AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.1.4

DNA and the genome

Past-paper questions

Tier	**Higher**
Question groups	**7**
Available paper years	**2008–2023**

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.

4.6.1.4 DNA and the genome

Question 01

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?

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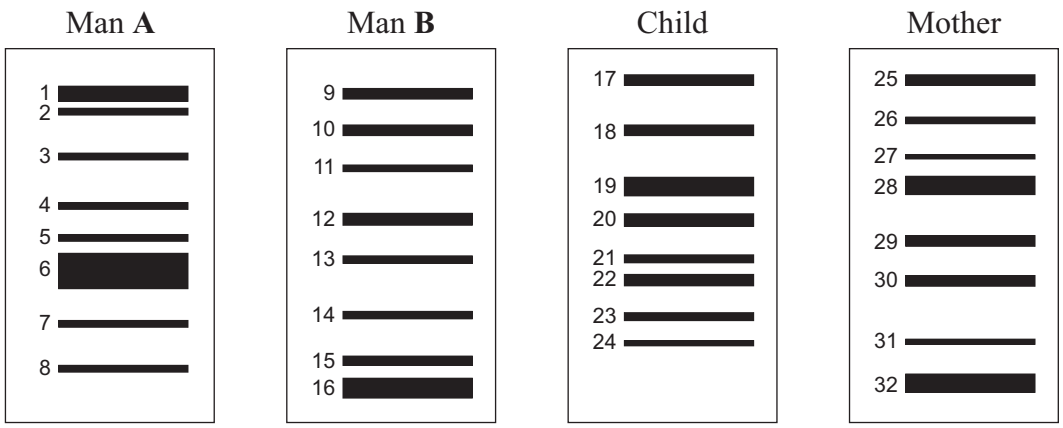
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(2 marks)

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.



4.6.1.4 DNA and the genome

Question 01 · 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.

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(3 marks)

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

Explain why.

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(2 marks)

