AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.1.6

Genetic inheritance

Past-paper questions

Tier	**Foundation**
Question groups	**25**
Available paper years	**2008–2025**

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.

4.6.1.6 Genetic inheritance

Question 01

June 2008 | BLY2F | Original Q8 | Legacy

8 Cystic fibrosis is an inherited disorder that can seriously affect health.

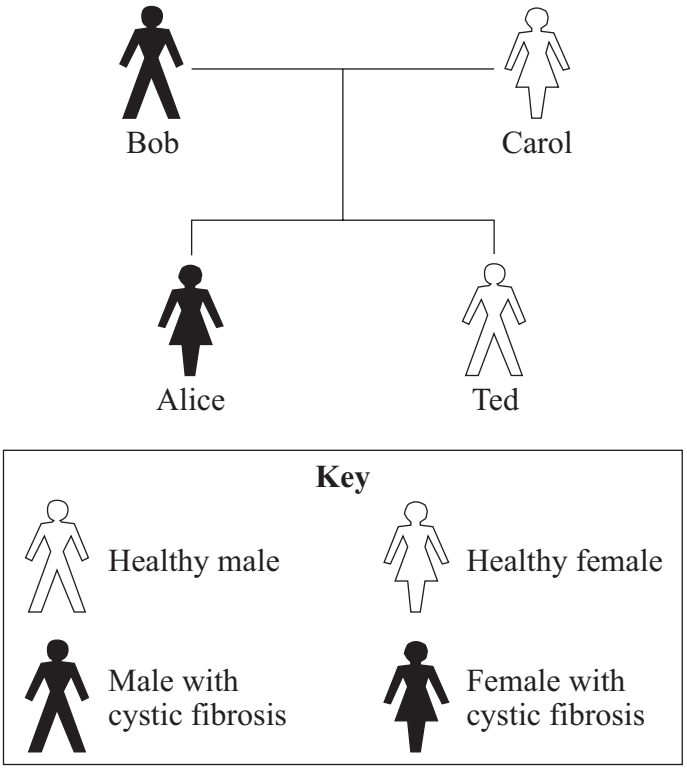
8 (a) Which **one** of these is affected by cystic fibrosis?

Draw a ring around your answer.

blood **cell membranes** **kidneys** **nervous system**

(1 mark)

8 (b) The diagram shows the inheritance of cystic fibrosis in a family. The allele that produces cystic fibrosis is recessive.



8 (b) (i) Explain why Alice inherited cystic fibrosis.

.....

.....

.....

.....

(2 marks)

4.6.1.6 Genetic inheritance

Question 01 · continued

for mark

8 (b) (ii) Explain why Ted did **not** inherit cystic fibrosis.

.....

.....

.....

.....

(2 marks)

8 (c) Bob and Carol know that there is a risk that their next baby will have cystic fibrosis.

Embryos can be screened for the allele that produces cystic fibrosis.

Many people support the screening of embryos, but others do not.

8 (c) (i) Suggest **one** reason why many people support the screening of embryos for the cystic fibrosis allele.

.....

.....

.....

(1 mark)

8 (c) (ii) Suggest **one** reason why many people are against the screening of embryos for the cystic fibrosis allele.

.....

.....

.....

(1 mark)

7

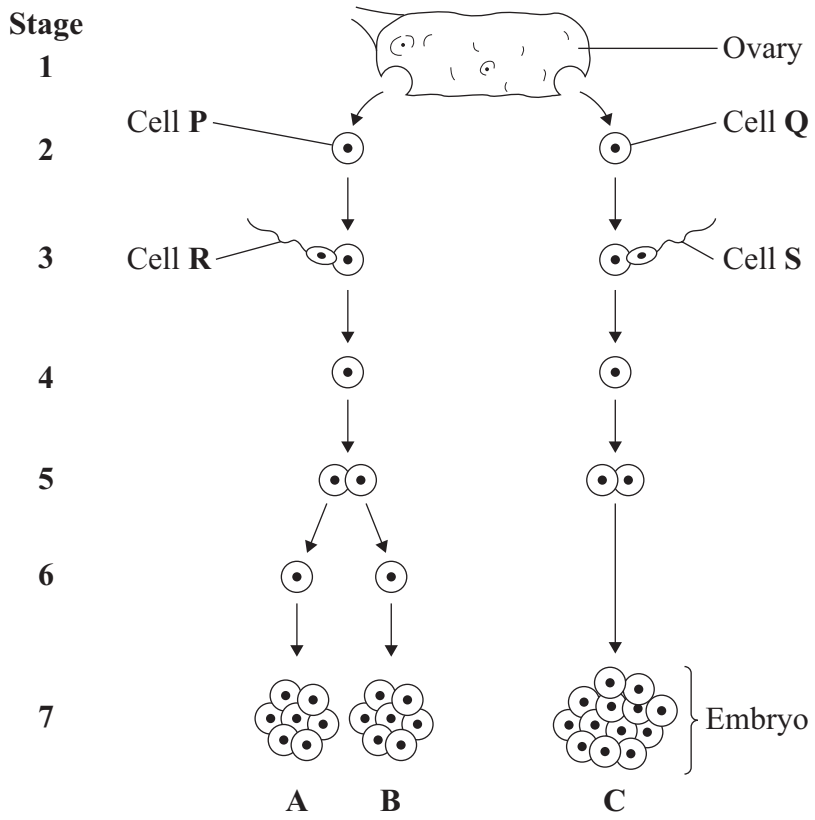
4.6.1.6 Genetic inheritance

Question 02

January 2009 | BLY2F | Original Q3 | Legacy

3 A woman gives birth to triplets.
Two of the triplets are boys and the third is a girl.
The triplets developed from two egg cells released from the ovary at the same time.

The diagram shows how triplets **A**, **B** and **C** developed.



3 (a) Which stages on the diagram show gametes?

Draw a ring around your answer.

1 and 2 **2 and 3** **3 and 7** **1 and 7**

(1 mark)

4.6.1.6 Genetic inheritance

Question 02 · continued

for mark

3 (b) Embryo **B** is male.

Which of the following explains why embryo **B** is male?

Tick (✓) **one** box.

Cell **P** has an X chromosome; cell **R** has an X chromosome. ☐

Cell **P** has a Y chromosome; cell **R** has an X chromosome. ☐

Cell **P** has an X chromosome; cell **R** has a Y chromosome. ☐

(1 mark)

3 (c) The children that develop from embryos **A** and **C** will **not** be identical.

Explain why.

