1 Read through the following passage on the structure of DNA, then write on the dotted lines the most appropriate word or words to complete the passage.

(8)

A DNA molecule consists of two strands of mononucleotides. Each of these strands is twisted around the other, forming a ..... .

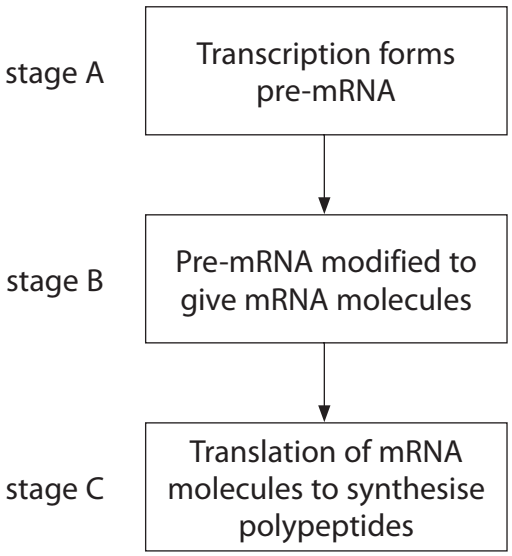
Each mononucleotide consists of a pentose sugar called ..... , a base and a ..... . In each strand, the mononucleotides are held together by ..... bonds.

The two strands are held together by complementary base pairing. Adenine bonds with ..... and cytosine bonds with ..... .

The name of the bond that forms between these bases is a ..... bond. A DNA molecule that is composed of 34% adenine will be composed of ..... % cytosine.

(Total for Question 1 = 8 marks)

2 The diagram below shows the sequence of events leading to polypeptide synthesis.



(a) Place a cross ☒ in the box next to the correct term that completes each of the following statements.

(i) Transcription takes place in the

(1)

☒ **A** Golgi apparatus

☒ **B** lysosome

☒ **C** nucleus

☒ **D** ribosome

(ii) A triplet of bases that could **not** be found in mRNA is

(1)

☒ **A** Adenine Adenine Guanine

☒ **B** Adenine Thymine Guanine

☒ **C** Adenine Cytosine Guanine

☒ **D** Adenine Uracil Guanine

(iii) The sequence of triplets on a section of DNA used to form a strand of pre-mRNA is a

(1)

☒ **A** cistron

☒ **B** codon

☒ **C** neutron

☒ **D** photon

(b) Describe how free nucleotides are bonded together in the correct sequence in pre-mRNA, at stage A.

(3)

(c) A strand of pre-mRNA consists of exons and introns. Exons are sections that can be used during translation for polypeptide synthesis. Introns are lost during the modification of pre-mRNA at stage B and are not used during translation.

During this modification, a variety of mRNA molecules is formed. Each molecule contains all or only some of the original exons in the pre-mRNA. However, the sequence of the exons in a strand of mRNA will always be the same as in the original pre-mRNA.

(i) Explain the function of the codons at each end of a strand of mRNA, during the process of translation.

(2)

(ii) Suggest why a variety of different protein structures could be formed from the polypeptides synthesised using the mRNA molecules from a single gene.

(3)

(Total for Question 2 = 11 marks)

3 The scientific article you have studied is adapted from articles in New Scientist. Use the information from the article and your own knowledge to answer the following questions.

(a) Name one 'retinal photoreceptor protein' (second paragraph on page 2) and describe its function.

(2)

(b) Explain what is meant by 'The human genome project could help to change that' (fourth paragraph on page 2).

(2)

(c) Suggest why genes are only partly responsible for the development of cancer and heart disease.

(3)

(d) Attempts to treat cystic fibrosis with gene therapy have not yet been successful.

Use information in the article to suggest reasons why inserting the correct gene into a cell may not be all that is required.

(3)

*(e) Explain how RNA templates are used to specify the chemical structure of a protein.

(6)

(f) Explain how a transcription factor might 'recognise a particular stretch of DNA' (first paragraph on page 4).

(2)

(g) Use the information in the article to describe ways in which new genes can arise.

(5)

(h) Explain how NF-k B might have a role in the development of atherosclerosis.

(2)

(i) Explain why a DNA strand is not read 'in six different ways' (eighth paragraph on page 8).

(2)

(j) About 10 million years ago, an event led to the production of antifreeze protein in one Antarctic fish. Explain why almost all Antarctic fish now contain antifreeze protein.

(3)

(Total for Question 3 = 30 marks)