AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.1.4

DNA and the genome

Past-paper questions

Tier	**Foundation**
Question groups	**6**
Available paper years	**2015–2021**

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

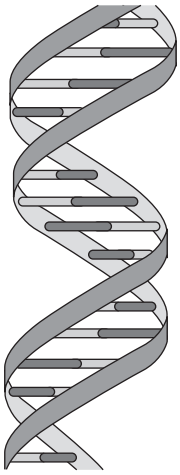
Question 01

June 2015 | BL2FP | Original Q9 | Legacy

9 DNA is the genetic material of human cells.

Figure 10 shows the structure of part of a DNA molecule.

Figure 10



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

[2 marks]

.....

.....

.....

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

What causes the cells to be genetically identical?

[1 mark]

.....

.....

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

9 (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]

.....

9 (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]

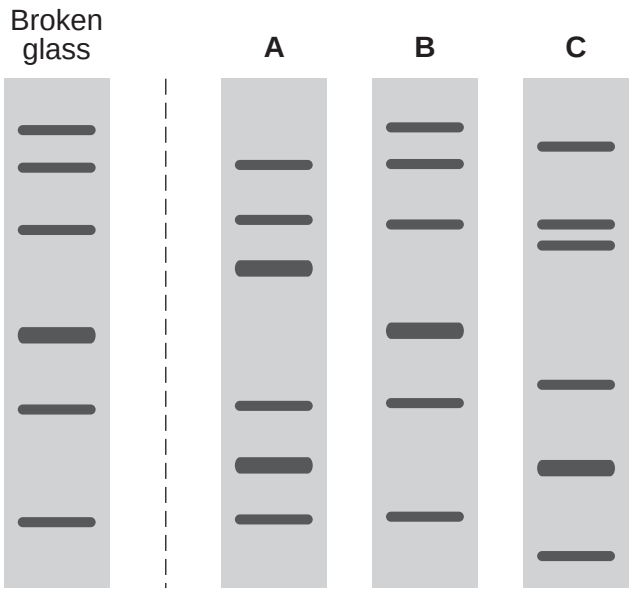
.....

9 (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 11 shows the scientists' results.

Figure 11



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 02

June 2018 | 8461/2F | Original Q4

0 4 In the mid-19th century, a scientist studied inheritance in pea plants.

The scientist's work was the beginning of our modern understanding of genetics.

0 4 . 1 What is the name of this scientist?

[1 mark]

Tick **one** box.

- Alfred Russel Wallace ☐
- Charles Darwin ☐
- Gregor Mendel ☐
- Jean-Baptiste Lamarck ☐

0 4 . 2 In the mid-20th century, other scientists identified the chemical substance that makes up genetic material.

What is the name of the chemical substance that makes up genetic material?

[1 mark]

Tick **one** box.

- Carbohydrate ☐
- DNA ☐
- Lipid ☐
- Protein ☐

4.6.1.4 DNA and the genome

Question 02 · continued

0 4 . 3 A gene often has two alleles.

One allele is dominant and the other allele is recessive.

When is a recessive allele expressed as a characteristic?

[1 mark]

Tick **one** box.

- When the dominant allele is not present ☐
- When the recessive allele is inherited from the female parent ☐
- When the recessive allele is inherited from the male parent ☐
- When the recessive allele is present on only one of the chromosomes ☐