You may use words from the box in your answer.

egg	**genes**	**sperm**

.....

.....

.....

.....

.....

(2 marks)

Question 3 continues on the next page

4.6.1.6 Genetic inheritance

Question 02 · continued

for mark

3 (d) Single cells from an embryo at **Stage 7** can be separated and grown in a special solution.

3 (d) (i) What term describes cells that are grown in this way?

Draw a ring around your answer.

alleles **screened cells** **stem cells**

(1 mark)

3 (d) (ii) What happens when the cells are placed in the special solution?

Tick (✓) **two** boxes.

The cells divide ☐

The cells fertilise ☐

The cells differentiate ☐

The cells separate ☐

(2 marks)

3 (d) (iii) Give **one** use of cells grown in this way.

.....

.....

(1 mark)

3 (d) (iv) Some people might object to using cells from embryos in this way.

Give **one** reason why.

.....

.....

.....

(1 mark)

9

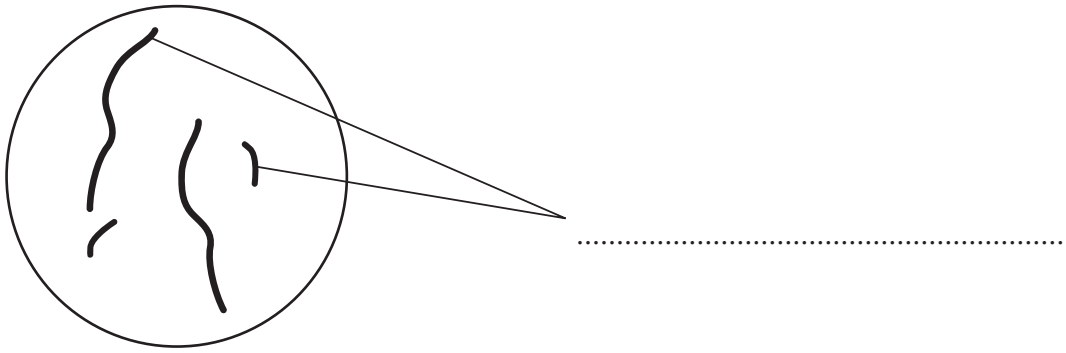
4.6.1.6 Genetic inheritance

Question 03

June 2009 | BLY2F | Original Q5 | Legacy

5 **Diagram 1** shows the nucleus of a body cell as it begins to divide by mitosis.

Diagram 1



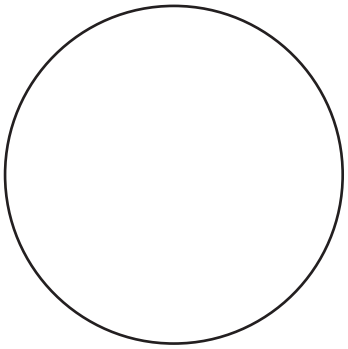
5 (a) Use a word from the box to label **Diagram 1**.

alleles	**chromosomes**	**gametes**

(1 mark)

5 (b) Complete **Diagram 2** to show what the nucleus of one of the cells produced by this mitosis would look like.

Diagram 2



(1 mark)

4.6.1.6 Genetic inheritance

Question 03 · continued

for mark

5 (c) Stem cells from a recently dead embryo can be grown in special solutions.

Some facts about stem cells are given below.

- Stem cells from an embryo can grow into any type of tissue.
- Stem cells may grow out of control, to form cancers.
- Large numbers of stem cells can be grown in the laboratory.
- Stem cells may be used in medical research or to treat some human diseases.
- Patients treated with stem cells need to take drugs for the rest of their life to prevent rejection.
- Collecting and growing stem cells is expensive.

Use **only** the information above to answer these questions.

5 (c) (i) Give **two** advantages of using stem cells.

1 .....

.....

2 .....

.....

(2 marks)

5 (c) (ii) Give **two** disadvantages of using stem cells.

1 .....

.....

2 .....

.....

(2 mark)

6

4.6.1.6 Genetic inheritance

Question 04

2 Humans reproduce sexually.

Draw a ring around the correct answer to complete each sentence.

2 (a) (i) At fertilisation chromosomes / genes / sex cells join together.

(1 mark)

2 (a) (ii) At fertilisation a single cell forms, which has new pairs of chromosomes. / nuclei. / sex cells.

(1 mark)

2 (b) Cystic fibrosis can be inherited by children whose parents do not have it.

2 (b) (i) A person who has cystic fibrosis has two / three / four copies of the cystic fibrosis allele.

(1 mark)

2 (b) (ii) The cystic fibrosis allele is large. / recessive. / strong.

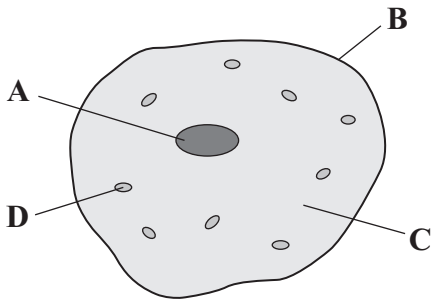
(1 mark)

4.6.1.6 Genetic inheritance

Question 04 · continued

for mark

2 (c) The diagram shows a human body cell.



Choose the correct answer from the box to complete each sentence.

cell membrane	**cell wall**	**cytoplasm**	**nucleus**

2 (c) (i) The part of the cell labelled **B** is the ..... .

(1 mark)

2 (c) (ii) The part of the cell labelled **C** is the ..... .

(1 mark)

2 (d) Which part of the cell, **A**, **B**, **C** or **D**:

2 (d) (i) contains the allele for cystic fibrosis ☐

(1 mark)

2 (d) (ii) is affected by cystic fibrosis? ☐

(1 mark)

8

4.6.1.6 Genetic inheritance

Question 05

March 2010 | BLY1BP | Original Q3 | Legacy

QUESTION THREE

This question is about reproduction.

Match words, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

A genes

B gametes

C characteristics

D nucleus

1	cells which fuse to form offspring
2	control the development of features
3	the part of a cell which contains chromosomes
4	features we can see, such as eye colour

4.6.1.6 Genetic inheritance

Question 06

June 2010 | BLY1F | Original Q4 | Legacy

4 We breed animals with the characteristics that we prefer.

4 (a) The photograph shows a rabbit with some of its babies.



Use words from the box to complete the sentences about inheritance in rabbits.

characteristic	**chromosome**	**gene**	**gamete**

4 (a) (i) The colour of a rabbit's fur is known as a ..... .

(1 mark)

4 (a) (ii) This colour is controlled by a ..... .

