Questions about the structure and function of DNA

Q1 In the mid-20th century the structure of DNA was discovered.

What is a section of DNA which codes for one specific protein called?

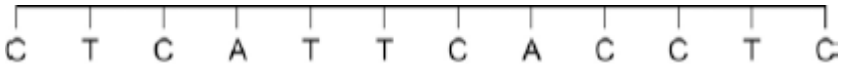
.....

(1)

(b) **Figure 1** shows one strand of DNA.

The strand has a sequence of bases (A, C, G and T).

Figure 1



How many amino acids does the strand of DNA in **Figure 1** code for?

Tick **one** box.

2 ☐

3 ☐

4 ☐

6 ☐

(1)

(Total 2 marks)

Q2 Spiders produce a protein thread which is extremely strong compared to man-made fibres of the same diameter.

Explain how genes control the way the protein is made in the spider's body.

.....

.....

.....

.....

.....

(Total 4 marks)

Q3. **Figure 1** shows an image of a small section of DNA.

Figure 2 shows the structure of a small section of DNA.

Figure 1

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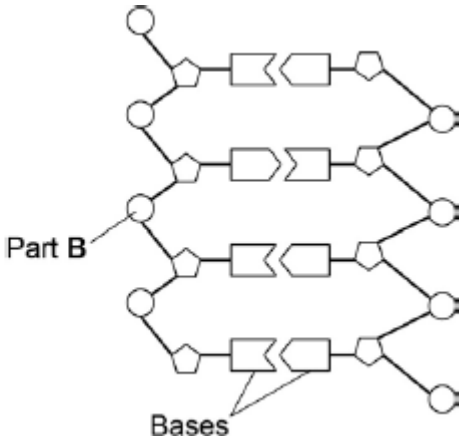
Figure 2



(a) What is Part **B**?

.....

.....

(1)

(b) In **Figure 1** the structure of DNA shows four different bases.

There are four different bases and they always pair up in the same pairs.

Which bases pair up together?

.....

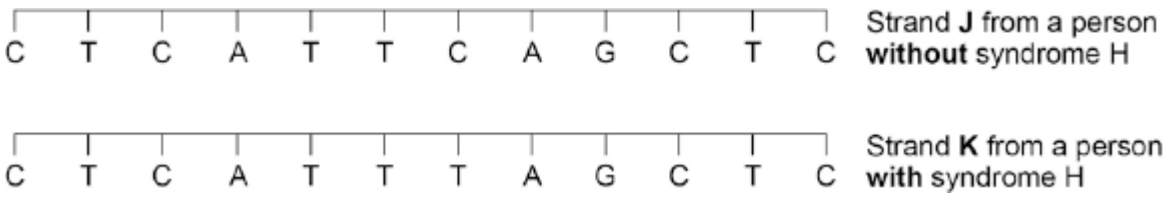
(1)

(c) Syndrome H is an inherited condition.

People with syndrome H do **not** produce the enzyme IDUA.

Figure 3 shows part of the gene coding for the enzyme IDUA.

Figure 3



Strand **K** shows a mutation in the DNA which has caused syndrome H.

The enzyme IDUA helps to break down a carbohydrate in the human body.

The enzyme IDUA produced from Strand **K** will not work.

Explain how the mutation could cause the enzyme **not** to work.

.....

.....

.....

.....

.....

.....

.....

(5)
(Total 7 marks)

