AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.1.2.1

Chromosomes

Past-paper questions

Tier	**Higher**
Question groups	**7**
Available paper years	**2018–2025**

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.

4.1.2.1 Chromosomes

Question 01

June 2018 | 8464/B/2H | Original Q7

0 7 Many people eat shellfish called oysters.

An oyster has 20 chromosomes in each body cell.

0 7 . 1 Which arrangement of chromosomes will a male oyster have in each body cell?

[1 mark]

Tick **one** box.

- One X and one Y chromosome and 8 pairs of other chromosomes ☐
- Two X and two Y chromosomes and 8 pairs of other chromosomes ☐
- One X and one Y chromosome and 9 pairs of other chromosomes ☐
- Two X chromosomes and 9 pairs of other chromosomes ☐

0 7 . 2 Oyster gametes only contain half the amount of DNA compared to a normal oyster body cell.

Describe the type of cell division that produces gametes.

[3 marks]

Question 7 continues on the next page

4.1.2.1 Chromosomes

Question 01 · continued

Biologists have discovered a way to produce oysters that have three sets of chromosomes (triploid) instead of the usual two sets (diploid).

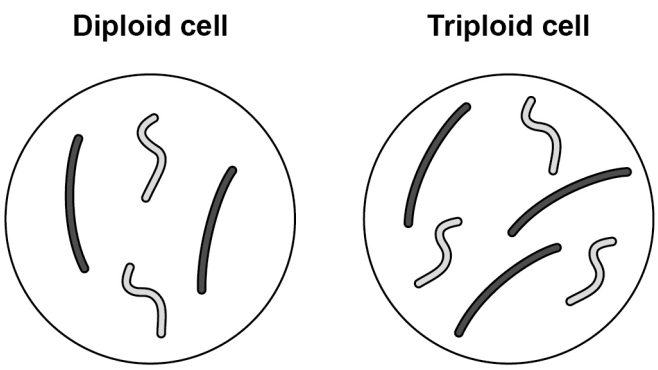
The triploid oysters cannot reproduce and so they grow more quickly.

Diploid oysters do not taste good in the reproductive season. Triploid oysters taste good all year.

Figure 5 shows the chromosomes in a diploid cell and in a triploid cell.

Only two sets of chromosomes are shown.

Figure 5



0 7 . 3 Suggest why the triploid oysters are **not** able to reproduce.

[1 mark]

0 7 . 4 Explain why the triploid oysters grow more quickly than the diploid oysters.

[2 marks]

4.1.2.1 Chromosomes

Question 01 · continued

0 7 . 5 The population of diploid oysters growing in the wild has reduced by over 80% in the last 20 years.

Suggest **two** environmental factors which may be causing this reduction.

Give a reason why each factor may be causing the reduction in the population.

[2 marks]

1 _____

_____

2 _____

_____

0 7 . 6 Oyster farmers grow the triploid oysters from young seed oysters.

The production of seed oysters involves the use of a chemical called cytochalasin B. Cytochalasin B has been shown to cause cancer in mice.

Evaluate the production of triploid oysters for supermarkets and restaurants.

[6 marks]

_____

_____

_____

_____

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_____

4.1.2.1 Chromosomes

Question 02

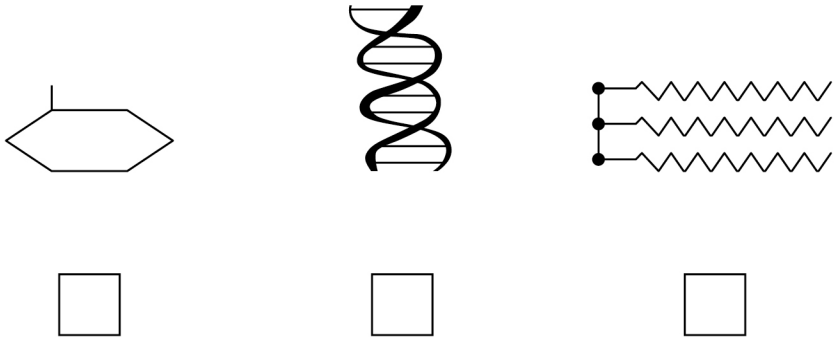
November 2020 | 8464/B/2H | Original Q1

0 1 This question is about DNA and genes.