(1 mark)

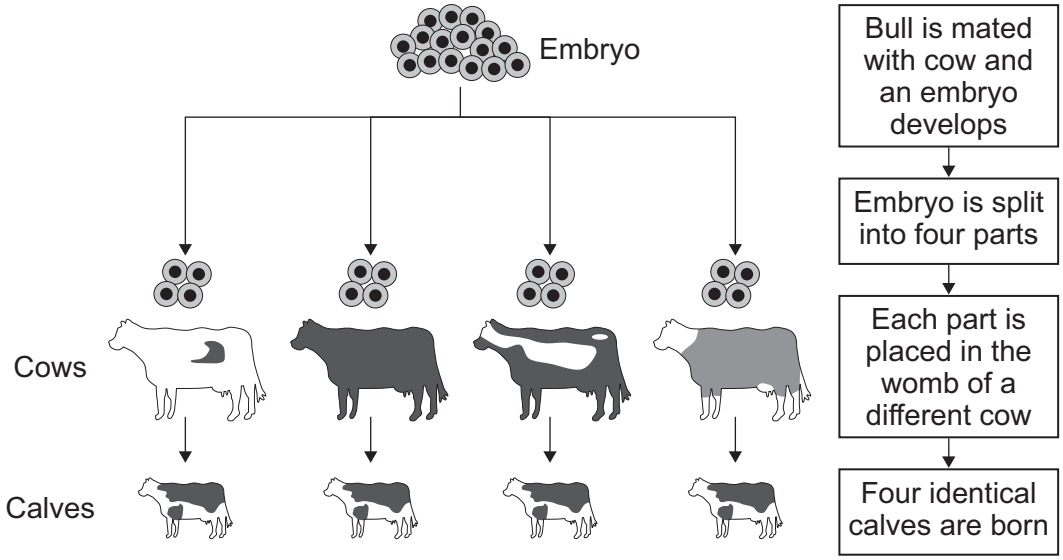
4 (a) (iii) Each sex cell of a rabbit is known as a ..... .

(1 mark)

4.6.1.6 Genetic inheritance

Question 06 · continued

4 (b) The diagram shows one way of producing calves.



Use words from the box to complete the sentences.

asexual	clones	cuttings	gametes	genetic	sexual

A bull was mated with a cow.

This is ..... reproduction.

The embryo produced was split into four parts.

The calves in the diagram have identical genetic information.

This is because the calves were produced by ..... reproduction.

The identical calves are known as ..... .

(3 marks)

6

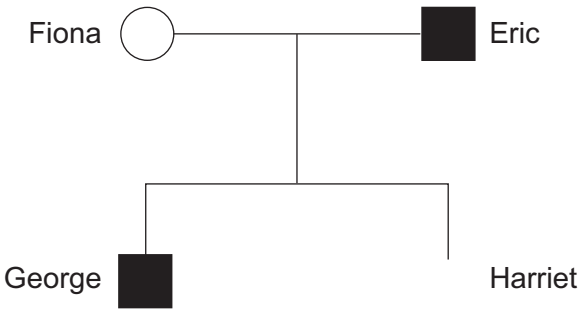
4.6.1.6 Genetic inheritance

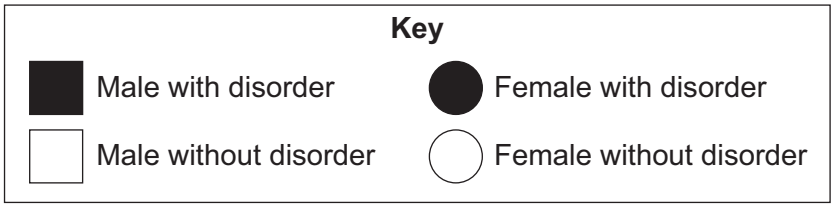
Question 07

June 2019 | BLY2F | Original Q4 | Legacy

4 The family tree shows the inheritance of a disorder caused by a dominant allele.

Fiona and Eric have two children George and Harriet.





4 (a) The son, George, has the disorder.

The daughter, Harriet, does **not** have the disorder.

4 (a) (i) Use the key to draw the symbol for Harriet next to her name **on the family tree**.

(2 marks)

4 (a) (ii) The symbol **D** represents the dominant allele for the disorder.
The symbol **d** represents the recessive allele.

Fiona has the pair of alleles **dd**.

Write the correct pairs of alleles in the boxes.

Harriet has the pair of alleles ☐ .

A person with the disorder could have

the pair of alleles ☐ or the pair of alleles ☐ .

(3 marks)

4.6.1.6 Genetic inheritance

Question 07 · continued

4 (b) Before Harriet was born, a doctor suggested that Fiona should have the embryo 'screened'.

4 (b) (i) Give **one** reason why the doctor suggested screening.

Tick (✓) **one** box.

To check for the **D** allele ☐

To check the sex of the embryo ☐

To cure the disorder ☐

(1 mark)

4 (b) (ii) Why do some people believe that embryos should **not** be screened?

.....

.....

(1 mark)

7

4.6.1.6 Genetic inheritance

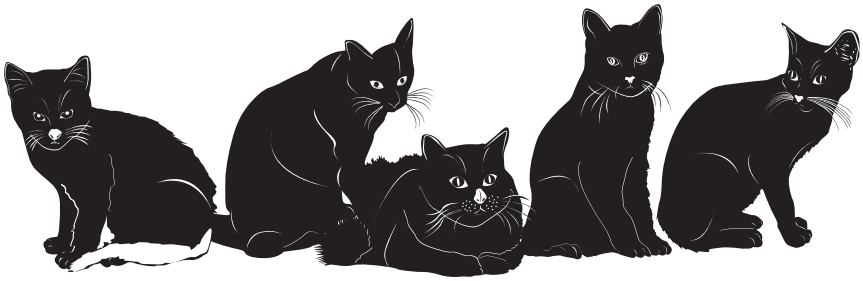
Question 08

November 2010 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

These young kittens look like their parents.

Kittens look like their parents because information is passed from the parents to their young. The information is about characteristics such as fur colour.



