA and a gene. (3)

3.1.2 Provide labels for structures A, B and C. (3)

A: _____

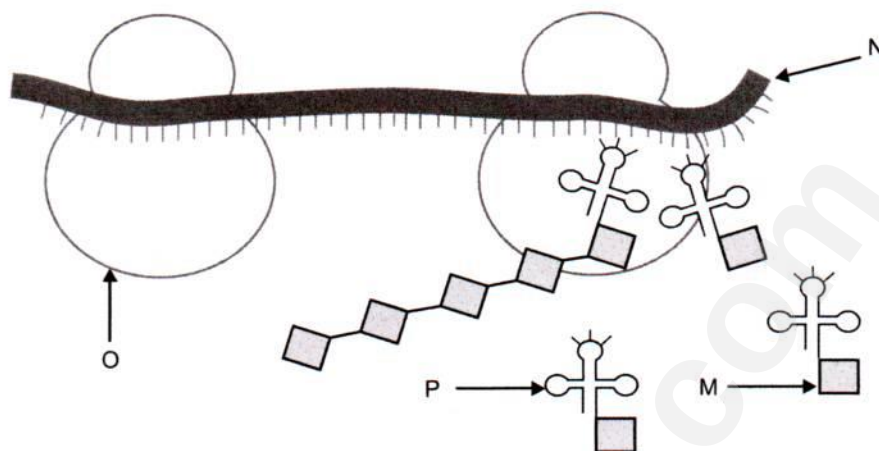
B: _____

C: _____

3.1.3 One structural component of the chromosomes is not evident in the diagram. Name this element. (1)

Question 4

The picture below shows a stage in protein synthesis.



- 4.1 Name the stage shown. _____ (1)
- 4.2 Where in the cell does this stage take place? _____ (1)
- 4.3 Provide labels for parts M, N, O and P (on the diagram). (4)
- 4.4 The table below shows a section of the sequence of nucleotides contained in molecule N. Complete the table by giving the corresponding sequence of nucleotides that would be found on the *DNA template or coding* strand from which molecule N was transcribed. (4)

Nucleotide sequence in molecule N	U	U	U	C	A	A	G	C	C
DNA template strand									

[10]

Question 5

Read through the following paragraph that describes the causes and effects of haemophilia. Then answer the questions that follow:

Haemophilia is a genetic disorder that impairs the body's ability to control blood clotting which is used to stop bleeding when a blood vessel is broken. Thus when a blood vessel is injured, a temporary scab forms, but the missing clotting factors prevent fibrin (a fibrous protein) formation which is necessary to maintain the blood clot.

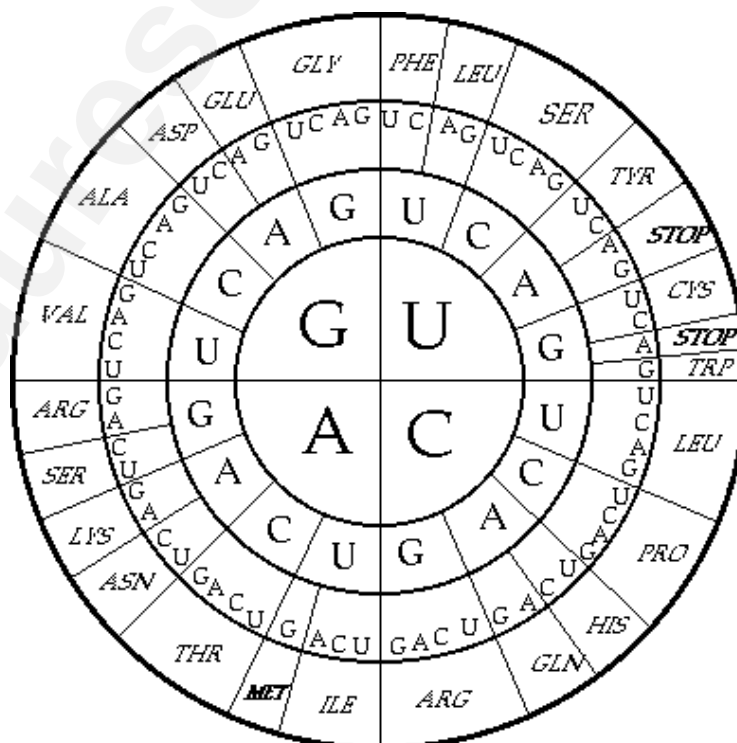
The disorder is caused by a point mutation in the fibrin gene that results in a stop codon being formed on the mRNA. This results in a shortened protein which lacks the functionality of the normal, non-mutant protein.

The DNA sequence below is part of the transcribing (coding) sequence for the **normal** fibrin gene.

Healthy DNA transcribing sequence: ...TAA TTT TTA TAG CTT AAA CCA AGG ...

↑
base 1102

- 5.1 Identify how many of the following are exhibited in the DNA sequence above: (3)
- nitrogenous bases _____
 - triplet codes _____
 - amino acids coded for _____
- 5.2 The mutation that causes haemophilia results in the nitrogen base C being replaced with the nitrogen base A at the base position 1117. Rewrite the transcribing DNA sequence shown above, but with the altered nitrogen base at position 1117. (2)
- _____
- 5.3 What kind of point mutation causes haemophilia? _____ (1)
- 5.4 Write the mRNA sequence for the mutant DNA strand that you have given in 6.2. (2)
- _____
- 5.5 Determine the amino acid sequence coded by the mRNA (in question 6.4) for the fragment of the mutant haemophilia protein using the mRNA-Amino Acid Wheel given below. (2)
- _____



NOTE: Read the wheel from the inside out.

[10]

Question 6

6.1 How are DNA and RNA different? Show by completing the table below **as fully as possible**:

[6]

DNA	Feature	RNA
	Nitrogen bases	
	Sugars	
	Location	

Question 7

The diagram below shows a knitted model of DNA.



[Google Image Result for <http://images.carolina.com/>]

7.1 Give the term used to describe the shape of a DNA molecule. _____ (1)

7.2 Describe ONE aspect of DNA structure that the model above represents well. (1)

7.3 Describe ONE aspect of DNA structure that the model does NOT represent well. (1)

7.4 How are models useful to educators? (2)

[5]**TOTAL: 50 MARKS**