7

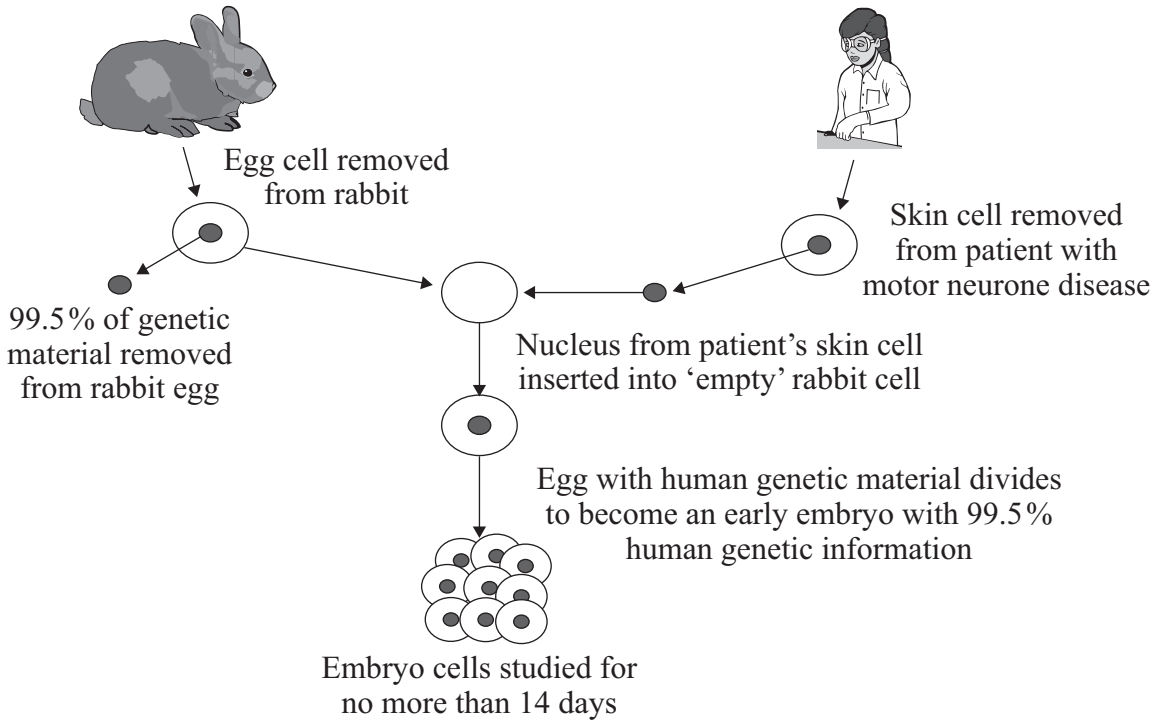
4.6.1.4 DNA and the genome

Question 02

January 2019 | BLY1H | Original Q8 | Legacy

8 Scientists in Korea have discovered a method of producing rabbit–human embryos. Rabbit–human embryos could provide cells for research into human diseases such as motor neurone disease. Rabbits produce large numbers of eggs. Rabbit–human embryos could overcome a shortage of human embryo cells for research.

The diagram shows how rabbit–human embryos are produced.



8 (a) Which structures in the nucleus contain 99.5 % of a cell's genetic information?

.....

(1 mark)

4.6.1.4 DNA and the genome

Question 02 · continued

for mark

8 (b) Use the above information and your own knowledge and understanding to evaluate how the production of rabbit–human embryos may help research into human diseases.

Remember to give a conclusion as part of your evaluation.

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(4 marks)

5

4.6.1.4 DNA and the genome

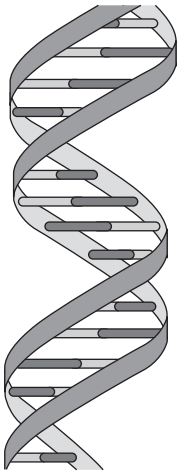
Question 03

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]

.....