Match words, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

A chromosomes

B clones

C gametes

D genes

1	are kittens with identical characteristics
2	control one characteristic, eg fur colour
3	are sex cells
4	are thread-like structures carrying the information

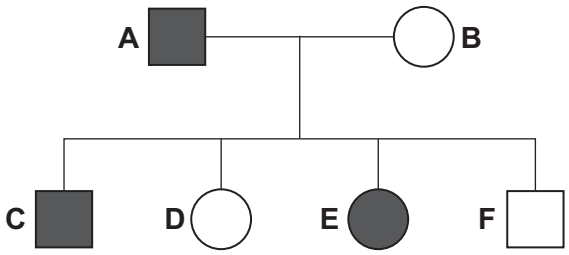
4.6.1.6 Genetic inheritance

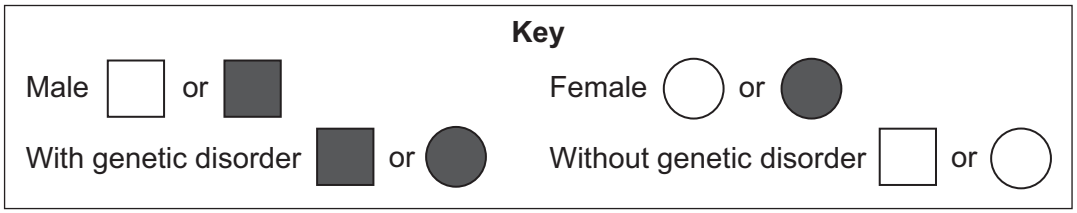
Question 09

January 2011 | BLY2F | Original Q4 | Legacy

4 The diagram shows the family tree of a pair of pigs, **A** and **B**.
Pigs **A** and **B** have four offspring, **C**, **D**, **E** and **F**.

Some of the pigs have a genetic disorder.





4 (a) Which pig, **A**, **B**, **C**, **D**, **E** or **F**, is:

4 (a) (i) a male pig with the genetic disorder ☐

(1 mark)

4 (a) (ii) a female pig without the genetic disorder? ☐

(1 mark)

4 (b) Draw a ring around the correct answer to complete the sentences.

Pig **C** has the genetic disorder.

4 (b) (i) Pig **C** inherited the genetic disorder from

pig **A**.
pig **B**.
pig **E**.

(1 mark)

4 (b) (ii) The gene for the genetic disorder was passed on in

an embryo.
an enzyme.
a gamete.

(1 mark)

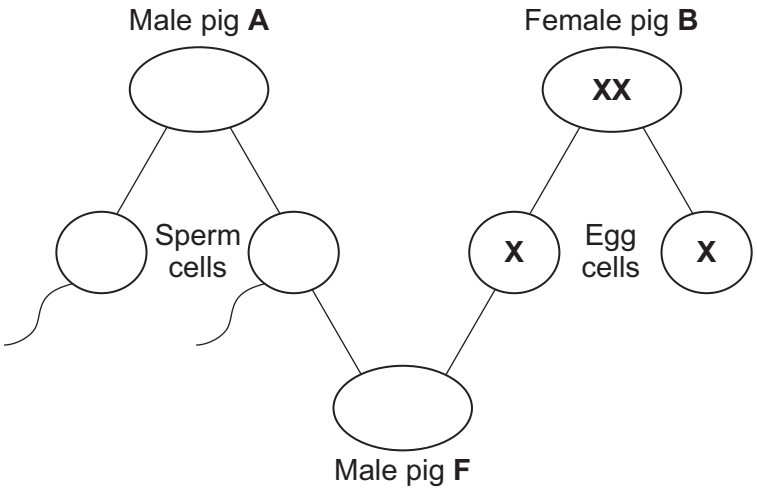
4.6.1.6 Genetic inheritance

Question 09 · continued

4 (c) Pig **F** is a male.

Complete the diagram to show how the sex of pig **F** depends on the inheritance of the sex chromosomes **X** and **Y**.

The sex chromosomes of pig **B** and the egg cells have been completed for you.



(3 marks)

7

4.6.1.6 Genetic inheritance

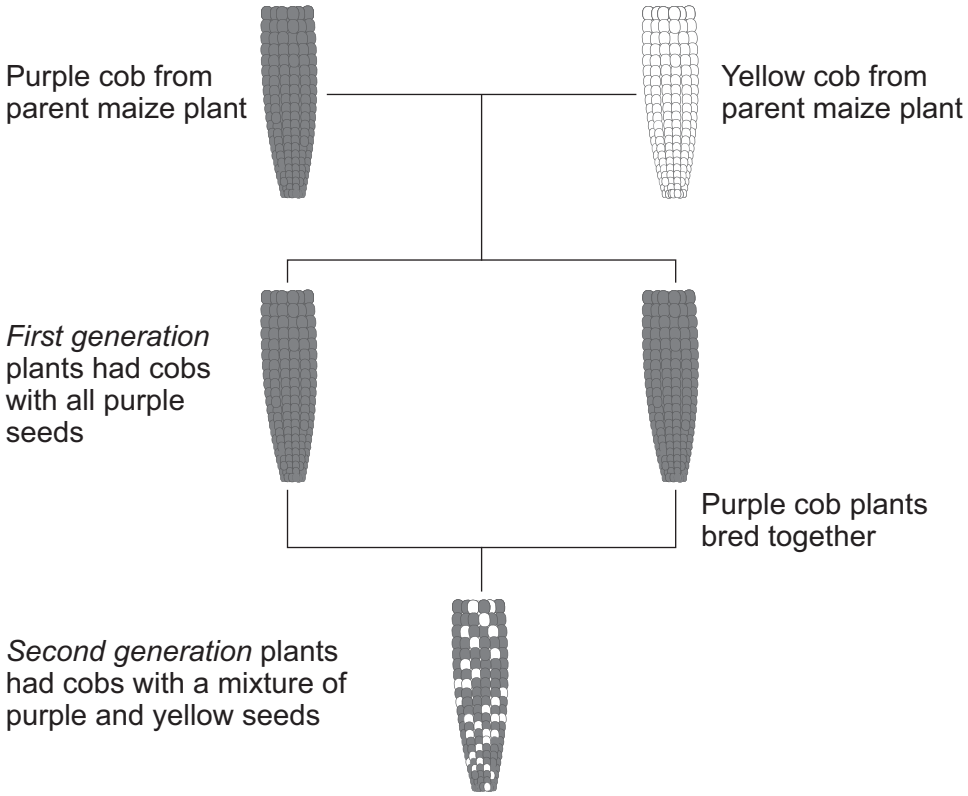
Question 10

June 2011 | BLY2F | Original Q5 | Legacy

5 Maize plants reproduce sexually to form maize cobs.
Each maize cob has many seeds.

The colour of the seeds is controlled by a gene.
The gene has two alleles, purple and yellow.

The diagram shows the cobs produced by breeding maize plants.



