AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.1.5

DNA structure (biology only)

Past-paper questions

Tier	**Higher**
Question groups	**9**
Available paper years	**2007–2023**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

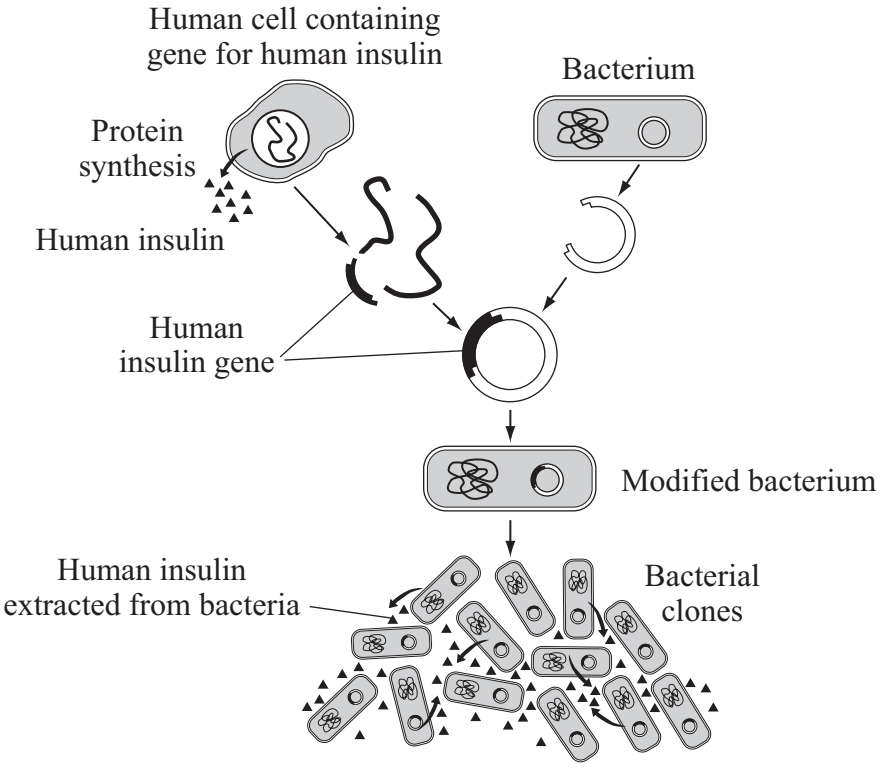
4.6.1.5 DNA structure (biology only)

Question 01

June 2007 | BLY1B | Original Q5 | Legacy

QUESTION FIVE

The diagram shows some of the stages involved in the production of the human protein insulin, by a bacterium.



5A The human insulin gene was cut out of a human . . .

1 chromosome.

2 gamete.

3 nucleus.

4 embryo.

5B The removal of the insulin gene from the human cell is carried out by . . .

1 an enzyme.

2 a hormone.

3 a human gene.

4 a bacterium.

4.6.1.5 DNA structure (biology only)

5C The advantage of using bacteria rather than mammals to manufacture the insulin is that . . .

1 it needs less research.

2 the bacteria can provide more insulin than a mammal.

3 the bacteria will produce insulin that is less toxic.

4 there are likely to be fewer ethical objections.

5D This method of producing a product using bacteria is an example of . . .

1 sexual reproduction.

2 evolution.

3 genetic engineering.

4 natural selection.

Turn over for the next question

4.6.1.5 DNA structure (biology only)

Question 02

June 2008 | BLY2H | Original Q4 | Legacy

4 Chromosomes contain molecules of DNA. Genes are small sections of DNA.

4 (a) Each gene contains a code.

What does a cell use this code for?

.....

.....

.....

