Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

(a) DNA is a polymer of nucleotides. Each nucleotide contains an organic base.

Explain how the organic bases help to stabilise the structure of DNA.

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(2)

(b) Triplets of bases in a DNA molecule code for the sequence of amino acids in a polypeptide. The genetic code is frequently written as the three bases on mRNA that are complementary to a triplet on DNA. **Table 1** shows what different combinations of bases on mRNA code for. The names of amino acids are abbreviated. For example, 'Ala' stands for alanine.

Table 1

First base	Second base				Third base
	Guanine (G)	**Adenine (A)**	**Cytosine (C)**	**Uracil (U)**	
G	GGG Ala GGA Gly GGC Gly GGU Gly	GAG Glu GAA Glu GAC Asp GAU Asp	GCG Ala GCA Ala GCC Ala GCU Ala	GUG Val GUA Val GUC Val GUU Val	**G** **A** **C** **U**
A	AGG Arg AGA Arg AGC Ser AGU Ser	AAG Lys AAA Lys AAC Asn AAU Asn	ACG Thr ACA Thr ACC Thr ACU Thr	AUG Met AUA Iso AUC Iso AUU Iso	**G** **A** **C** **U**
C	CGG Arg CGA Arg CGC Arg CGU Arg	CAG Gln CAA Gln CAC Hist CAU Hist	CCG Pro CCA Pro CCC Pro CCU Pro	CUG Leu CUA Leu CUC Leu CUU Leu	**G** **A** **C** **U**
U	UGG Trp UGA **stop**	UAG **stop** UAA **stop**	UCG Ser UCA Ser	UUG Leu UUA Leu	**G** **A**

	UGC	Cyst	UAC	Tyr	UCC	Ser	UUC	Phe	**C**
	UGU	Cyst	UAU	Tyr	UCU	Ser	UUU	Phe	**U**

Suggest **one** advantage of showing the genetic code as base sequences on mRNA, rather than triplets on DNA.

_____

_____

_____

(1)

(c) What name is given to a group of three bases on mRNA that codes for an amino acid?

_____

(1)

(d) Use information from **Table 1** to explain why the genetic code is described as degenerate.

_____

_____

_____

_____

_____

(2)

(e) Suggest the role of the mRNA base triplets UGA, UAG and UAA.

_____

_____

_____

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_____

(2)

(f) **Table 2** shows the sequence of mRNA bases forming part of a single gene.

Table 2

Base on DNA template									
Base on mRNA	G	U	G	U	A	C	U	G	G
Encoded amino acid									

Complete **Table 2** to show the base sequence of the DNA template from which this mRNA was

transcribed and the encoded amino acid sequence.

(2)
(Total 10 marks)

Q2.

Haemoglobin transports oxygen around the body of many animals.

(a) Haemoglobin is a protein with a quaternary structure.

Explain the meaning of **quaternary structure**.

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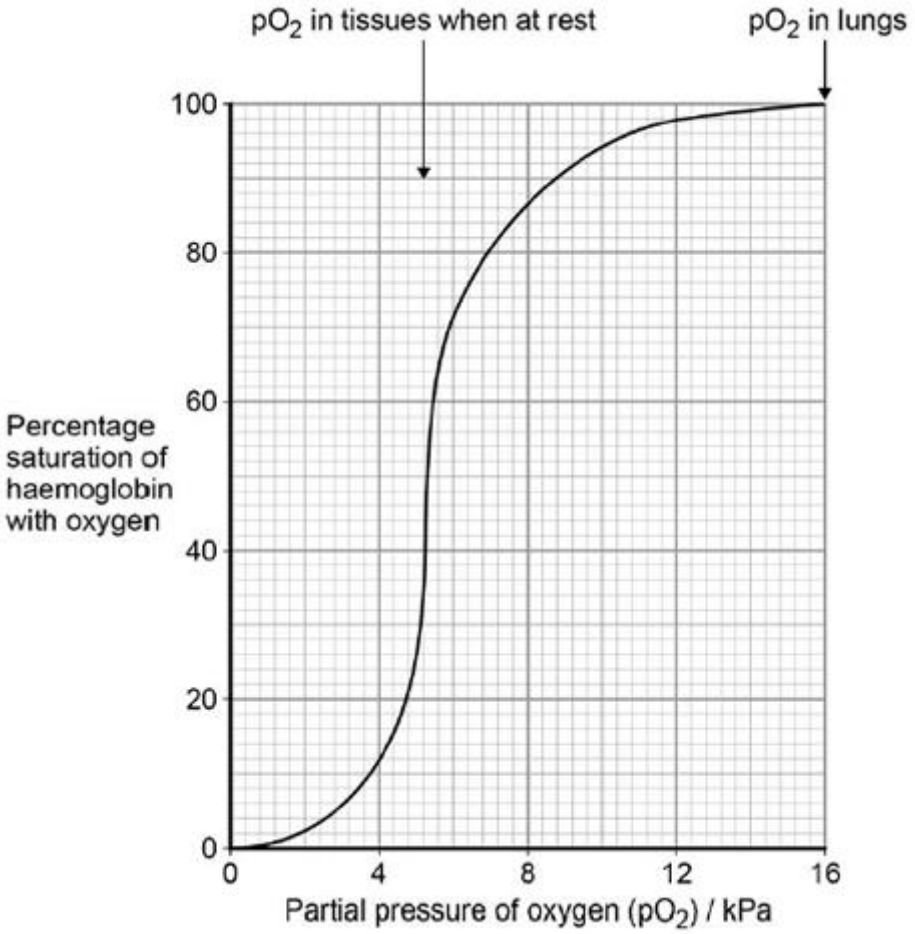
_____

_____

(1)

(b) When fully saturated, each molecule of haemoglobin is bound to four molecules of oxygen.

The graph shows the percentage saturation of haemoglobin with oxygen at different partial pressures.



Give the formula for calculating the percentage saturation of haemoglobin with oxygen.

Percentage saturation of haemoglobin with oxygen =

(1)

(c) The first molecule of oxygen to bind causes a change in the shape of the haemoglobin molecule.

This change of shape makes it easier for other oxygen molecules to bind to the haemoglobin molecule.

Explain how the graph provides evidence for this.

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_____

_____

_____

_____

(2)

(d) Suggest **one** advantage of this change in the affinity of haemoglobin for oxygen.

_____

_____

_____

(1)

(e) Tests on the man whose blood was used to construct the graph gave the following data.

- Concentration of haemoglobin in blood = 150 g dm^{-3}.
- Volume of oxygen carried by fully saturated haemoglobin = 1.35 cm^3 g^{-1}.
- Resting heart rate = 60 beats $minute^{-1}$.
- Volume of blood pumped out of left ventricle each beat = 60 cm^3.

Use these data and information from the graph to calculate the volume of oxygen released to the man's tissues per minute whilst he was at rest.

Show your working.

Answer =_____ cm^3 $minute^{-1}$

(3)

(Total 8 marks)