0 1 . 1 Which diagram represents a DNA molecule?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐

0 1 . 2 Describe the structure of a DNA molecule.

[1 mark]

_____

_____

0 1 . 3 A gene is a small section of DNA on a chromosome.

Complete the sentences.

[2 marks]

A gene codes for a particular sequence of _____ .

This sequence makes a specific _____ .

4.1.2.1 Chromosomes

Question 02 · continued

0 1 . 4 What is meant by the term genome?

[1 mark]

0 1 . 5 The complete human genome is now known.

Which important scientific advance was made using knowledge of the human genome?

[1 mark]

Tick (✓) **one** box.

- Discovering antibiotic resistant bacteria ☐
- Finding more foods to eat from tropical forests ☐
- Tracing how aboriginal people spread across Australia ☐
- Working out when the last ice age ended ☐

Question 1 continues on the next page

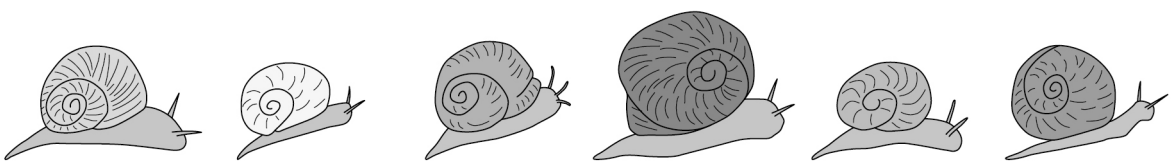
4.1.2.1 Chromosomes

Question 02 · continued

A student found six different snails of one species in his garden.

Figure 1 shows the snails.

Figure 1



0 1 . 6 All the snails are different.

What scientific term describes differences in characteristics between individuals of a species?

[1 mark]

0 1 . 7 A change in DNA has caused snail **P** to be very different from the other five snails.

Suggest why there might be an increasing number of snails similar to snail **P** in each future generation.

[2 marks]

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4.1.2.1 Chromosomes

Question 03

November 2020 | 8464/B/2H | Original Q5

0 5 This question is about inheritance.

Humans have 23 pairs of chromosomes in each body cell.

One pair of chromosomes determines sex.

0 5 . 1 Complete **Figure 5**.

[2 marks]

Figure 5

		Female	
		X	**X**
Male			

0 5 . 2 In some families all children are the same sex.

Give the reason why.

[1 mark]

4.1.2.1 Chromosomes

Question 03 · continued

Cystic fibrosis (CF) is an inherited disorder.

0 5 . 3 A man and a woman do **not** have CF.

The man and the woman have a child who has CF.

Draw a Punnett square diagram to find the probability that their next child will have CF.

Use the symbols:

T = dominant allele

t = recessive allele

Draw a ring around the genotype of any children with CF.

[4 marks]

Probability = _____

Question 5 continues on the next page

4.1.2.1 Chromosomes

Question 03 · continued

Embryo screening for CF can be done by two methods.

Method 1

- The woman becomes pregnant by sexual intercourse.
- After 10 weeks of pregnancy a fine needle is inserted into the uterus.
- A sample of the fluid surrounding the embryo is taken.
- The DNA of the embryo is tested for CF.

The screening is done free by specialist hospitals for couples who are at risk of having a child with CF.

There is a small risk of miscarriage.

Method 2

- The couple use In Vitro Fertilisation (IVF) to produce a small number of embryos.
- Each embryo is tested for CF.
- One or two embryos without CF are implanted in the woman's uterus.

In 2017 the success rate for having a baby by IVF for women under 35 years was 30%

IVF is a stressful, invasive procedure.

In most UK areas the free public health service does not provide IVF for all women asking for it.

