Protein synthesis

Question Paper 4

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Nucleic acids and protein synthesis
Sub Topic	Protein synthesis
Booklet	Theory
Paper Type	Question Paper 4

Time Allowed : **56 minutes**

Score : **/ 46**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** Explain how changes in the nucleotide sequence of DNA may affect the amino acid sequence in a protein. [7]

(b) Explain how natural selection may bring about evolution. [8]

[Total: 15]

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2 Fig. 3.1 shows a molecule of haemoglobin.

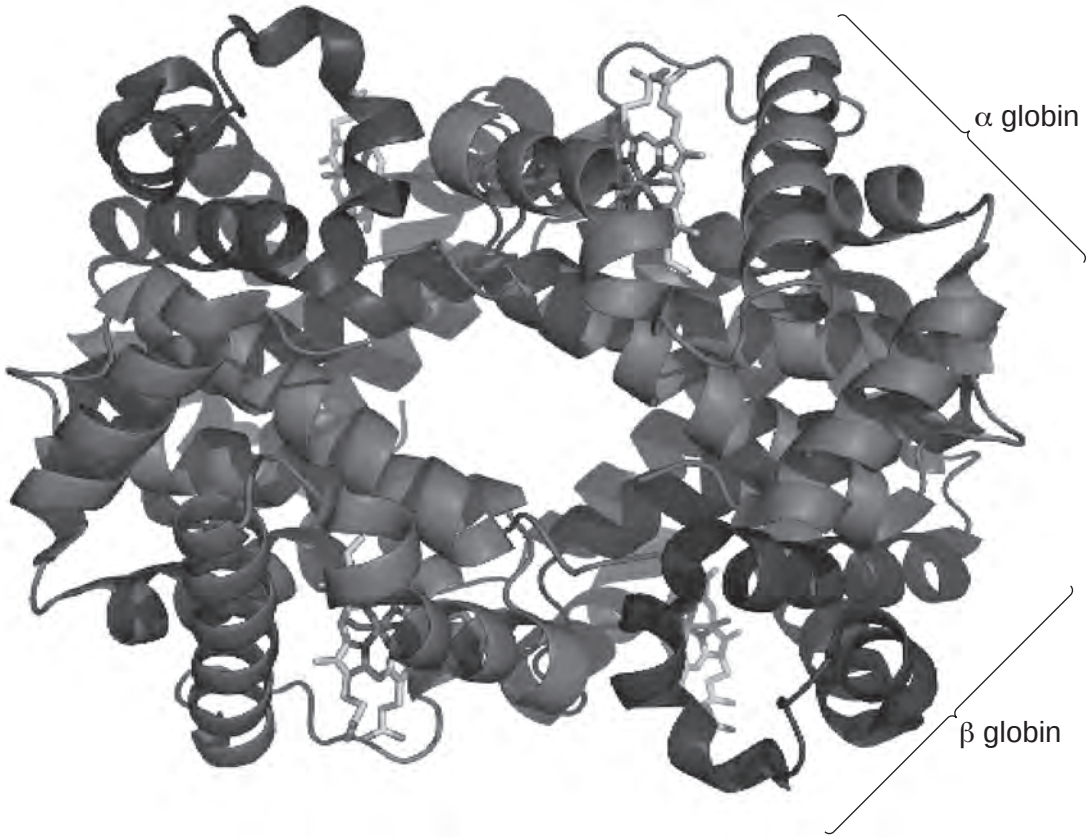

Fig. 3.1

(a) Explain how a molecule of haemoglobin shows the four levels of organisation of protein molecules.

primary structure .....

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secondary structure .....

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tertiary structure .....

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quaternary structure .....

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..... [4]

There are many different variants of haemoglobin. The sequence of bases in DNA that code for the first seven amino acids in two variants of the β-globin polypeptide are shown in Fig. 3.2.

The genetic dictionary for some of the amino acids is in Table 3.1.