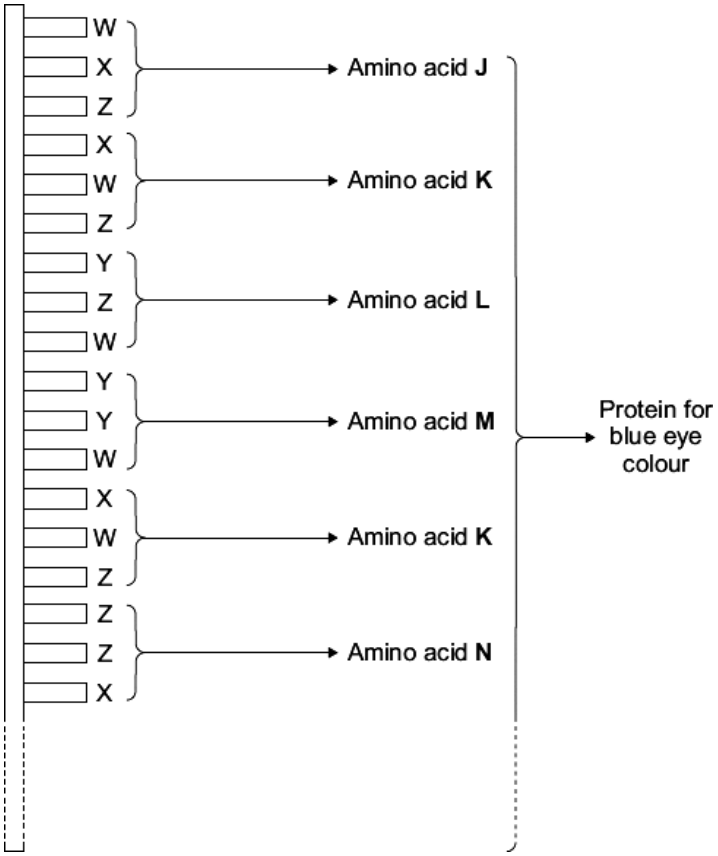
Q4. A molecule of DNA contains four different bases, **W**, **X**, **Y** and **Z**.

The four bases are arranged in a long chain.

The chain of bases controls the synthesis of a protein.

The diagram shows a small section of a DNA molecule.

This section is responsible for synthesising the protein for blue eye colour.



(a) What word is used to describe '*a small section of a DNA molecule that controls the synthesis of a protein*'?

.....

(1)

(b) In the cell, where are proteins synthesised?

.....

(1)

(c) Describe how the protein for blue eye colour is synthesised.

To gain full marks you must use information from the diagram.

.....

.....

.....

.....

.....

.....

.....

(3

(d) Mistakes sometimes occur when DNA molecules are copied during cell division.

Suppose that one of the **W** bases shown in the diagram was substituted by an **X** base.

(i) What would happen to the structure of the protein synthesised by this part of the DNA molecule?

.....

.....

(1)

(ii) What might be the effect of this change in structure of the protein?

.....

.....

(1)

(Total 7 marks)

M1. a gene

allow allele

1

(b) 4

1

M2. *idea*

- (gene) in DNA (i.e. mention of DNA)
- (DNA) contains bases
- (bases) code for amino acids (in protein)
- (amino acids) in correct order
- to make the (spider) protein

any four for 1 mark each

(No credit for double helix, **pairs** of bases - but no penalty)

[4]

M3.(a) phosphate

allow PO_4^{3-}

1

*do **not** allow P*

(b) A / adenine and T / thymine
and
C / cytosine and G / guanine

*do **not** allow U / uracil*

1

(c) (mutation) changes from C to T DNA code
or
there is a change in the three bases / triplet from CAG to TAG

1

(mutation) changes the amino acid

1

(this could) change the protein

1

(so it) forms a different shape / changed active site

accept different tertiary structure

1

(therefore) the enzyme no longer fits the substrate / carbohydrate

1

[12]

M4. (a) gene / allele

1

(b) (in / on) ribosome(s)

1

(c) any **three** from:

- amino acids make up a protein
- (protein is) particular combination / sequence (of amino acids)
- bases form a <u>code</u>
- the bases work in threes or description

  accept bases work in triplet
- (code / three bases) for one amino acid

  *accept eg (bases) WXZ for amino acid J for **2** marks*

3

(d) (i) different / wrong amino acid (coded for) **or** different / wrong shape

ignore reference to amino acid 'made'
ignore change unqualified
ignore different protein

1

(ii) different / example of different eye colour

allow protein may / would not be made / function (normally)

1

[7]

M5. (i) DNA (*accept* RNA)

for one mark

1

(ii) DNA carries <u>coded</u> information
which controls the order of amino acids
in proteins

for 1 mark each

3

[4]