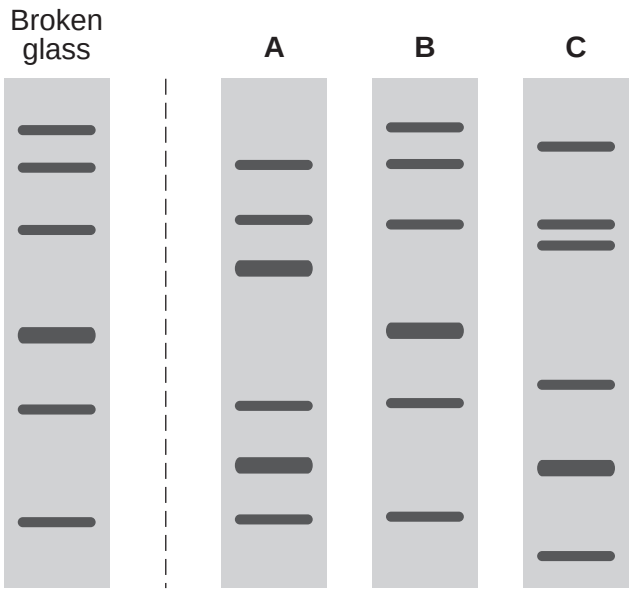
Question 03 · continued

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

4.6.1.4 DNA and the genome

Question 04

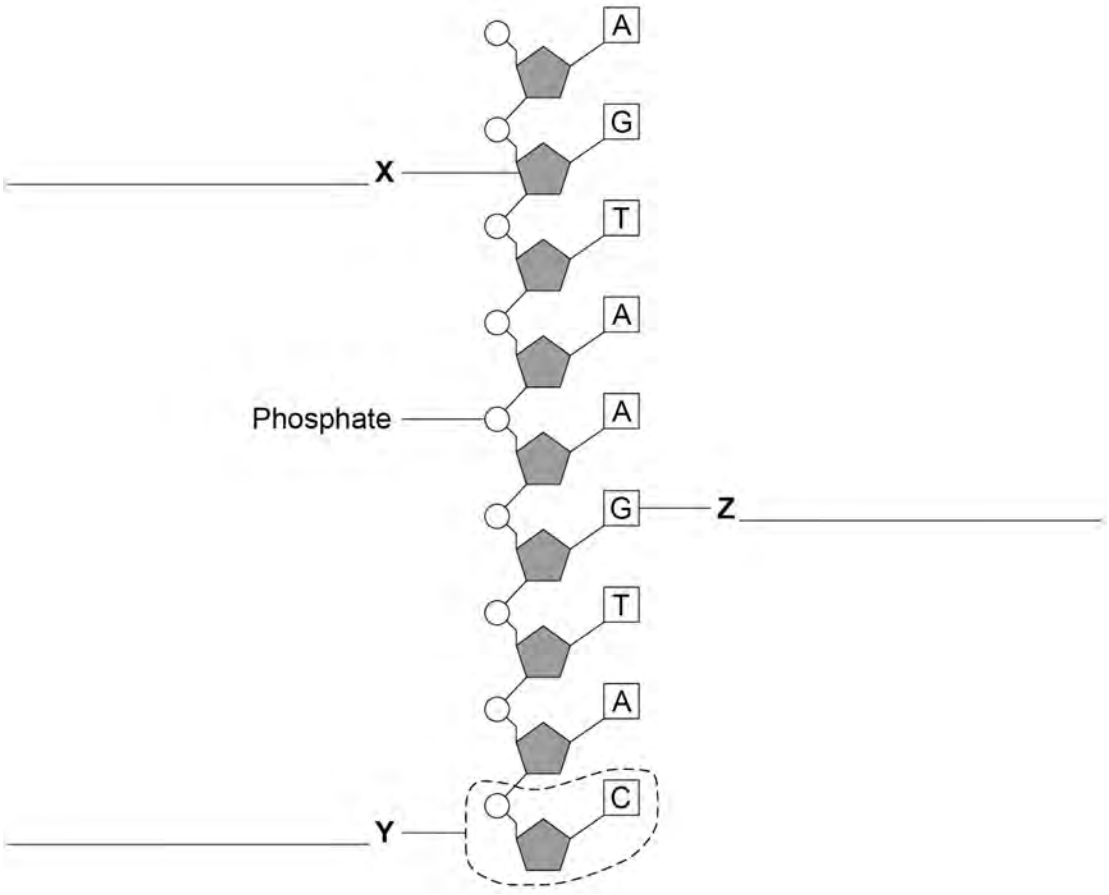
0 2 Genetic material is made of DNA.

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**

4.6.1.4 DNA and the genome

Question 04 · 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

4.6.1.4 DNA and the genome

Question 05

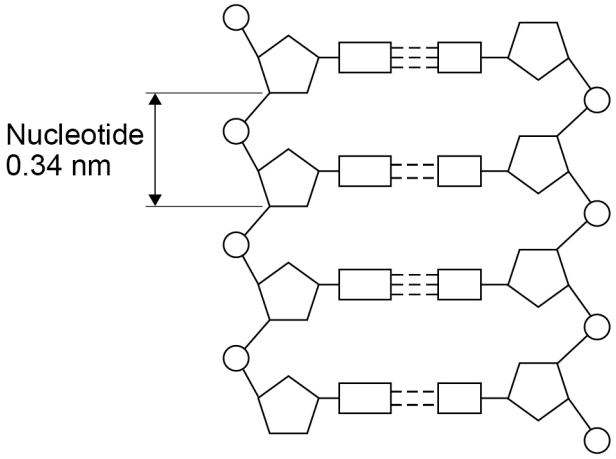
0 4 DNA is a polymer of nucleotides.

