GENETICS – end of chapter questions

1. **The table shows the sequence of bases on part of the template strand of DNA**

Base sequence on template strand of DNA	**C**	**G**	**T**	**T**	**A**	**C**
Base sequence of mRNA	G	C	A	A	U	G

(a) Complete the table to show the base sequence of the mRNA transcribed from this DNA strand

(b) A piece of mRNA is 660 nucleotides long but the DNA template strand from which it was transcribed is 870 nucleotides long.

(i) Explain this difference in numbers of nucleotides

DNA is edited – introns present in DNA

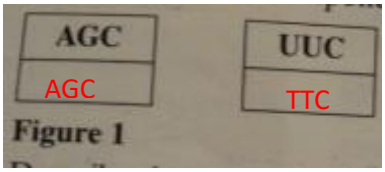
(ii) What is the maximum number of amino acids in the protein translated from this piece of mRNA? Explain your answer.

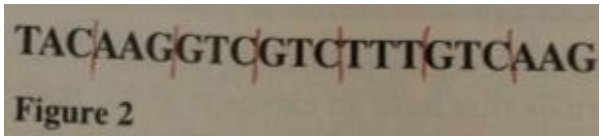
220 – three bases code for one amino acid

(c) Draw a table to give 2 differences between the structure of mRNA and the structure of tRNA

tRNA	mRNA
Has no base pairing	Has base pairing
Clover shape	Linear
Has binding site for amino acids	Has no binding site for amino acids
Only a few (20) kinds	It is different for each gene so there are many kinds

2. **The figure 1 shows the exposed bases (anticodons) of 2 tRNA molecules involved in the synthesis of a protein.**





(a) Complete the boxes to show the sequence of bases found along the corresponding section of the coding DNA strand.

(b) Describe the role of tRNA in the process of translation

The anticodon complementary to the codon reads the message on mRNA and brings the specific acid which is transferred to the ribosome and the correct sequence of amino acids is formed to make the polypeptide

(c) The table below shows the sequences of bases in a section of DNA coding for a polypeptide of 7 amino acids. The polypeptide was hydrolysed. It contained four different amino acids. The number of each type obtained is shown in the table.

Amino acid	Number present
Phe	2
Met	1
Lys	1
Gln	3

Use the base sequence shown in figure 2 to work out the order of amino acids in the polypeptide

Met, phe, gln, gln, lys, gln, phe

3. Read the following passage;

The sequence of bases in a molecule of DNA codes for proteins. Different sequences of bases code for different proteins. The genetic code, however, is degenerate. Although the base sequence for AGT codes for serine, other sequences may also code for this same amino acid. There are 4 base sequences which code for amino acid glycine. These are GGA, GGC, GGG and GGT

Pieces of DNA which have a sequence where the same base is repeated many times are called 'slippery'. When 'slippery' DNA is copied during replications, errors may occur in copying. Individual bases may be copied more than once. This may give rise to differences in the protein which is produced by the piece of DNA containing the errors.

(a) Different sequences of bases code for different proteins. Explain how

Proteins are made of a chain of amino acids and each amino acid has its own base code/triplet code

(b) The base sequence AGT codes for serine. Give the mRNA codon transcribed from this base sequence.

UCA

(c) Glycine-proline-proline is a series of amino acids found in a particular protein. Give the sequence of DNA bases for these three amino acids which contain the longest 'slippery' sequence.

CCG GGG GGG

(d) Explain how copying bases more than once may give rise to differences in the protein

It changes the base sequence of later triplets

(e) Starting with mRNA in the nucleus of a cell, describe how a molecule of protein is synthesised.

mRNA leaves the nucleus through the nuclear pore and goes to the ribosome. tRNA brings amino acids to the ribosome (specific tRNA's have specific amino acids). The anticodon of the tRNA is complementary to the codon on mRNA. Peptide bonds form between amino acids and the tRNA detaches and goes to collect another amino acid while the ribosome moves along the mRNA

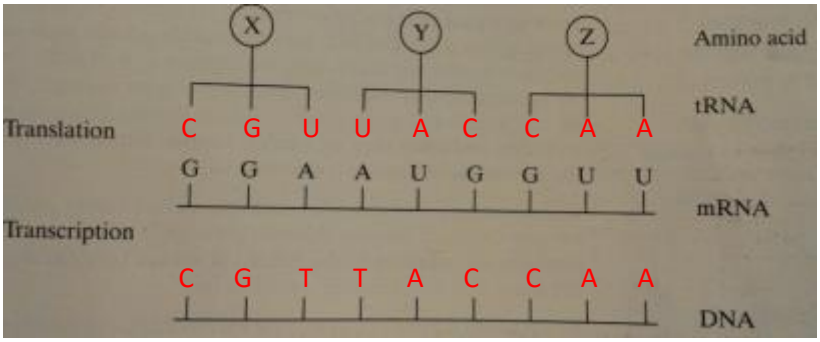
4. (a) (i) what is the role of RNA polymerase in transcription?

To join nucleotides to form a strand

(ii) name the organelle involved in translation

Ribosome

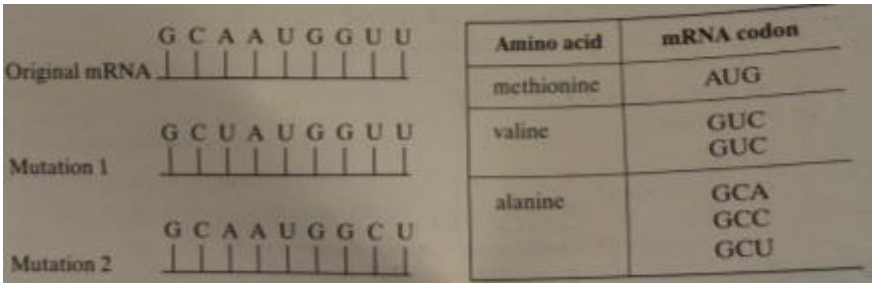
(b) below shows some molecules in protein synthesis



Complete the diagram to show:

(i) The bases on the DNA strand from which the mRNA was transcribed
(ii) The bases forming the anticodons of the tRNA molecules.

Below shows the effects of 2 different mutations of the DNA on the base sequence of the mRNA codons for 3 amino acids.



Amino acid	mRNA codon
methionine	AUG
valine	GUC GUC
alanine	GCA GCC GCU

(C) name the type of mutation represented by mutation 1

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Substitution

(d) Use the information in the table to;

(i) Identify amino acid X in figure 3

Alanine

(ii) Explain how each mutations may affect the polypeptide for which this section of DNA is part of the code.

MUTATION 1 – no change to the sequence of amino acids so it still codes for alanine due to the degenerate nature

MUTATION 2 – change in sequence so valine replaced by alanine. Changes the tertiary structure.