5 (a) Use words from the box to complete the sentences.

dominant	**environmental**	**recessive**

5 (a) (i) The first generation plants show that the purple allele is

..... .

(1 mark)

5 (a) (ii) The second generation plants show that the yellow allele is

..... .

(1 mark)

4.6.1.6 Genetic inheritance

Question 10 · continued

5 (b) The allele for purple can be represented by the letter **A**.
The allele for yellow can be represented by the letter **a**.

5 (b) (i) What alleles does a yellow seed have?

Draw a ring around **one** answer.

AA **Aa** **aa**

(1 mark)

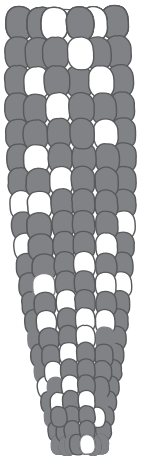
5 (b) (ii) What alleles does a purple seed from a *first generation* plant have?

Draw a ring around **one** answer.

AA **Aa** **aa**

(1 mark)

5 (c) The drawing shows a cob from one of the *second generation* plants.



A student counted 334 purple seeds and 110 yellow seeds on this maize cob.

What is the approximate ratio of purple seeds to yellow seeds on the cob?

Tick (✓) **one** box.

3 purple : 1 yellow ☐

1 purple : 3 yellow ☐

1 purple : 1 yellow ☐

(1 mark)

5

4.6.1.6 Genetic inheritance

Question 11

June 2012 | BL2FP | Original Q7 | Legacy

7 Cystic fibrosis is an inherited disorder.

Mr and Mrs Brown do **not** have cystic fibrosis but they have a child with cystic fibrosis.

7 (a) Draw a ring around the correct answer to complete each sentence.

7 (a) (i) The allele for cystic fibrosis is a

carrier allele.

dominant allele.

recessive allele.

(1 mark)

7 (a) (ii) Mr and Mrs Brown are both

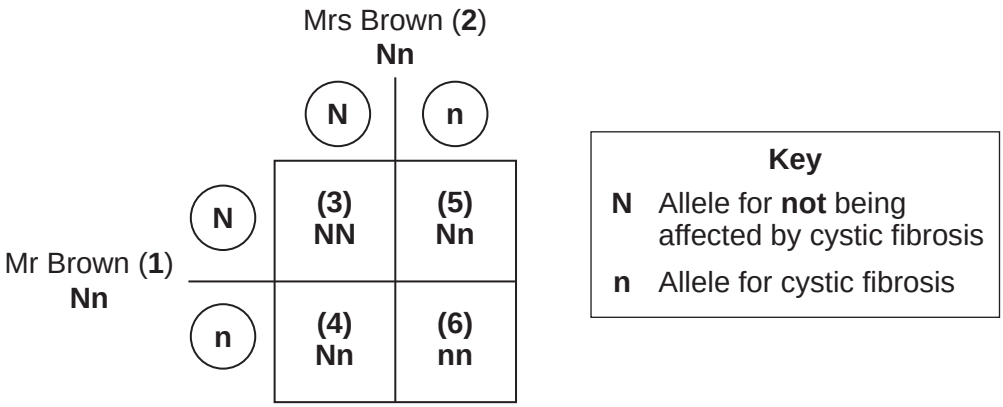
carriers.

immune.

infected.

(1 mark)

7 (b) The diagram shows how the allele for cystic fibrosis can be inherited by Mr and Mrs Brown's children.



7 (b) (i) Give the number of **one** person in the diagram who has cystic fibrosis. ☐

(1 mark)

7 (b) (ii) The chance that Mr and Mrs Brown's next child will have cystic fibrosis is

..... .

(1 mark)

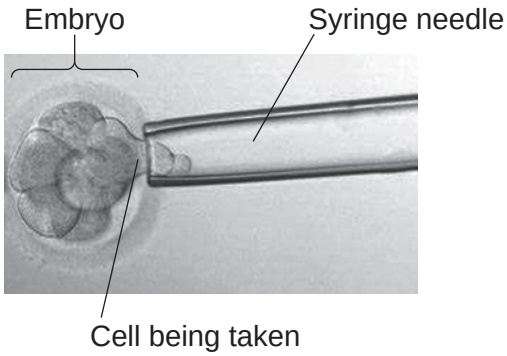
4.6.1.6 Genetic inheritance

Question 11 · continued

7 (c) A genetic counsellor describes to Mr and Mrs Brown one way of screening embryos for cystic fibrosis.

- Some eggs are collected from Mrs Brown.
- The eggs are then fertilised in a dish.
- Several embryos may start to develop.

The photograph shows how doctors take one cell from each embryo when it is only 3 days old.



Source: © Pascal Goetgheluck/Science Photo Library

- The DNA in the cell from each embryo is tested for cystic fibrosis.
- Doctors select one embryo that is unaffected and place it in Mrs Brown's uterus.
- The embryo then develops into a baby.

Use the information to suggest **one** advantage and **one** disadvantage of screening embryos in this way.

Advantage .....

.....

Disadvantage .....

.....

(2 marks)