Question 4 continues on the next page

4.6.1.4 DNA and the genome

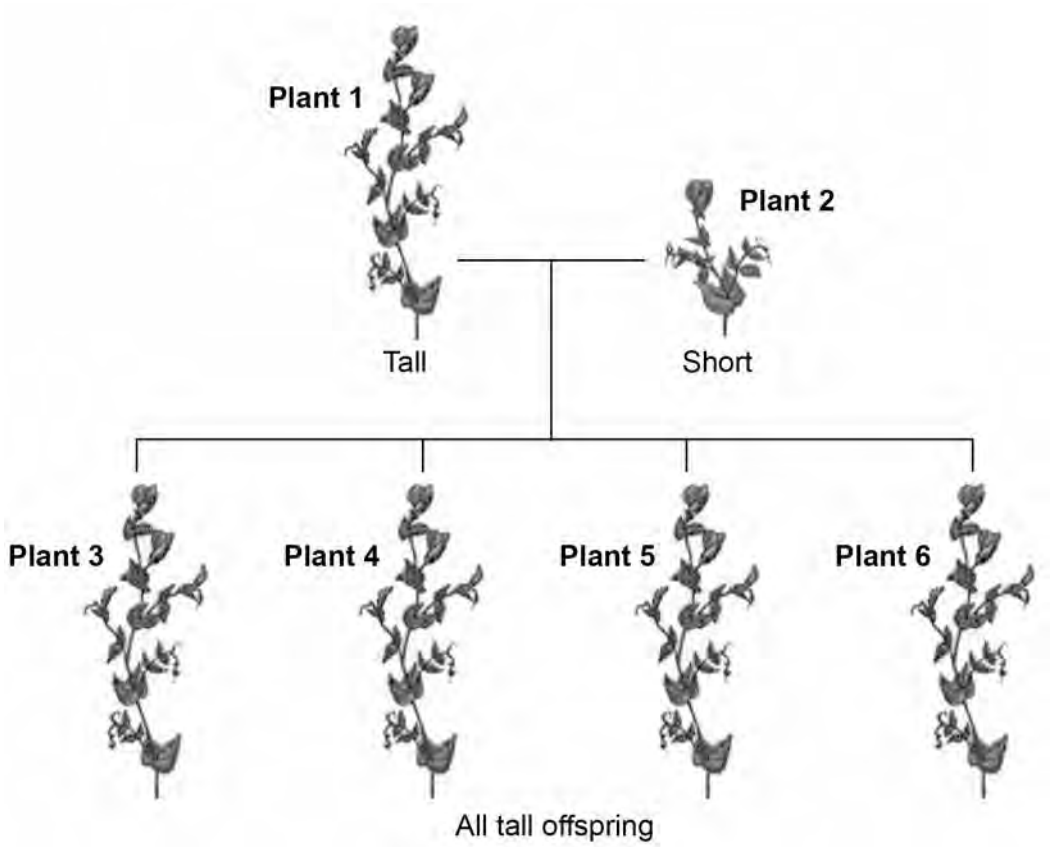
Question 02 · continued

A scientist investigated the inheritance of height in pea plants.

The scientist crossed tall pea plants with short pea plants.

Figure 4 shows the scientist's results.

Figure 4



Question 02 · continued

In Questions **04.4** and **04.5**, use the following symbols to represent alleles:

T = the dominant allele for tall.

t = the recessive allele for short.

0 4 . 4 In **Figure 4**, the genotype of plant **1** is **TT**.

Give the genotype of plant **2**.

[1 mark]

_____

0 4 . 5 The scientist crossed plant **3** with plant **4**.

Complete **Figure 5** to show the offspring produced from this cross.

[2 marks]

Figure 5

		Male gametes: T	Male gametes: t
Female gametes	T	TT	
Female gametes	t		

0 4 . 6 Draw a circle around **one** of the homozygous offspring in **Figure 5**.

[1 mark]

0 4 . 7 What is the ratio of tall plants **:** short plants in the offspring in **Figure 5**?

[1 mark]