4.1.2.1 Chromosomes

Question 03 · continued

0 5 . 4 Suggest **three** reasons for choosing **Method 1** instead of **Method 2**.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

0 5 . 5 Suggest **one** advantage of **Method 2**.

[1 mark]

_____

_____

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4.1.2.1 Chromosomes

Question 04

June 2022 | 8464/B/1H | Original Q2

0 2 This question is about cell division.

0 2 . 1 Write the biological structures from the box in the correct order of size.

[1 mark]

cell	**chromosome**	**gene**	**nucleus**

Smallest

↓

Largest

_____

_____

_____

_____

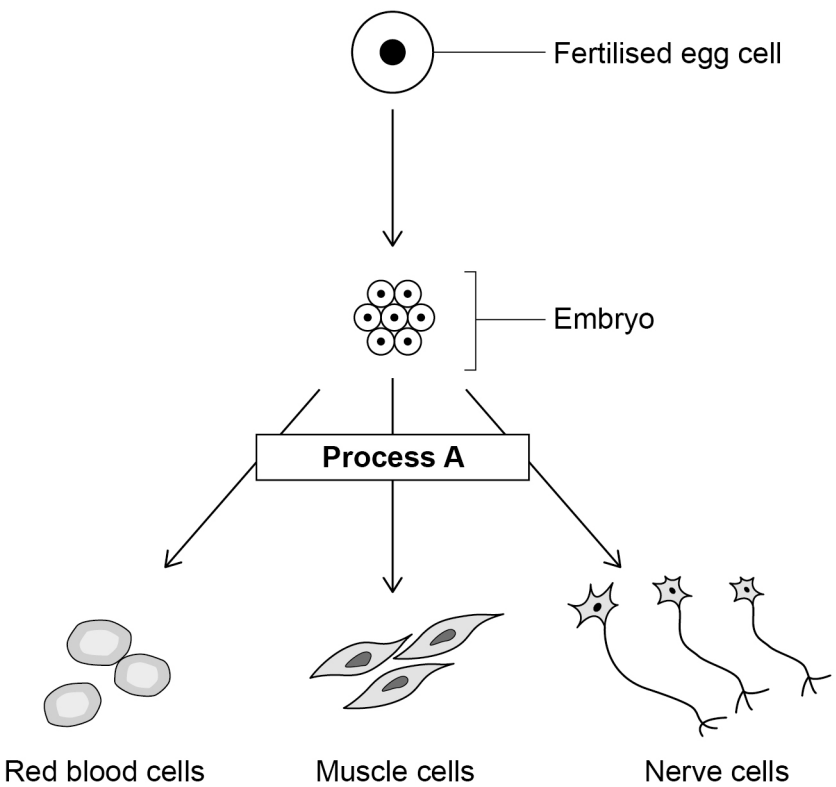
Question 2 continues on the next page

4.1.2.1 Chromosomes

Question 04 · continued

Figure 3 shows how a fertilised egg cell can produce specialised cells.

Figure 3



0 2 . 2 Name **Process A**.

[1 mark]

0 2 . 3 How many cell divisions are needed to form a 16-cell embryo from the original fertilised egg cell?

[1 mark]

Number of cell divisions = _____

4.1.2.1 Chromosomes

Question 04 · continued

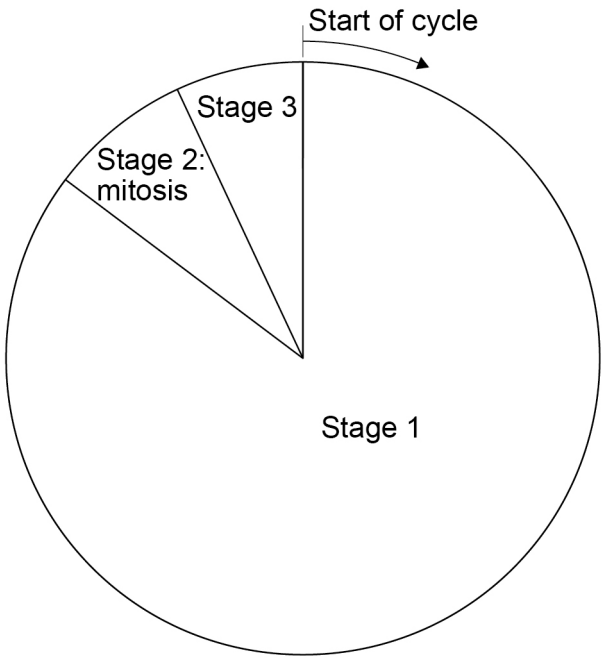
0 2 . 4 In humans a fertilised egg cell contains 23 pairs of chromosomes.