6

4.6.1.6 Genetic inheritance

Question 12

January 2013 | BL2FP | Original Q5 | Legacy

5 In each question, draw a ring around the correct answer to complete the sentence.

5 (a) Our understanding of how genes are inherited is mostly because of

the work of

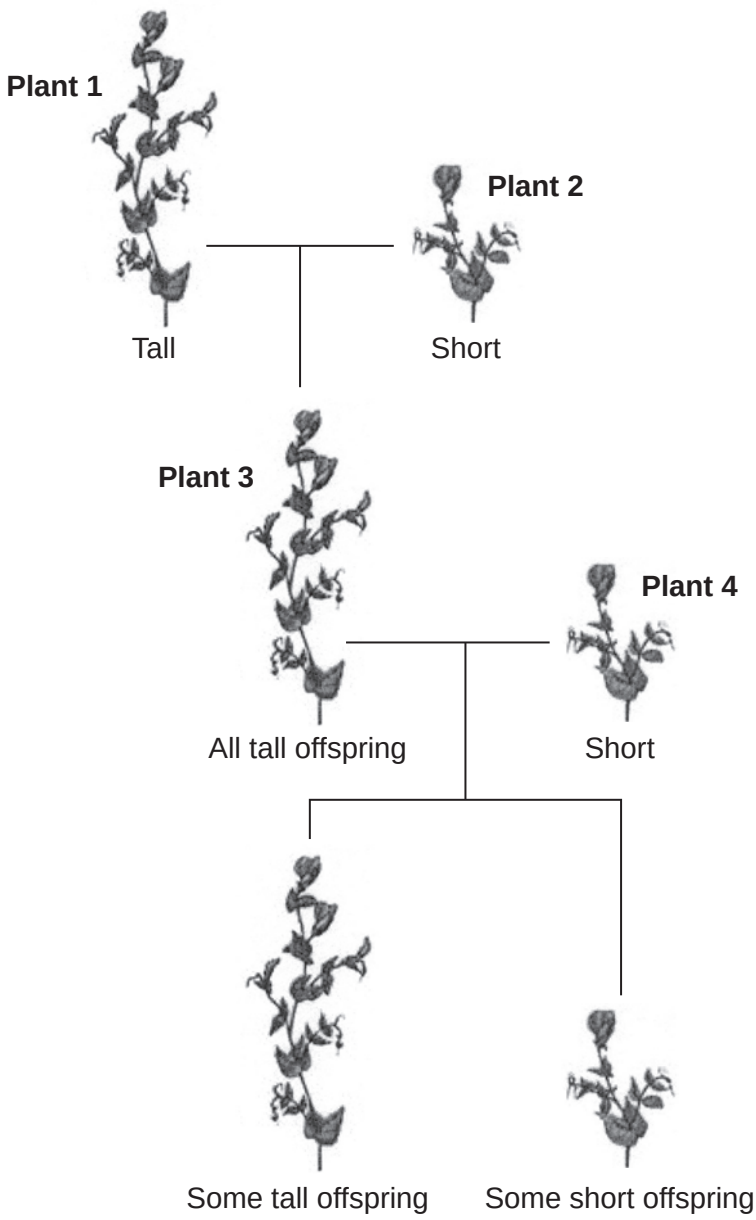
Darwin.
Lamarck.
Mendel.

(1 mark)

5 (b) A scientist investigated inheritance in pea plants.

The scientist crossed tall pea plants with short pea plants. **Diagram 1** shows the results.

Diagram 1



Question 12 · continued

In the rest of this question, the following symbols are used to represent alleles.

T = allele for tall
t = allele for short

5 (b) (i) The 1st cross in **Diagram 1** produced 120 offspring. All of these offspring were tall.

This shows that **plant 1** contained the alleles

- **TT**.
- **Tt**.
- **tt**.

(1 mark)

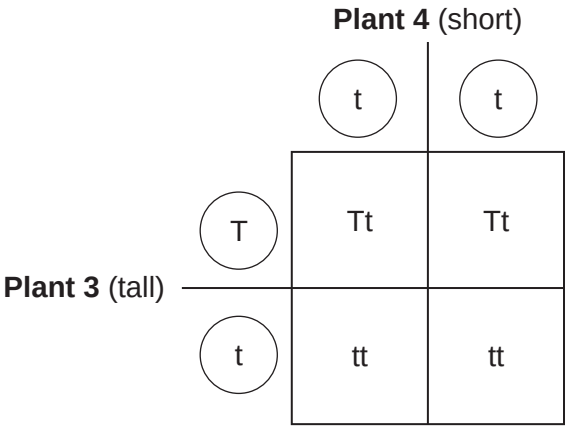
5 (b) (ii) **Plant 3** is tall because of

- a dominant allele.
- the environment.
- a recessive allele.

(1 mark)

5 (c) **Diagram 2** gives more information about the cross between **plant 3** and **plant 4**.

Diagram 2



This cross produced some tall offspring and some short offspring.

The ratio of tall to short offspring in **Diagram 2** is

- 1:1.
- 2:1.
- 3:1.

(1 mark)

Question 5 continues on the next page

4.6.1.6 Genetic inheritance

Question 12 · continued

5 (d) Two short plants were crossed. This cross produced 100 offspring.

The expected offspring would be

- 100 short plants.
- 50 tall plants and 50 short plants.
- 75 tall plants and 25 short plants.

(1 mark)

5

4.6.1.6 Genetic inheritance

Question 13

June 2013 | BL2FP | Original Q5 | Legacy

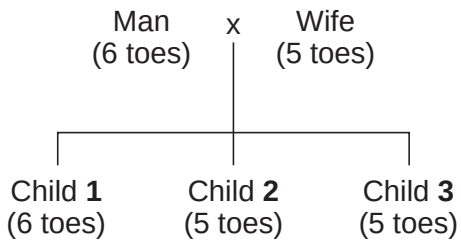
5 Polydactyly is an inherited condition. Polydactyly is controlled by a dominant allele.

The photograph shows the foot of a baby with polydactyly.



A man and his wife have three children. The man has polydactyly.

The diagram shows the inheritance of polydactyly in this family.
The diagram also shows the number of toes each person has on each foot.



In the rest of this question, the following symbols are used to represent alleles.

D = allele for polydactyly (6 toes on each foot)
d = allele for 5 toes on each foot

5 (a) (i) How many alleles for the number of toes will there be in **one** sperm cell? ☐

(1 mark)

5 (a) (ii) Complete the sentence.

A sperm cell joins with an egg cell in a process called ..... .

(1 mark)

4.6.1.6 Genetic inheritance

Question 13 · continued

5 (b) (i) What combination of alleles does the man have?

Tick (✓) **one** box.

DD ☐

Dd ☐

dd ☐

(1 mark)

5 (b) (ii) What combination of alleles does the man's wife have?

Tick (✓) **one** box.

DD ☐

Dd ☐

dd ☐

(1 mark)

5 (c) Draw a ring around the correct answer to complete each sentence.

5 (c) (i) The man and his wife plan to have a fourth child.

The probability that this child will have 6 toes on each foot is

1 in 2.

1 in 3.

1 in 4.

(1 mark)

5 (c) (ii) When Child **2** grows up, he marries a woman with 5 toes on each foot.

The probability that their first child will have 6 toes on each foot is

0.

1 in 2.

1 in 4.

(1 mark)

6

4.6.1.6 Genetic inheritance

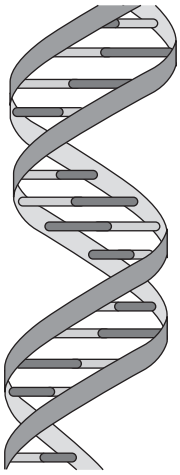
Question 14

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]

.....