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]

4.6.1.4 DNA and the genome

Question 05 · 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

4.6.1.4 DNA and the genome

Question 06

November 2021 | 8461/2H | Original Q1

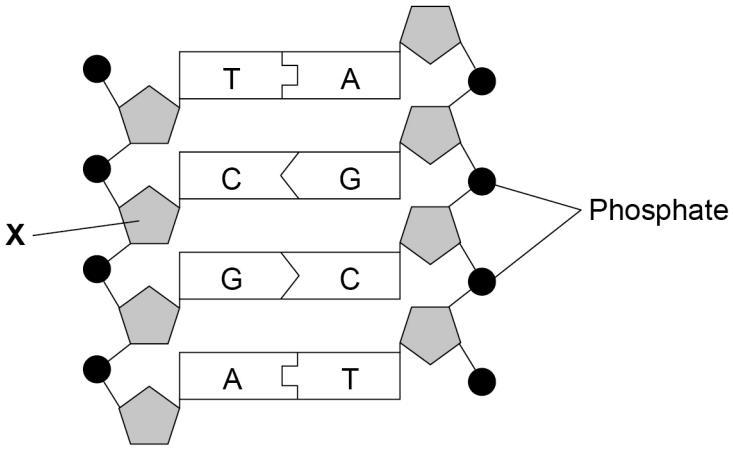
0 1 The nucleus of a cell contains DNA.

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**?

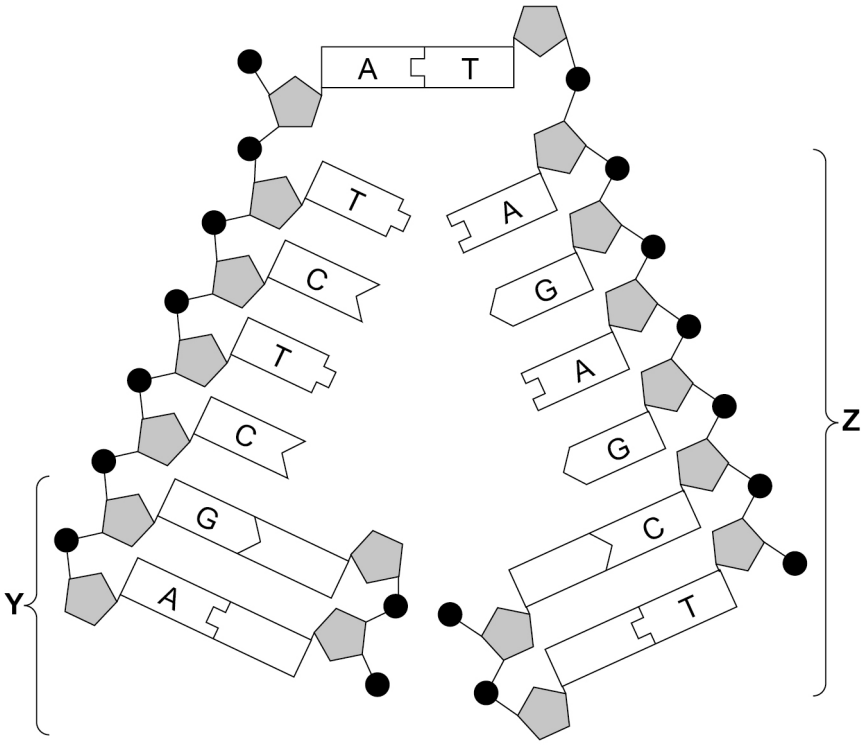
[1 mark]