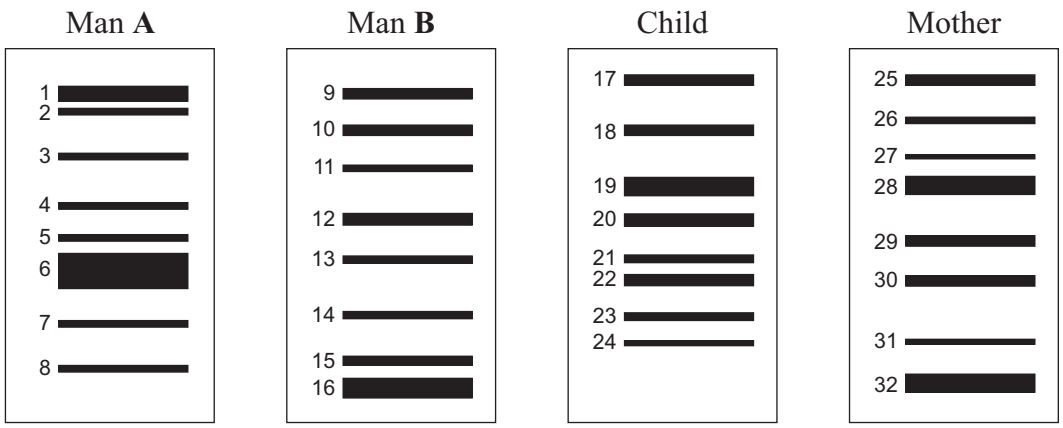
.....

(2 marks)

4 (b) DNA fingerprints can be used to identify people. One example of the use of DNA fingerprints is to find out which man is the father of a child.

The diagram shows the DNA fingerprints of a child, the child's mother and two men who claim to be the child's father.

The numbers refer to the bars on the DNA fingerprints.



4.6.1.5 DNA structure (biology only)

Question 02 · continued

for mark

4 (b) (i) Which man, **A** or **B**, is more likely to be the father of the child?

Use the numbers on the DNA fingerprints to explain your choice.

In your answer you should refer to all four people.

.....

.....

.....

.....

.....

.....

.....

(3 marks)

4 (b) (ii) Only half the bars of the child's DNA fingerprint match the mother's DNA fingerprint.

Explain why.

.....

.....

.....

.....

.....

(2 marks)

7

4.6.1.5 DNA structure (biology only)

Question 03

June 2013 | BL2HP | Original Q6 | Legacy

6 A certain gene codes for the production of an enzyme called 'HEXA'.

One human genetic disorder causes damage to nerve cells in the brain.
This disorder is caused by a small change in the DNA of the HEXA gene.
People with this disorder make a changed HEXA enzyme that does not work.

6 (a) Explain how a change in the DNA of the HEXA gene can result in the production of a changed HEXA enzyme that does not work.

.....

.....

.....

.....

.....

.....

(3 marks)

6 (b) The gene coding for the HEXA enzyme is found on chromosome number 15.

6 (b) (i) How many chromosomes are there in the nucleus of a human nerve cell? .....

(1 mark)

6 (b) (ii) A boy had the changed HEXA gene on the chromosome number 15 that he inherited from his father.
The changed HEXA gene coded for a HEXA enzyme that does not work.
The boy did **not** develop the genetic disorder.

Explain why the boy did **not** develop the genetic disorder.

.....

.....

.....

.....

(2 marks)

4.6.1.5 DNA structure (biology only)

Question 03 · continued

6 (b) (iii) The boy grew up and got married.

A blood test showed that his wife had also inherited the same changed HEXA gene.

There is a 1 in 4 chance that this couple's first child will have the genetic disorder.

Use a genetic diagram to explain why.

Use the following symbols in your explanation:

H = allele for making the normal HEXA enzyme
h = allele for making a HEXA enzyme that does not work.

(3 marks)

9

4.6.1.5 DNA structure (biology only)

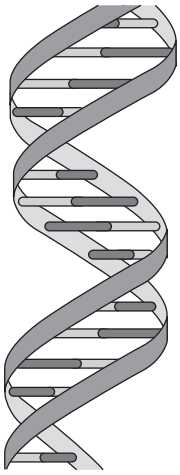
Question 04

June 2015 | BL2HP | Original Q3 | Legacy

3 DNA is the genetic material of human cells.

Figure 4 shows the structure of part of a DNA molecule.