Ratio of tall plants **:** short plants = _____ **:** _____

8

4.6.1.4 DNA and the genome

Question 03

June 2019 | 8461/2F | Original Q8

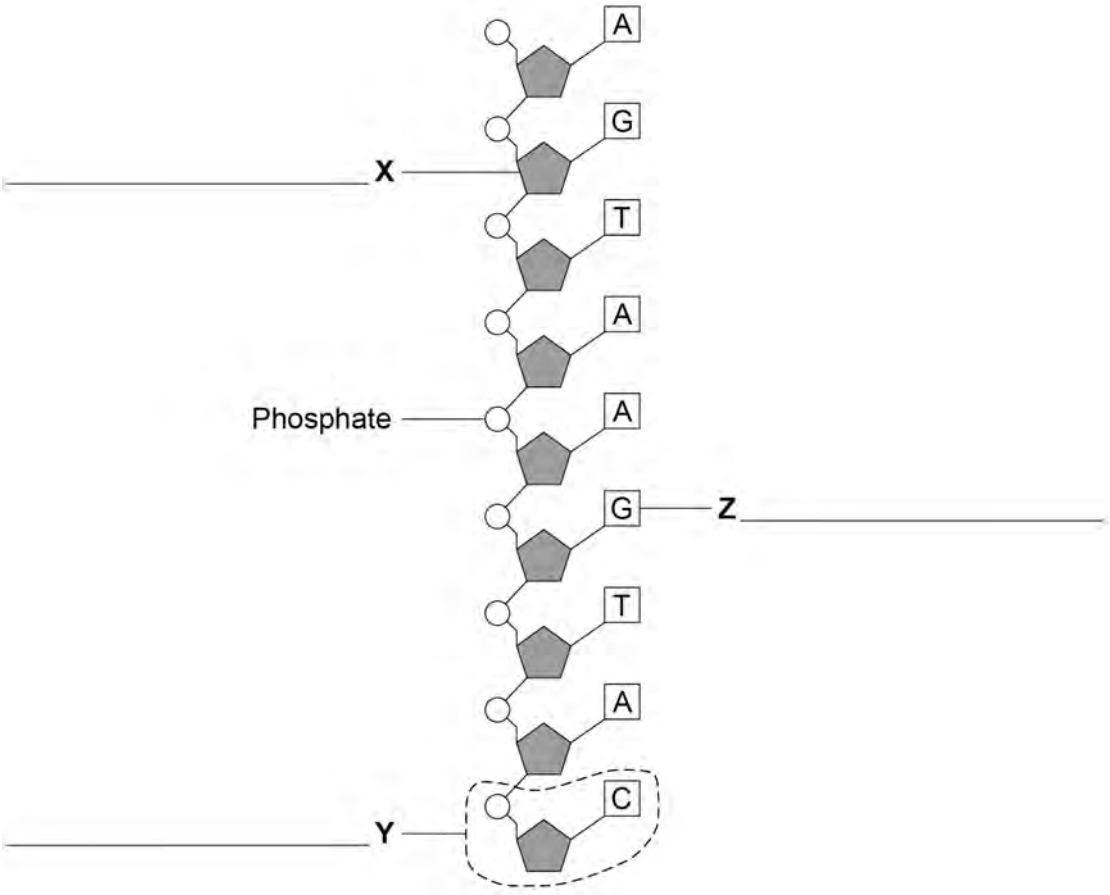
0 8 Genetic material is made of DNA.

0 8 . 1 Which structures in the nucleus of a human cell contain DNA?

[1 mark]

Figure 16 shows part of one strand of a DNA molecule.

Figure 16



0 8 . 2 Label parts **X**, **Y** and **Z** on **Figure 16**.

[3 marks]

Choose answers from the box.

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

4.6.1.4 DNA and the genome

Question 03 · continued

0 8 . 3 A complete DNA molecule is made of two strands twisted around each other.

What scientific term describes this structure?

[1 mark]

_____

0 8 . 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 16**?

[1 mark]

Tick (✓) **one** box.

2 ☐ 3 ☐ 9 ☐ 18 ☐

0 8 . 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 04

November 2020 | 8461/1F | Original Q2

0 2 This question is about cell division.

0 2 . 1 Which process makes two identical new body cells for growth and repair?

[1 mark]

Tick (✓) **one** box.

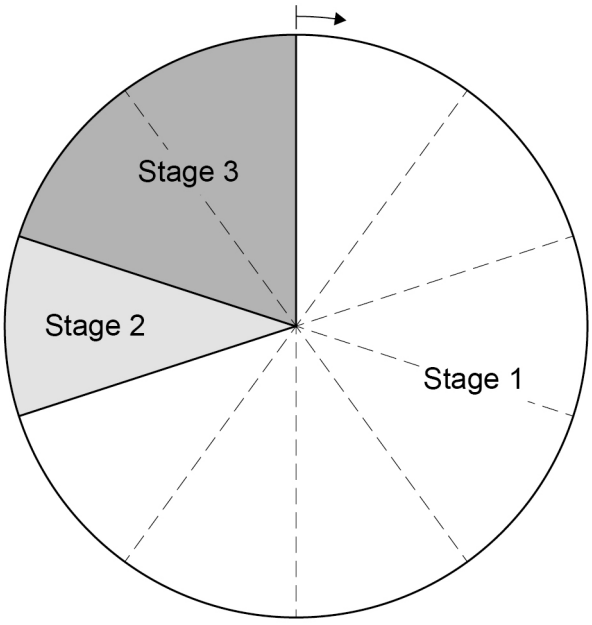
Differentiation ☐

Fertilisation ☐

Mitosis ☐

Figure 5 shows the three stages of a cell cycle.

Figure 5



4.6.1.4 DNA and the genome

Question 04 · continued

0 2 . 2 Draw **one** line from each stage of the cell cycle to what happens during that stage.