4.6.1.4 DNA and the genome

Question 06 · continued

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 ☐

4.6.1.4 DNA and the genome

Question 06 · 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

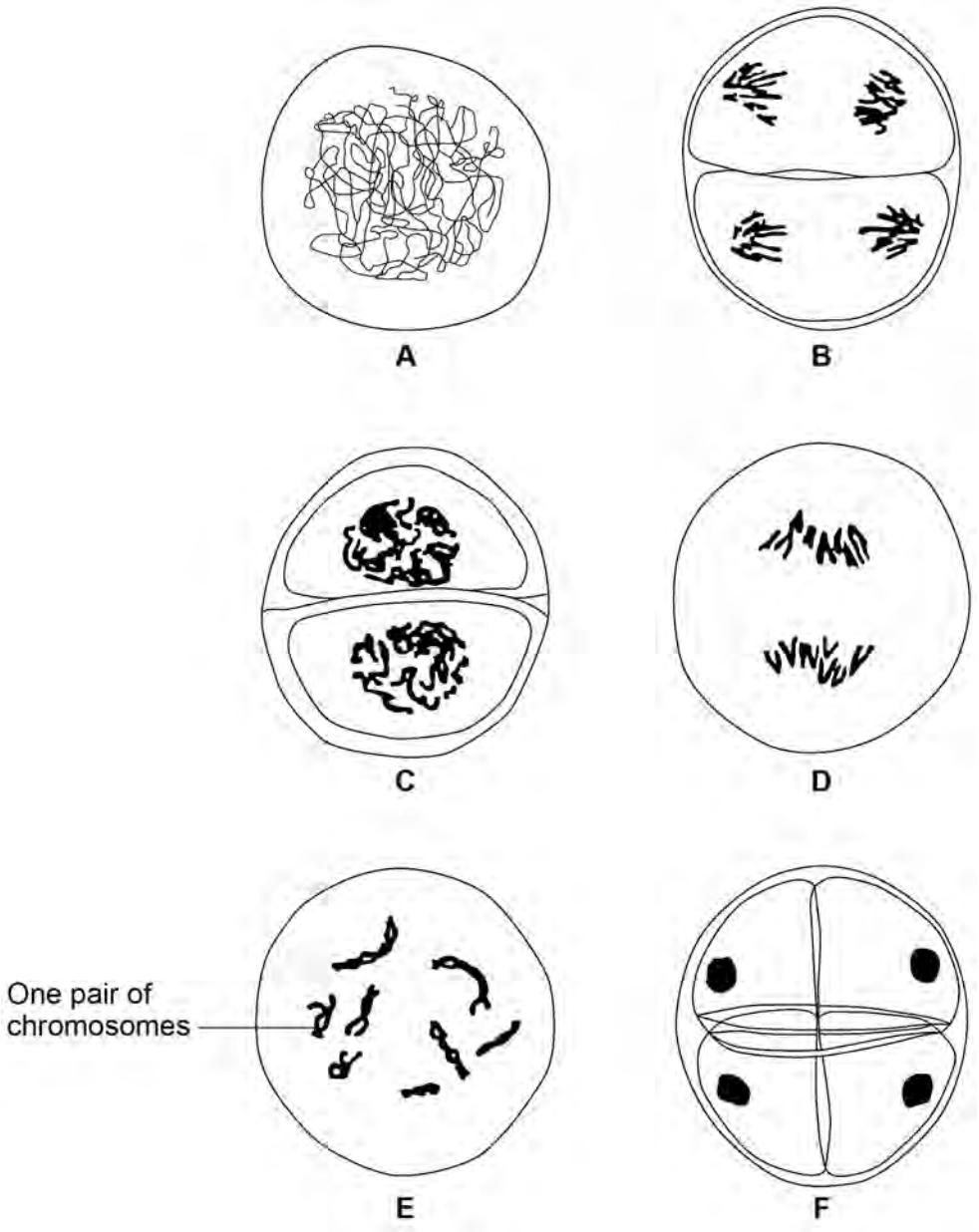
4.6.1.4 DNA and the genome

Question 07

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**

Question 07 · 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

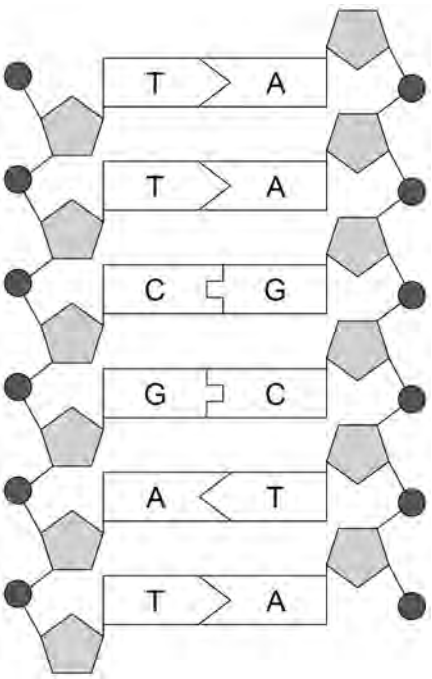
4.6.1.4 DNA and the genome

Question 07 · continued

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