Figure 4



3 (a) (i) Describe where DNA is found in a human cell.

[2 marks]

.....

.....

.....

3 (a) (ii) When a cell divides by mitosis the new cells are genetically identical.

What causes the cells to be genetically identical?

[1 mark]

.....

.....

3 (b) Many genes have different forms called alleles.

3 (b) (i) A person has polydactyly (extra fingers or toes). Polydactyly is caused by a dominant allele.
What is the smallest number of copies of the dominant allele for polydactyly that could be found in a body cell of this person?

[1 mark]

.....

3 (b) (ii) Another person has cystic fibrosis. Cystic fibrosis (CF) is caused by a recessive allele.
How many copies of the recessive CF allele are there in a body cell of this person?

[1 mark]

.....

4.6.1.5 DNA structure (biology only)

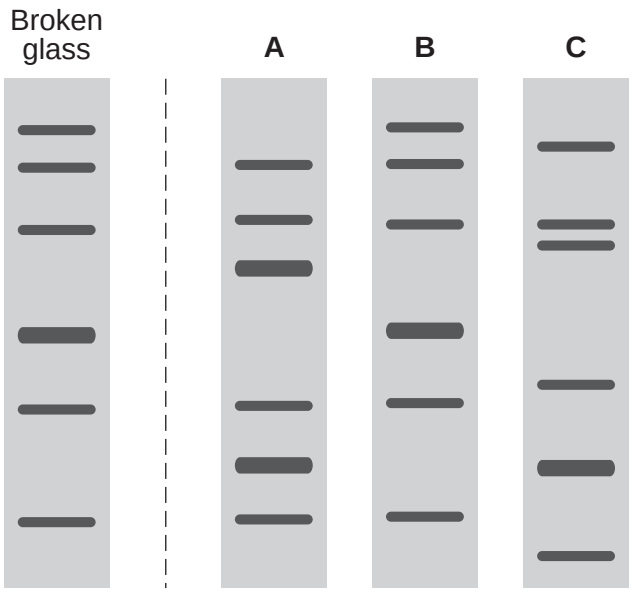
Question 04 · continued

3 (c) A burglar broke into a house. The burglar cut his hand on some broken glass. Scientists extracted DNA from the blood on the broken glass.

The scientists analysed the DNA from the glass and DNA from three suspects, **A**, **B** and **C**. The scientists used a method called DNA fingerprinting.

Figure 5 shows the scientists' results.

Figure 5



Which suspect, **A**, **B** or **C**, is most likely to have been the burglar?

[1 mark]

Tick (✓) **one** box.