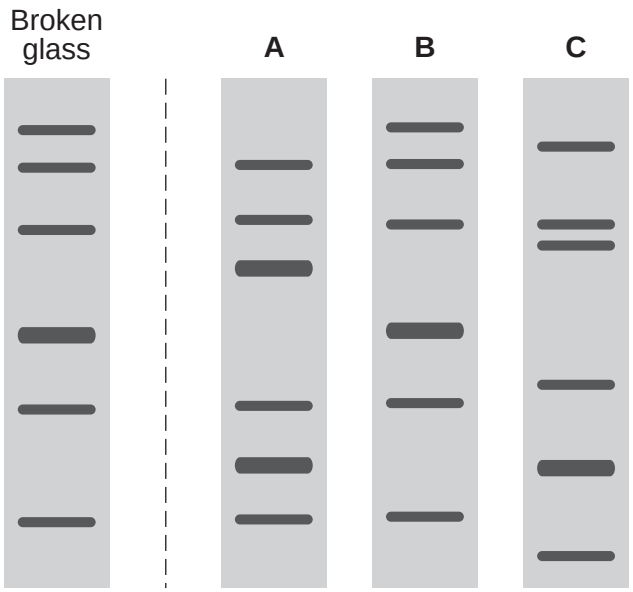
Question 14 · continued

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

4.6.1.6 Genetic inheritance

Question 15

June 2016 | BL2FP | Original Q4 | Legacy

4 In humans, hair colour is an inherited characteristic.

Red hair is caused by a recessive allele.

4 (a) When does a recessive allele control the development of a characteristic?

[1 mark]

Tick (✓) **one** box.

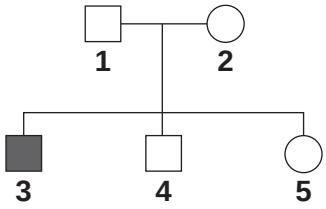
When the allele is present on only one of the chromosomes. ☐

When the dominant allele is not present. ☐

When the allele is inherited from the female parent. ☐

4 (b) **Figure 4** shows the inheritance of hair colour in one family.

Figure 4



Key

- Male with brown hair
- Female with brown hair
- Male with red hair
- Female with red hair

4 (b) (i) Brown hair is caused by a dominant allele, **B**.

Red hair is caused by the recessive allele, **b**.

What combination of alleles does person **1** have?

[1 mark]

Tick (✓) **one** box.

BB ☐

Bb ☐

bb ☐

4.6.1.6 Genetic inheritance

Question 15 · continued

4 (b) (ii) Person **3** married a woman with brown hair.

Figure 5 shows how hair colour could be inherited by their children.

Figure 5

	Woman Brown hair: B	**Woman** Brown hair: b
Person 3 Red hair: b	Bb	
Person 3 Red hair: b		

Complete **Figure 5** to show the combination of alleles that the children would inherit.
One has been done for you.

[2 marks]

4 (b) (iii) What is the probability that one of the children would have red hair?

[1 mark]

Tick (✓) **one** box.

1 in 2 ☐

1 in 3 ☐

1 in 4 ☐

5

4.6.1.6 Genetic inheritance

Question 16

June 2017 | BL2FP | Original Q4 | Legacy

4 Alkaptonuria (AKU) is a rare, inherited condition.

4 (a) The allele that causes AKU is on chromosome number 3.

4 (a) (i) How many chromosomes are there in most human cells?

[1 mark]

Draw a ring around the correct answer.

23 **24** **46** **48**

4 (a) (ii) The allele for AKU is recessive.

What is a recessive allele?

[1 mark]

Tick (✓) **one** box.

An allele that causes a genetic disorder. ☐

An allele that shows its effect only if the dominant allele is not present. ☐

An allele that shows its effect when only one chromosome carries it. ☐

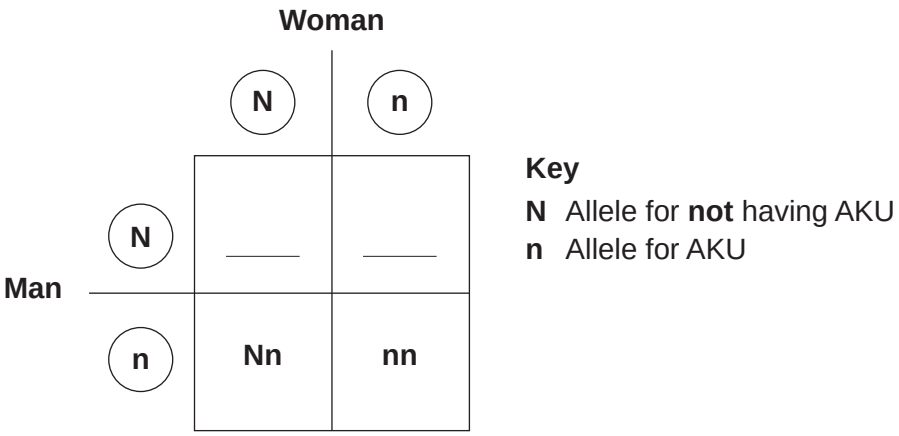
4.6.1.6 Genetic inheritance

Question 16 · continued

4 (b) Two parents, who do **not** have AKU, have a child with AKU.

Figure 4 shows how this can happen.

Figure 4



4 (b) (i) **Figure 4** is incomplete.

Complete **Figure 4** to show the missing combinations of alleles.

[2 marks]

Write the correct letters in the **two** empty boxes.

4 (b) (ii) Draw a ring around **one** pair of alleles in **Figure 4** to show a child with AKU.

[1 mark]

4 (b) (iii) The man and woman in **Figure 4** want to have another child.

What is the chance that their next child will have AKU?

[1 mark]

Draw a ring around the correct answer.