Variant 1

1	2	3	4	5	6	7
CAC	GTG	GAC	TGA	GGA	CTC	CTC

Variant 2

1	2	3	4	5	6	7
CAC	GTG	GAC	TGA	GGA	CAC	CTC

Fig. 3.2

Table 3.1

amino acid	**abbreviation**	**DNA triplets on the coding polynucleotide**
valine	val	CAA, CAC, CAG, CAT
proline	pro	GGA, GGC, GGG, GGT
threonine	thr	TGA, TGC, TGG, TGT
histidine	his	GTA, GTG
glutamic acid	glu	CTC, CTT
leucine	leu	AAC, AAT, GAA, GAC, GAG, GAT

(b) Use the genetic dictionary to describe the similarities and differences between the two variants of haemoglobin.

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..... [3]

(c) Collagen is a fibrous protein found in many tissues in animals.

(i) State the function of collagen in the walls of arteries.

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..... [1]

(ii) State **one** way in which the **structure** of collagen differs from the structure of haemoglobin.

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..... [1]

[Total: 9]

3 **(a)** Fig. 4.1 shows the structure of deoxyribose sugar.

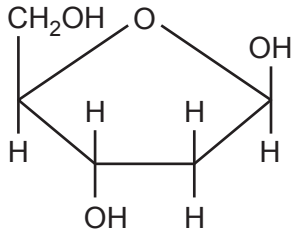

Fig. 4.1

State the differences between the structure of deoxyribose shown in Fig. 4.1 and the ring structure of α-glucose.

You may use the space below to help you in your answer.

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[3]

(b) Match the biological macromolecule with the type of bond that is formed when the molecule is synthesised. Choose from the list below.

amylose **cell** **yceride** **otein** **ylopectin**

type of bond(s)	biological macromolecule
β, 1-4 glycosidic	
α, 1-4 glycosidic **and** α, 1-6 glycosidic	
phosphodiester	
peptide	

[4]

Semi-conservative replication of DNA and transcription involve the formation of polynucleotide chains.

(c) State the type of reaction that occurs in the formation of a polynucleotide chain.

.....[1]

(d) Complete Table 4.1 to show **four** differences between DNA replication and DNA transcription.

Table 4.1

	replication	**transcription**
1		
2		
3		
4		

[4]

[Total: 12]

4 Fig. 5.1 represents part of a DNA molecule.

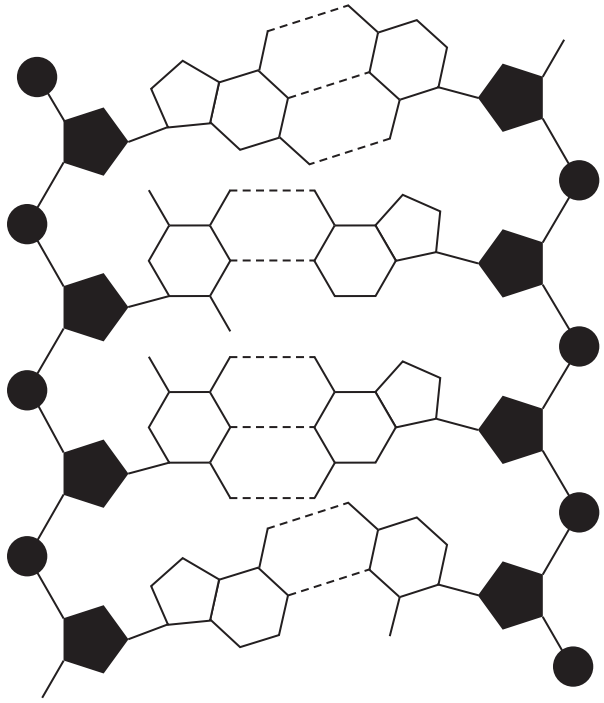

Fig. 5.1

(a) On Fig. 5.1

(i) draw a box around a nucleotide [1]

(ii) label, with the letter **P**, a phosphate group. [1]

(b) Describe how a DNA molecule replicates.

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..... [5]

(c) DNA codes for polypeptides in cells. Transfer RNA (tRNA) is involved in this process.

Describe the role of tRNA in the production of polypeptides in cells.

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..... [3]

[Total: 10]