A ☐

B ☐

C ☐

6

4.6.1.5 DNA structure (biology only)

Question 05

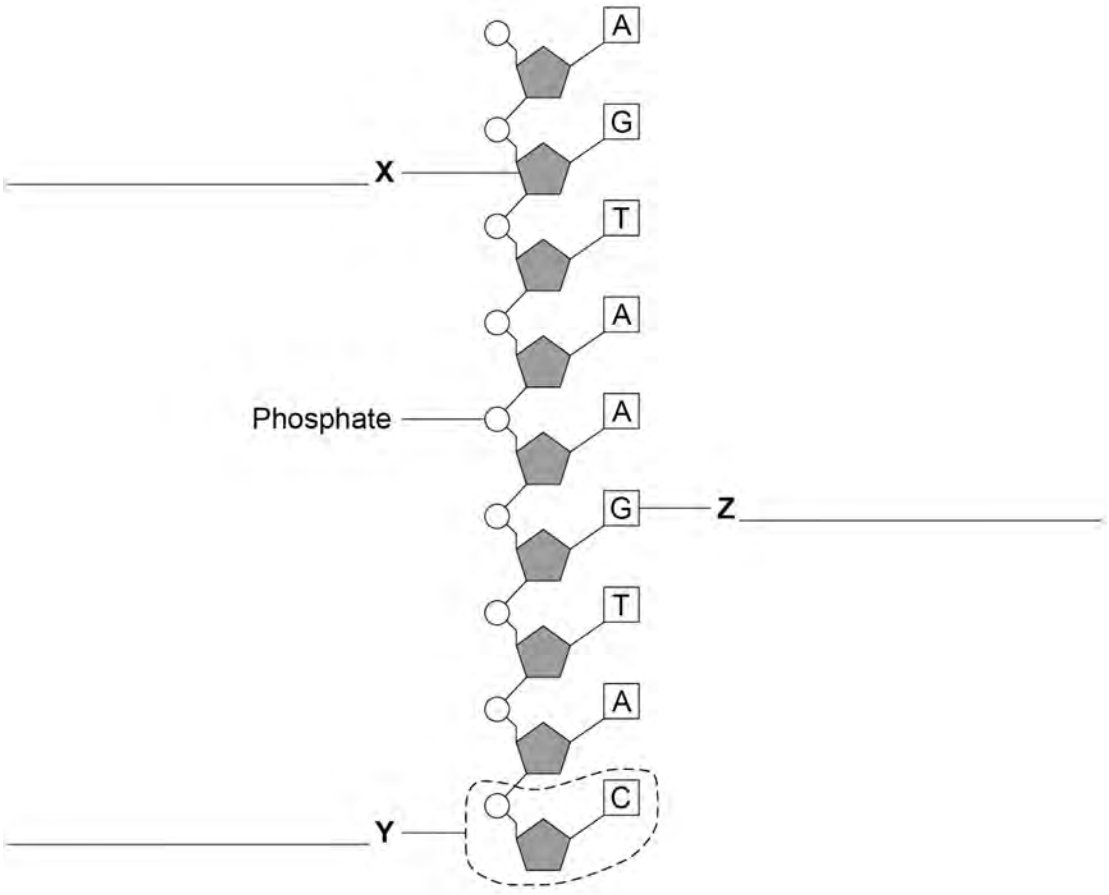
0 2 Genetic material is made of DNA.

0 2 . 1 Which structures in the nucleus of a human cell contain DNA?

[1 mark]

Figure 3 shows part of one strand of a DNA molecule.

Figure 3



0 2 . 2 Label parts **X**, **Y** and **Z** on **Figure 3**.

[3 marks]

Choose answers from the box.

Base	**Fatty acid**	**Nucleotide**	**Sugar**	**Glycerol**

Question 05 · continued

0 2 . 3 A complete DNA molecule is made of two strands twisted around each other.

What scientific term describes this structure?

[1 mark]

_____

0 2 . 4 DNA codes for the production of proteins.

A protein molecule is a long chain of amino acids.

How many amino acids could be coded for by the piece of DNA shown in **Figure 3**?

[1 mark]

Tick (✓) **one** box.

2 ☐ 3 ☐ 9 ☐ 18 ☐

0 2 . 5 Scientists have now studied the whole human genome.

Give **two** benefits of understanding the human genome.

[2 marks]

1 _____

_____

2 _____

_____

8

4.6.1.5 DNA structure (biology only)

Question 06

November 2020 | 8461/2H | Original Q4

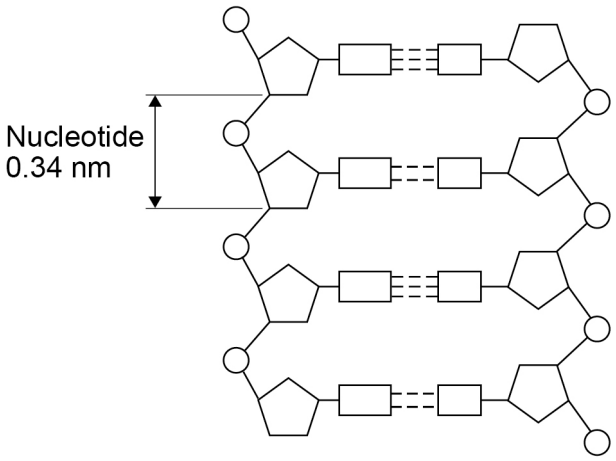
0 4 DNA is a polymer of nucleotides.

