1. What is a direct consequence of the genetic code being degenerate?

A It is possible that a mutation could change the sequence of amino acids but leave the function of the protein unchanged.
B It is possible that a mutation could leave the primary structure of the protein unchanged.
C It is possible that a mutation could leave the sequence of bases unchanged.
D It is possible that a mutation could substitute one amino acid for another with similar properties.

Your answer ☐ **[1]**

2. Which of the statements describe(s) control of gene expression at the post-transcriptional level?

1 binding of a repressor protein to an operator sequence
2 the removal of introns to form mature RNA
3 editing of primary RNA

A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer ☐ **[1]**

3. Lactose metabolism in *E. coli* is controlled by the *lac* operon.

Which of the structures associated with the *lac* operon contain nucleic acids?

1: the operator
2: the regulator gene
3: the structural gene product

A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer ☐ **[1]**

4. Homeobox genes control body plan in eukaryotes.

Which of the statements about homeobox genes are correct?

1: they bind to transcription factors
2: they contain a highly conserved sequence of 180 base pairs
3: they regulate the expression of structural genes

A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer ☐ **[1]**

5. Homeobox genes, including Hox genes, code for transcription factors and regulate the expression of structural genes.

Describe the general roles of homeobox genes in the human body **and** suggest the roles of these genes in the development of the brain.

[6]

6(a). Body plan is important in multicellular organisms.

Complete the following sentences about control of body plan using the most appropriate terms.

Body plan is under genetic and ..... control. Internal and external..... can influence the expression of genes that regulate the cell cycle. Such genes can promote or inhibit programmed cell death, known as ..... . During programmed cell death ..... digest the cell contents and the products are removed by ..... so that they do not damage the surrounding tissues.

[5]

(b). State the name of the type of gene responsible for controlling body plan in multicellular organisms.

_____ **[1]**

7. Sickle cell disease is a genetic disease that results from a substitution mutation in one of the genes that code for haemoglobin.

Fig. 16.2 below shows part of the mRNA sequence that codes for normal haemoglobin and the corresponding sequence of amino acids.

mRNA	ACU	CCU	GAG	GAG	AAG
Amino acids	1	2	glutamic acid	glutamic acid	lysine

Fig. 16.2

Fig. 16.3 is a representation of the genetic code.

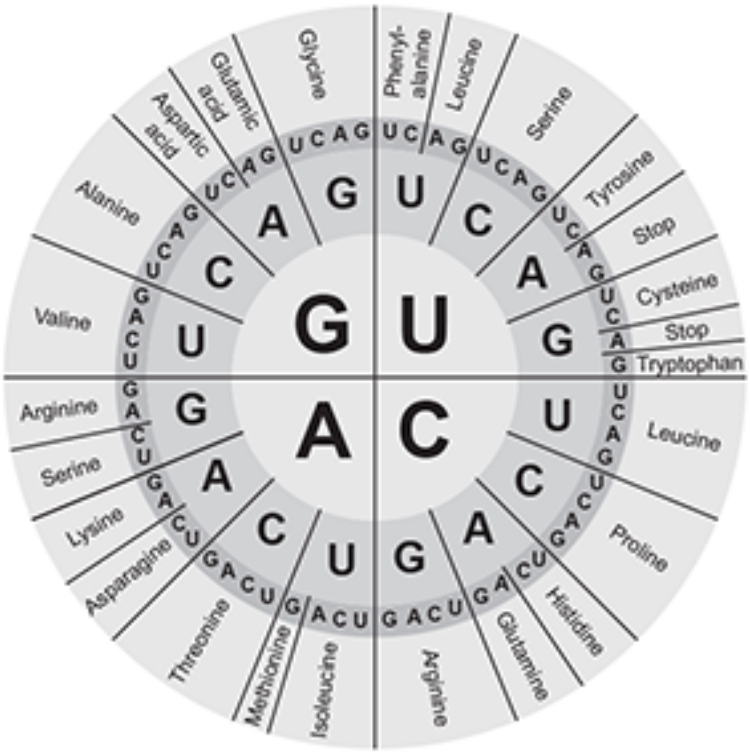

Fig. 16.3

i. Use **Fig. 16.3** to identify the missing amino acids 1 and 2 in **Fig. 16.2**.

1 _____

2 _____

[2]

ii. Outline the role of RNA polymerase in the production of the mRNA sequence in **Fig. 16.2**.

_____

_____

_____

[2]

iii. In sickle cell disease, the haemoglobin contains the amino acid valine in one of the positions normally occupied by glutamic acid.

State the base sequence on the anticodon of a tRNA molecule that brings valine to the ribosome.

[1]

iv. *In sickle cell disease, the mutated haemoglobin has a reduced ability to carry oxygen.

Some gene mutations do not affect protein function.

Use **Fig. 16.3 and** levels of protein structure to explain why some gene mutations do **not** affect the function of a protein.

_____

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_____

[6]

Additional answer space if required.

END OF QUESTION PAPER