[2 marks]

Stage of cell cycle	What happens during that stage
Stage 1	One set of chromosomes is pulled to each end of the cell
Stage 2	The cytoplasm and cell membrane divide to form two new cells
Stage 3	The cell grows and the chromosomes replicate

0 2 . 3 What percentage of the total time for the cell cycle is taken by stage 1?

[2 marks]

Percentage = _____ %

0 2 . 4 A cell divides to form two new cells every 24 hours.

How many days will it take for the original cell to divide into 8 cells?

[1 mark]

Tick (✓) **one** box.

1 ☐ 3 ☐ 6 ☐ 8 ☐

4.6.1.4 DNA and the genome

Question 04 · continued

0 2 . 5 The chromosomes contain the genetic material.

Name the chemical which the genetic material is made from.

[1 mark]

0 2 . 6 The genetic material is made of many small sections.

Each section codes for a specific protein.

What is one section of genetic material on a chromosome called?

[1 mark]

Tick (✓) **one** box.

- A gamete ☐
- A gene ☐
- A nucleus ☐

0 2 . 7 Stem cells are cells which have **not** yet been specialised to carry out a particular job.

Bone marrow cells are one example of stem cells.

Explain how a transplant of bone marrow cells can help to treat medical conditions.

[2 marks]

10

4.6.1.4 DNA and the genome

Question 05

November 2020 | 8461/2F | Original Q7

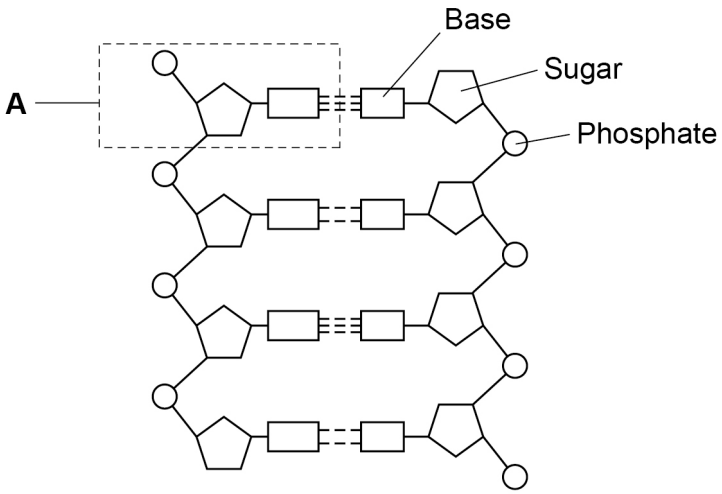
0 7 This question is about DNA.

0 7 . 1 Describe the shape of a DNA molecule.

[2 marks]

Figure 10 shows part of a DNA molecule.

Figure 10



0 7 . 2 DNA codes for a sequence of amino acids.

Which part of DNA forms the code for a particular amino acid?

[1 mark]

Tick (✓) **one** box.

- Bases ☐
- Phosphates ☐
- Sugars ☐

4.6.1.4 DNA and the genome

Question 05 · continued

0 7 . 3 Which substance is produced when amino acids are joined together?

[1 mark]

Tick (✓) **one** box.

Carbohydrate ☐

Fat ☐

Protein ☐

0 7 . 4 DNA is made of repeating units. One of the units is labelled **A** in **Figure 10**.

What is the name of the repeating unit labelled **A**?

[1 mark]

Tick (✓) **one** box.

Chromosome ☐

Enzyme ☐

Nucleotide ☐

Question 7 continues on the next page

4.6.1.4 DNA and the genome

Question 05 · continued

0 7 . 5 The DNA in one human body cell is the length of 6 000 million repeating units (part **A**).

Each repeating unit is 0.34 nanometres (nm) long.

Calculate the length of the DNA in the cell in millions of nanometres.

[2 marks]

Length = _____ million nm

0 7 . 6 Give your answer to Question **07.5** in metres.

1 metre = 1×10^9 nanometres

[1 mark]

Length = _____ m

0 7 . 7 DNA analysis can show people which alleles they have.

Patients who have certain types of cancer can be offered DNA analysis.

The family of the patient can also be offered DNA analysis.

Suggest **one** advantage of having DNA analysis.