0 4 . 1 Why is DNA described as a polymer?

[1 mark]

Figure 5 shows part of a DNA molecule.

Figure 5



0 4 . 2 Describe the structure of a nucleotide.

[4 marks]

4.6.1.5 DNA structure (biology only)

Question 06 · continued

0 4 . 3 The length of a DNA double helix increases by 0.34 nm for every pair of nucleotides.

The total number of nucleotides in a human body cell is 1.2×10^{10}.

Calculate the total length of double helix in a human body cell.

Give your answer in metres. Use information from **Figure 5**.

[5 marks]

Total length = _____ m

0 4 . 4 Some parts of DNA do **not** code for proteins.

Describe how non-coding parts of DNA can affect the expression of genes.

[1 mark]

11

4.6.1.5 DNA structure (biology only)

Question 07

November 2021 | 8461/2H | Original Q1

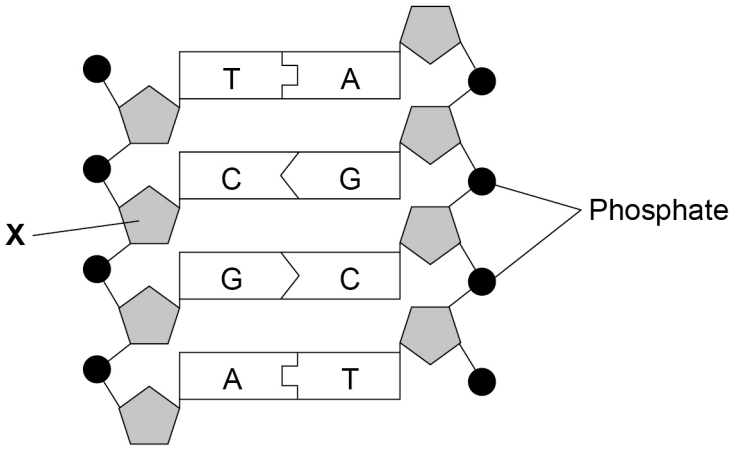
0 1 The nucleus of a cell contains DNA.

0 1 . 1 Name the structures inside the cell nucleus that contain DNA.

[1 mark]

Figure 1 shows part of a DNA molecule.

Figure 1



0 1 . 2 Name the part of the DNA molecule labelled **X**.

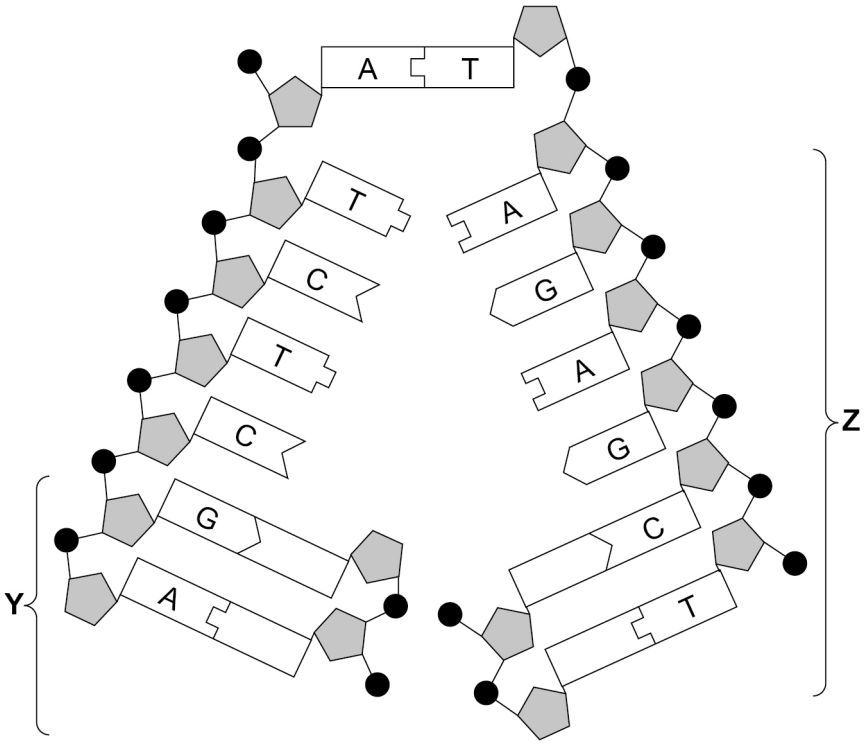
[1 mark]