How many chromosomes will there be in each of the embryo cells?

[1 mark]

0 2 . 5 **Figure 4** represents a cell cycle for a human embryonic cell.

Figure 4



Describe **one** change in the cell that occurs during **each** of the stages of the cell cycle.

[3 marks]

Stage 1

Stage 2

Stage 3

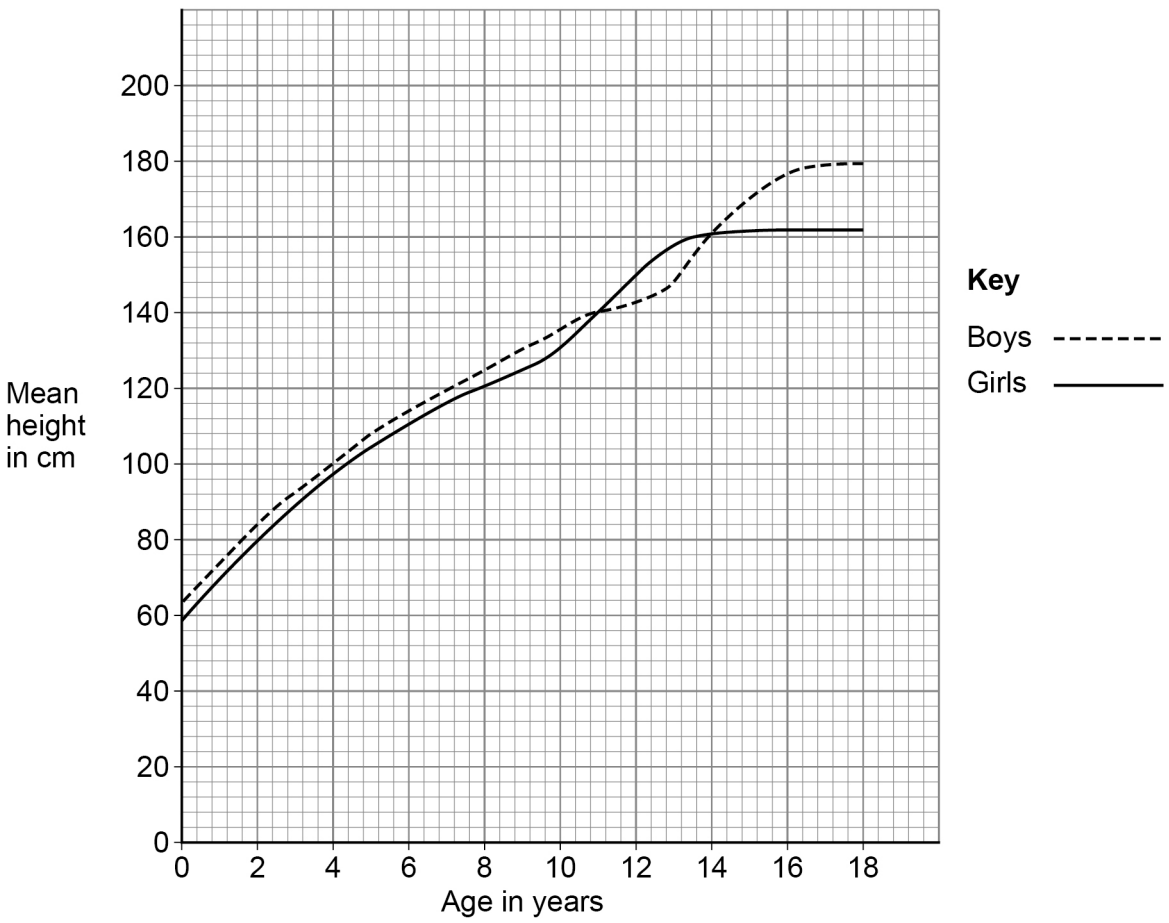
4.1.2.1 Chromosomes

Question 04 · continued

Cell division is important in the growth of multicellular organisms.