[1 mark]

9

4.6.1.4 DNA and the genome

Question 06

November 2021 | 8461/2F | Original Q8

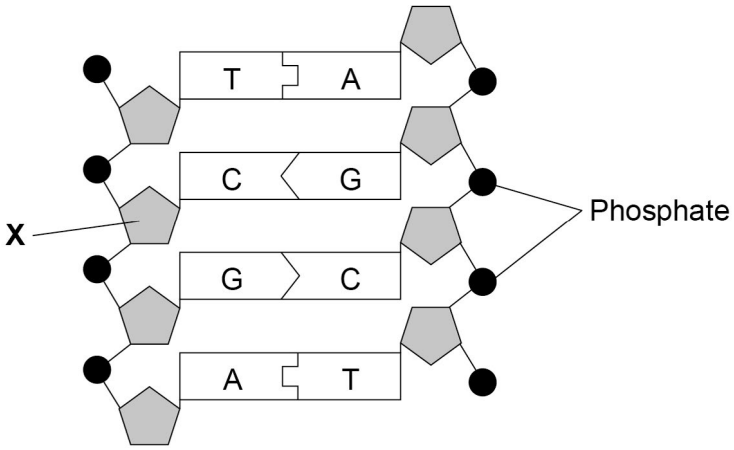
0 8 The nucleus of a cell contains DNA.

0 8 . 1 Name the structures inside the cell nucleus that contain DNA.

[1 mark]

Figure 13 shows part of a DNA molecule.

Figure 13



0 8 . 2 Name the part of the DNA molecule labelled **X**.

[1 mark]

0 8 . 3 What type of substances are labelled **A**, **C**, **G** and **T** in **Figure 13**?

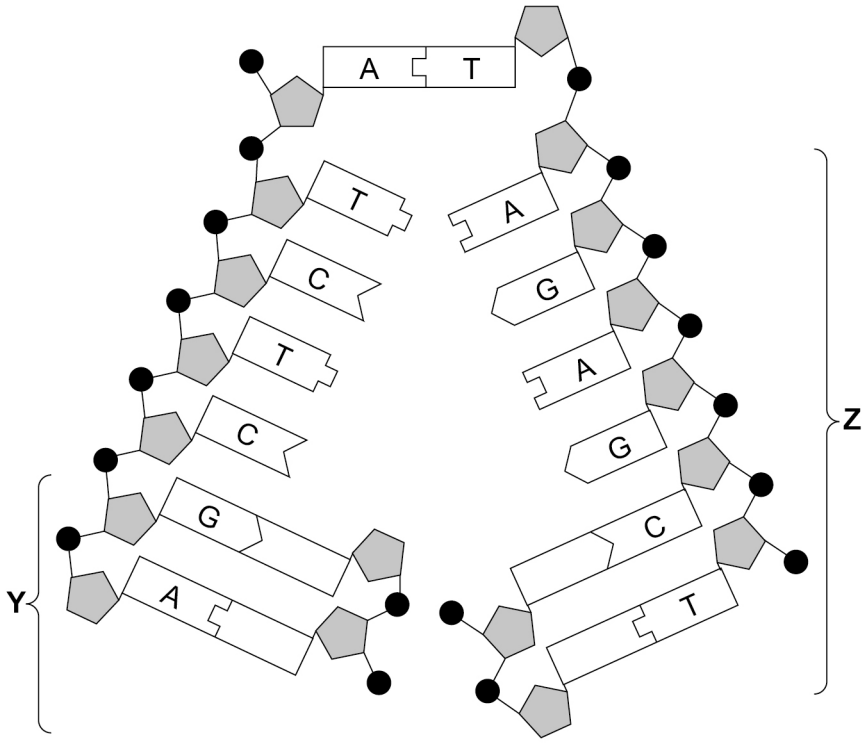
[1 mark]

4.6.1.4 DNA and the genome

Question 06 · continued

Figure 14 shows another section of a DNA molecule.

Figure 14



0 8 . 4 Four of the substances you named in Question **08.3** are **not** labelled in part **Y** of **Figure 14**.

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

Use information from other parts of **Figure 14** to help you.

[1 mark]

0 8 . 5 What is happening to the DNA in part **Z** of **Figure 14**?

[1 mark]

Tick (✓) **one** box.

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

4.6.1.4 DNA and the genome

Question 06 · continued

0 8 . 6 A gene is a length of DNA.

What type of substance does a gene code for?

[1 mark]

_____

0 8 . 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 8 . 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