0 1 . 3 What type of substances are labelled **A**, **C**, **G** and **T** in **Figure 1**?

[1 mark]

Figure 2 shows another section of a DNA molecule.

Figure 2



0 1 . 4 Four of the substances you named in Question **01.3** are **not** labelled in part **Y** of **Figure 2**.

Label each of these substances with the correct letter, **A**, **C**, **G** or **T**.

Use information from other parts of **Figure 2** to help you.

[1 mark]

0 1 . 5 What is happening to the DNA in part **Z** of **Figure 2**?

[1 mark]

Tick (✓) **one** box.

- Differentiation ☐
- Evolution ☐
- Fertilisation ☐
- Replication ☐

4.6.1.5 DNA structure (biology only)

Question 07 · continued

0 1 . 6 A gene is a length of DNA.

What type of substance does a gene code for?

[1 mark]

0 1 . 7 Most human body cells contain 6×10^{-12} grams of DNA.

What mass of DNA will a human sperm cell contain?

[1 mark]

Tick (✓) **one** box.

- 6×10^{-6} grams ☐
- 6×10^{-12} grams ☐
- 3×10^{-6} grams ☐
- 3×10^{-12} grams ☐

0 1 . 8 What is the name of the type of cell division that produces sperm cells?

[1 mark]

Tick (✓) **one** box.

- Binary fission ☐
- Differentiation ☐
- Meiosis ☐
- Mitosis ☐

8

4.6.1.5 DNA structure (biology only)

Question 08

June 2023 | 8461/1H | Original Q5

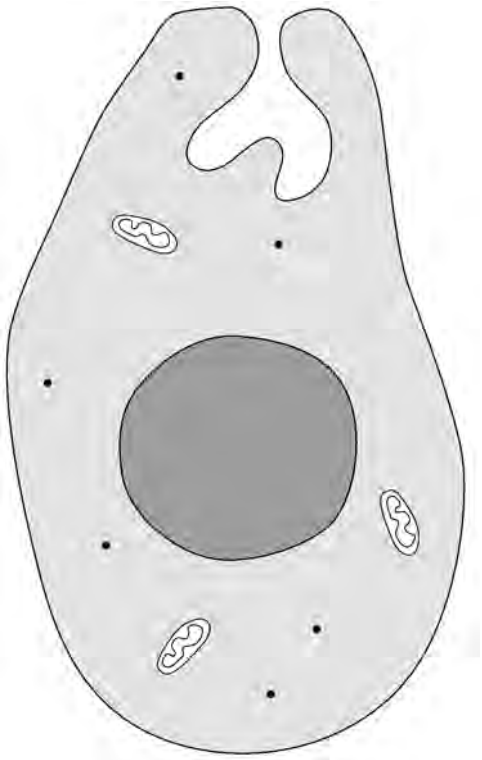
0 5 The protist that causes malaria is passed from one person to another person by mosquitos.

0 5 . 1 What term describes an organism that passes a pathogen from one person to another person?

[1 mark]

0 5 . 2 **Figure 7** shows the malarial protist.

Figure 7



4.6.1.5 DNA structure (biology only)

Question 08 · continued

The malarial protist is a eukaryotic cell.

Describe **three** ways the structure of the malarial protist is different from the structure of a prokaryotic cell.