0 2 . 6 **Figure 5** shows the mean height of boys and of girls from birth to age 18 years.

Figure 5



4.1.2.1 Chromosomes

Question 04 · continued

Compare the growth of boys with the growth of girls.

Use data from **Figure 5** in your answer.

[6 marks]

0 2 . 7 Give **one** way that cell division by mitosis is important in **fully grown** animals.

[1 mark]

14

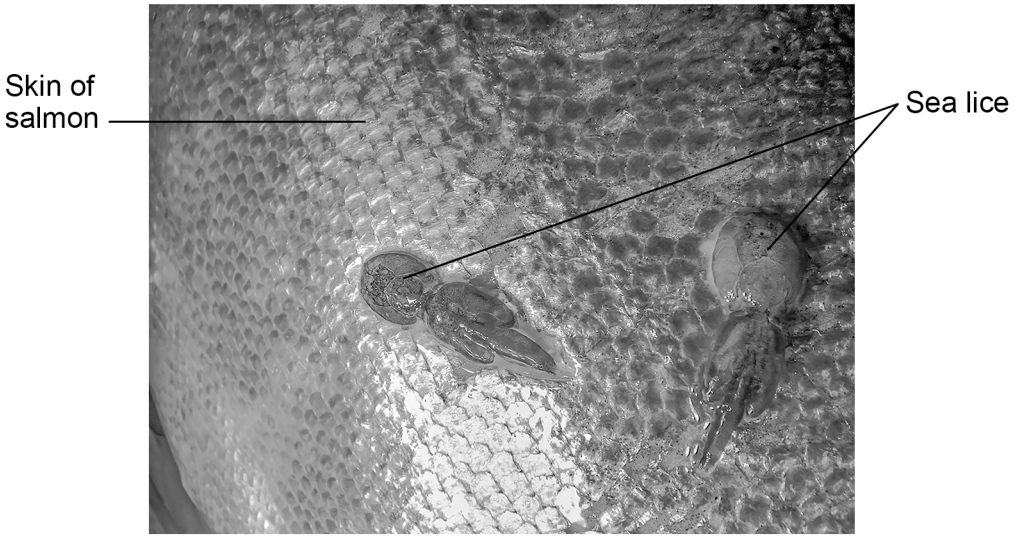
4.1.2.1 Chromosomes

Question 05

0 4 Sea lice are small animals that feed on the skin and blood of salmon fish.

Figure 3 shows sea lice attached to the skin of a salmon, *Oncorhynchus keta*.

Figure 3



0 4 . 1 What is the genus name of salmon?

[1 mark]

0 4 . 2 Which domain are sea lice classified in?

[1 mark]

4.1.2.1 Chromosomes

Question 05 · continued

0 4 . 3 Some salmon have genes that result in fewer sea lice attaching to the skin.

Describe how fish farmers can selectively breed salmon that sea lice **cannot** attach to.

[3 marks]

0 4 . 4 Explain the advantages to salmon farmers of producing salmon that do **not** have sea lice attached to their skin.

[3 marks]

Question 4 continues on the next page

4.1.2.1 Chromosomes

Question 05 · continued

0 4 . 5 Explain the **disadvantage** of selectively breeding salmon.

Do **not** refer to cost or to time in your answer.

