

Name of the Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

Q1.

- (a) Draw the general structure of an amino acid.

(1)

Table 1 shows mRNA codons and the amino acids coded for by each codon. It also shows some properties of the R group of each amino acid.

Table 1

1st base	2nd base				3rd base
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Leu		Stop	Stop	C
				Trp	A
					G
C	Leu	Pro	His	Arg	U
			Gin		C
					A
					G
A	Ile	Thr	Asn	Ser	U
	Met		Lys	Arg	C
					A
					G
G	Val	Ala	Asp	Gly	U
			Glu		C
					A
					G

Key to the properties of the R group of each amino acid



No overall change



Positively charged



Negatively charged

(b) The genetic code is described as degenerate.

What is meant by this? Use an example from **Table 1** to illustrate your answer.

(2)

A scientist investigated changes in the amino acid sequence of a human enzyme resulting from mutations. All these amino acid changes result from single base substitution mutations. This enzyme is a polypeptide 465 amino acids long.

Table 2 shows the result of three of the base substitutions.

Table 2

Amino acid number	Correct amino acid	Amino acid inserted as a result of mutation
203	Val	Ala
279	Glu	Lys
300	Glu	Lys

(c) What is the minimum number of bases in the gene coding for this polypeptide?

Answer = _____

(1)

- (d) Use information from **Table 1** to tick (✓) one box that shows a single base substitution mutation in DNA that would result in a change from Val to Ala at amino acid number 203

CAA → CGA

☐

GUU → GCA

☐

GUU → GUC

☐

CAC → CGG

☐

(1)

- (e) A change from Glu to Lys at amino acid 300 had no effect on the rate of reaction catalysed by the enzyme. The same change at amino acid 279 significantly reduced the rate of reaction catalysed by the enzyme.

Use all the information and your knowledge of protein structure to suggest reasons for the differences between the effects of these two changes.

(3)

(Total 8 marks)

Q2.

- (a) The genetic code is **degenerate** and **non-overlapping**.

Explain the meaning of:

Degenerate _____

Non-overlapping _____

(2)

The table shows a short section of a messenger RNA (mRNA) molecule and the section of a polypeptide for which it codes.

mRNA	G G G	G C U	U C A	C C G	G C A	A C G
Polypeptide	glycine	alanine	serine	proline	alanine	threonine

- (b) Name the bases represented in the table by:

A _____

C _____

G _____

U _____

(2)

- (c) Use information in the table to give the sequence of bases in **DNA** that codes for serine.

(1)

(Total 5 marks)

Q3.

In a eukaryotic cell, transcription results in a molecule of pre-mRNA that is modified to produce mRNA. In a prokaryotic cell transcription produces mRNA directly.

(a) Explain this difference.

(2)

(b) Give **two** differences between the structure of mRNA and the structure of tRNA.

1.

2.

(2)

(Total 4 marks)