Do **not** refer to size in your answer.

[3 marks]

1 _____

2 _____

3 _____

0 5 . 3 During one stage of malaria infection, the malarial protists enter red blood cells and cause them to burst.

Explain why the bursting of red blood cells causes tiredness.

[2 marks]

_____

_____

_____

_____

Question 5 continues on the next page

0 5 . 4 The malarial protist reproduces sexually and asexually during a life cycle.

Complete **Table 3** to give **three** differences between sexual reproduction and asexual reproduction.

[3 marks]

One difference has been completed for you.

Table 3

	Sexual reproduction	Asexual reproduction
	Involves two parents	Involves one parent
1		
2		
3		

0 5 . 5 One drug for treating malaria prevents mitosis occurring in the malarial protist.

The drug stops the synthesis of new DNA bases in the cell.

Suggest how the drug prevents mitosis occurring.

[1 mark]

4.6.1.5 DNA structure (biology only)

Question 08 · continued

0 5 . 6 Describe the process of cell division by mitosis.

[3 marks]

Question 5 continues on the next page

0 5 . 7 Different types of disease may interact.

Scientists studied the incidence of malaria infections in children:

- with disorder **S**
- without disorder **S**.

The incidence of malaria in children with disorder **S** was calculated as a percentage of the incidence in children without disorder **S**.

Table 4 shows the results.

Table 4

Age in years	Calculated percentage (%) incidence of malaria in children with disorder S
2 to < 4	69
4 to < 6	63
6 to < 8	50
8 to 10	45
> 10	73

Describe what the results in **Table 4** show about the interaction between disorder **S** and malaria.

[2 marks]

15

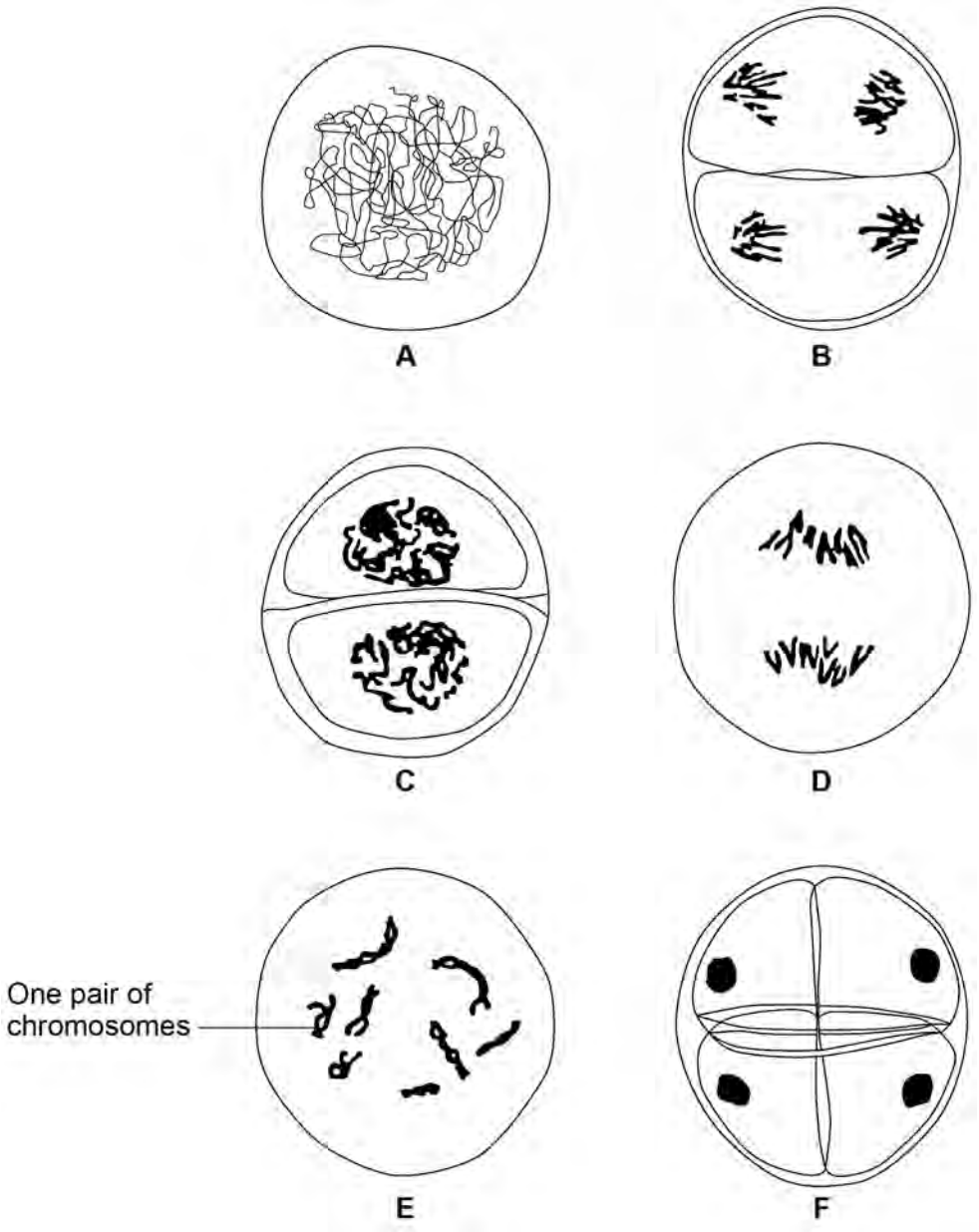
4.6.1.5 DNA structure (biology only)