[2 marks]

10

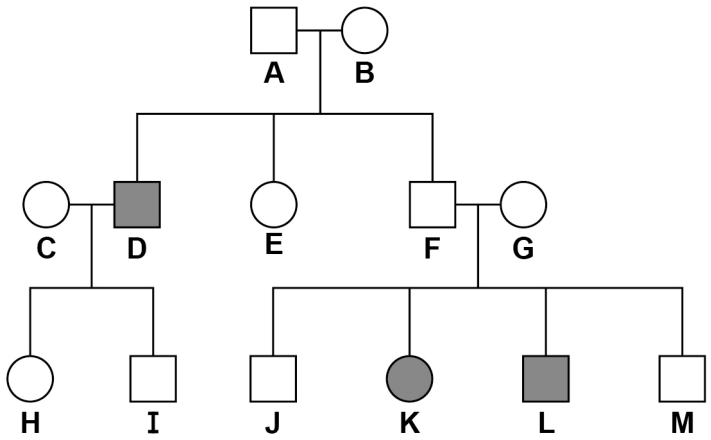
4.1.2.1 Chromosomes

Question 06

0 3 AKU is a genetic disorder.

Figure 3 shows the inheritance of AKU in one family.

Figure 3



Key

- Male who has AKU
- Female who has AKU
- Male who does **not** have AKU
- Female who does **not** have AKU

0 3 . 1 Describe how **Figure 3** shows that the allele for AKU is recessive.

[1 mark]

0 3 . 2 Which person is **definitely** heterozygous for AKU?

[1 mark]

Tick (✓) **one** box.

C ☐ D ☐ E ☐ G ☐

4.1.2.1 Chromosomes

0 3 . 3 A female who has AKU and a male who is heterozygous for AKU plan to have a child.

Determine the probability that the child will have AKU.

You should:

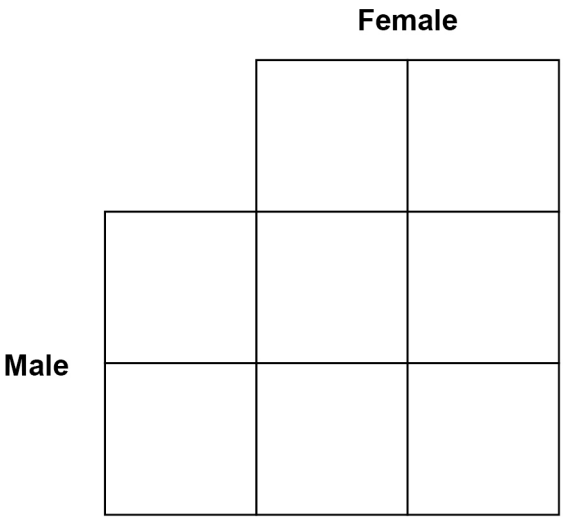
- complete **Figure 4**
- identify the phenotype of each offspring genotype
- use the symbols:

  A = dominant allele

  a = recessive allele.

[5 marks]

Figure 4



Probability that the child will have AKU = _____

Question 3 continues on the next page

4.1.2.1 Chromosomes

Question 06 · continued

0 3 . 4 A mutation is a change in a gene.

People who have AKU have a mutation that causes the production of a non-functioning enzyme.

Enzymes are proteins.

Suggest how a mutation can result in the production of a non-functioning enzyme.

[2 marks]

0 3 . 5 Some people have In Vitro Fertilisation (IVF) treatment to increase the chance of becoming pregnant.

Describe how the process of IVF can result in pregnancy.

[4 marks]

4.1.2.1 Chromosomes

Question 06 · continued

0 3 . 6 Embryos can be screened to detect inherited disorders.

Give **two** arguments **against** embryo screening.

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

[2 marks]

1 _____

_____

2 _____

_____

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Turn over for the next question

4.1.2.1 Chromosomes

Question 07

June 2025 | 8464/B/2H | Original Q1

0 1 This question is about genetics.

The fur colour of rabbits is controlled by two alleles.

0 1 . 1 Draw **one** line from each term to the meaning of the term relating to genetics in rabbits.