Question 09

June 2023 | 8461/2H | Original Q8

0 8 **Figure 13** shows six stages in the process of meiosis.

Figure 13



0 8 . 1 In **Figure 13**, **A** is the first stage and **F** is the final stage.

Stages **B** to **E** are **not** in the correct order.

Give the correct order of stages **A** to **F**.

[1 mark]

A → _____ → _____ → _____ → _____ → **F**

4.6.1.5 DNA structure (biology only)

Question 09 · continued

At the end of meiosis the number of chromosomes is different from the number of chromosomes at the start of meiosis.

0 8 . 2 Give the number of chromosomes in **one** cell in **Figure 13**:

- at the start of meiosis
- at the end of meiosis.

[2 marks]

Start _____

End _____

0 8 . 3 Explain why the change in the number of chromosomes is important.

[3 marks]

0 8 . 4 Meiosis produces cells that are genetically different.

Describe how meiosis produces cells that are genetically different.

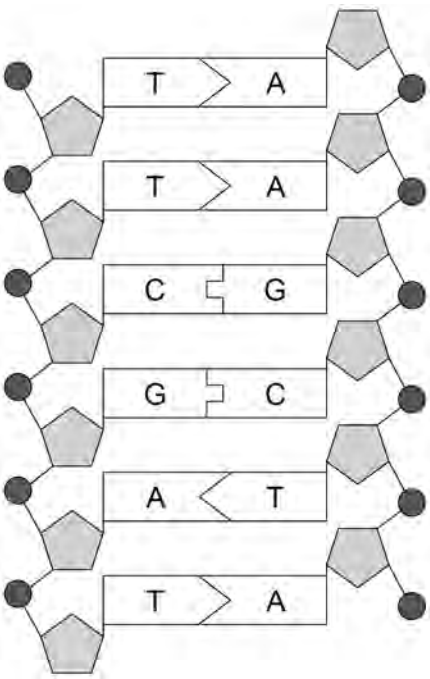
[2 marks]

Question 8 continues on the next page

Chromosomes contain DNA.

Figure 14 shows part of a DNA molecule.

Figure 14



0 8 . 5 What type of substances are labelled **A**, **C**, **G** and **T** in **Figure 14**?

[1 mark]

0 8 . 6 DNA is made of nucleotides.

How many nucleotides are shown in **Figure 14**?

[1 mark]

10