[3 marks]

Term	Meaning of the term
Chromosome	A fur colour that is seen
Gene	A whole strand of DNA found in the nucleus of a rabbit cell
Genome	Codes for a protein that affects fur colour
	The complete genetic composition of a rabbit

Question 1 continues on the next page

4.1.2.1 Chromosomes

0 1 . 2 In rabbits:

- the allele for brown fur (**B**) is dominant
- the allele for white fur (**b**) is recessive.

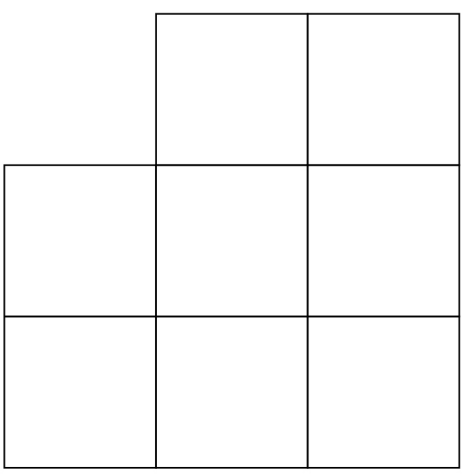
A rabbit with the alleles **Bb** and a rabbit with the alleles **bb** breed together.

Determine the probability that one of the offspring will have white fur.

You should:

- complete the Punnett square diagram
- identify any offspring that will have white fur.

[5 marks]



Probability = _____

4.1.2.1 Chromosomes

Question 07 · continued

0 1 . 3 A male rabbit is heterozygous for fur colour.

The rabbit's body cells have the genotype **Bb**.

One of the sperm cells from the rabbit has the allele **b**.

Explain why the alleles in the rabbit's body cells and the allele in the sperm cell are different.

[2 marks]

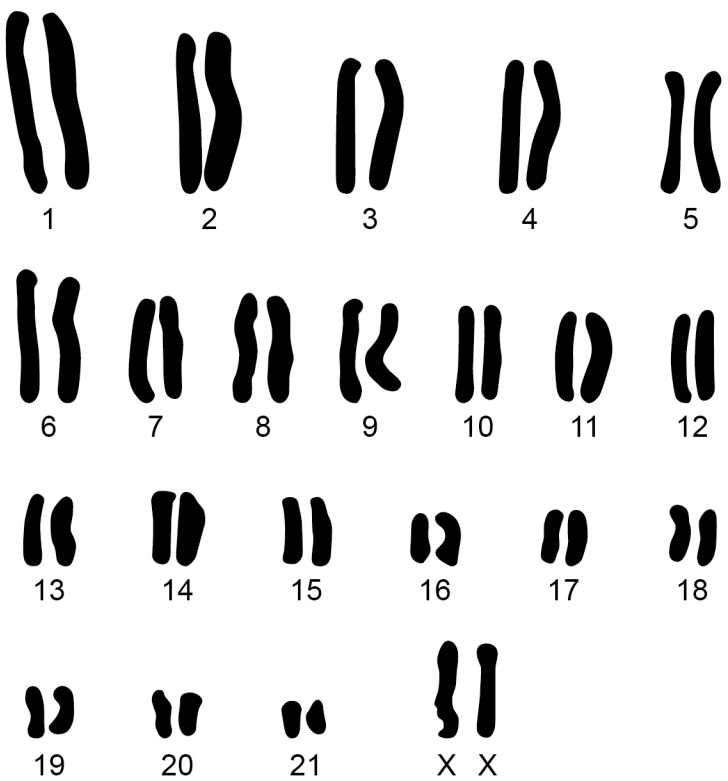
Question 1 continues on the next page

4.1.2.1 Chromosomes

Question 07 · continued

Figure 1 shows the chromosomes of a rabbit.

Figure 1



0 1 . 4 How many chromosomes would be found in a skin cell of a rabbit?

Use **Figure 1**.

[1 mark]

Number of chromosomes = _____

0 1 . 5 The sex of a rabbit is controlled in the same way as the sex of a human.

Give the evidence from **Figure 1** that the rabbit is female.

[1 mark]

_____

_____

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