0 in 4 **1 in 4** **2 in 4** **3 in 4**

6

4.6.1.6 Genetic inheritance

Question 17

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 ☐

4.6.1.6 Genetic inheritance

Question 17 · 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

4.6.1.6 Genetic inheritance

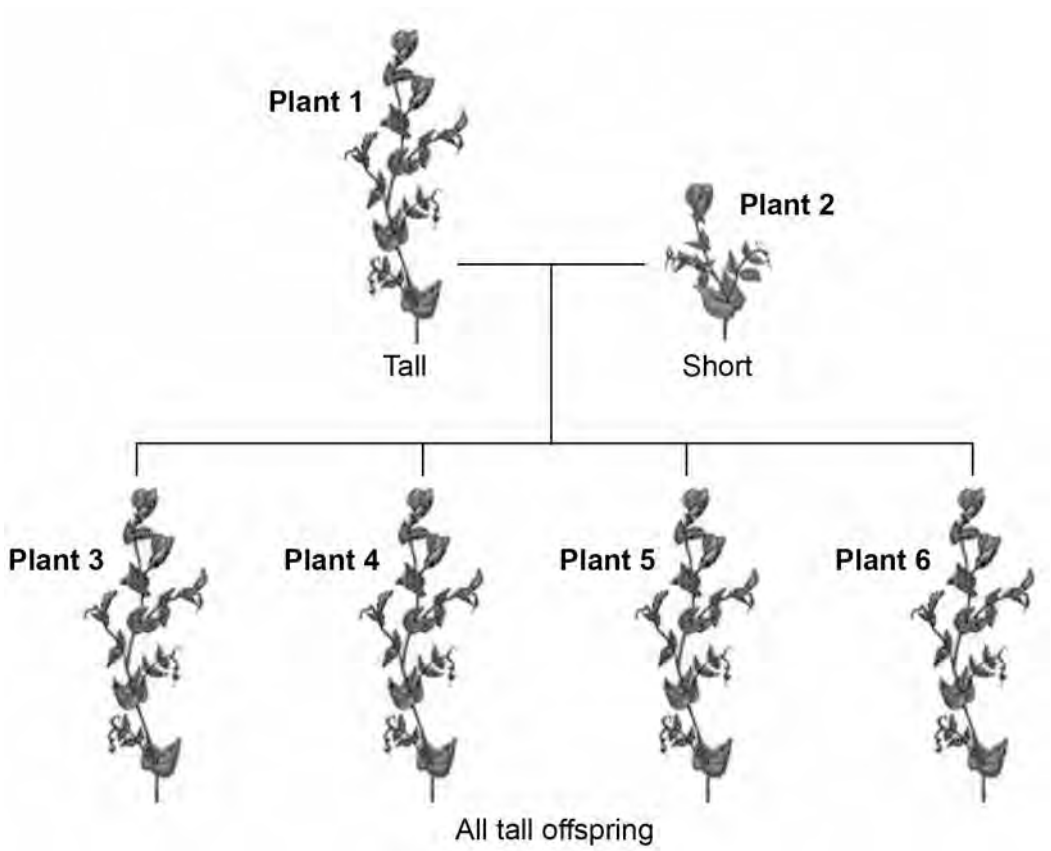
Question 17 · continued

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



4.6.1.6 Genetic inheritance

Question 17 · 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

4.6.1.6 Genetic inheritance

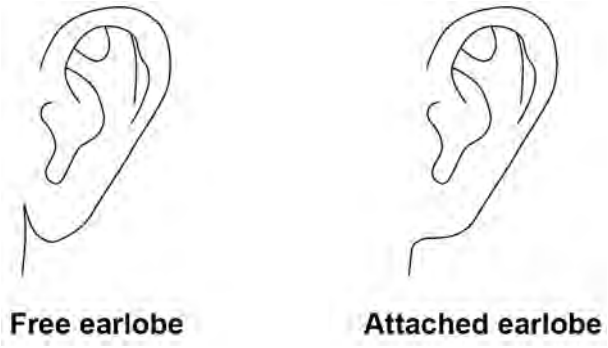
Question 18

June 2019 | 8461/2F | Original Q2

0 2 The shape of a person's earlobes is controlled by a gene.

Figure 3 shows two types of earlobe.

Figure 3



A dominant allele codes for free earlobes.

0 2 . 1 What is a dominant allele?

[1 mark]

Tick (✓) **one** box.

- An allele expressed even if a person only has one copy of the allele ☐
- An allele expressed only if a person has two copies of the allele ☐
- An allele expressed only if a person has no recessive allele ☐
- An allele expressed only if it is inherited from the male parent ☐

Question 2 continues on the next page

Question 18 · continued

0 2 . 2 A man with free earlobes and a woman with attached earlobes have children together.

Complete **Figure 4** to show the possible genotypes of the children.

Use the symbols:

E = allele for free earlobes
e = allele for attached earlobes

[2 marks]

Figure 4

Woman

Man		**e**	**e**
	E	**Ee**	
	e		

0 2 . 3 What is the probability that one of the children would have attached earlobes?

Use **Figure 4**.

[1 mark]

Tick (✓) **one** box.

0.125 ☐ 0.25 ☐ 0.5 ☐ 0.75 ☐

4.6.1.6 Genetic inheritance

Question 18 · continued

0 2 . 4 **Figure 5** shows the inheritance of the sex chromosomes, **X** and **Y**.

Complete **Figure 5** to show the sex chromosomes in the gametes of the man and the woman.

[2 marks]

Figure 5

		Woman	
Man		**XX**	**XX**
		XY	**XY**

0 2 . 5 Calculate the probability that the man and the woman's next child will be a girl with attached earlobes.

[2 marks]

Use the equation:

probability of a girl with attached earlobes

= probability of attached earlobes × probability of being a girl

Probability of a girl with attached earlobes = _____

8

4.6.1.6 Genetic inheritance

Question 19

November 2020 | 8461/2F | Original Q3

0 3 Sperm cells and egg cells are formed by meiosis.

0 3 . 1 During meiosis a cell divides twice.

How many sperm cells are formed when a cell divides by meiosis?

[1 mark]

0 3 . 2 Human body cells contain 46 chromosomes.

How many chromosomes are in each human egg cell?

[1 mark]

4.6.1.6 Genetic inheritance

Question 19 · continued

Dupuytren's is a disorder that affects the hands.

One form of Dupuytren's is caused by a dominant allele (**D**).

The allele for **not** having Dupuytren's is recessive (**d**).

0 3 . 3 What is an allele?

[1 mark]

Tick (✓) **one** box.

- A different form of a chromosome ☐
- A different form of a gamete ☐
- A different form of a gene ☐

0 3 . 4 A man with Dupuytren's has the genotype **Dd**.

Which word describes the man's genotype?

[1 mark]

Tick (✓) **one** box.

- Heterozygous ☐
- Homozygous ☐
- Phenotype ☐

Question 3 continues on the next page

Question 19 · continued

The man with Dupuytren's (**Dd**) and a woman who does **not** have Dupuytren's (**dd**) plan to have a child.

0 3 . 5 Complete the genetic diagram in **Figure 4** to show the possible genotypes of the child.

[2 marks]

Figure 4

		Woman	
		d	**d**
Man	**D**	Dd	
	d		

0 3 . 6 Draw a ring around the genotype of a child in **Figure 4** who will have Dupuytren's.

[1 mark]

0 3 . 7 What is the chance of the child having Dupuytren's?

[1 mark]

Tick (✓) **one** box.

25% ☐ 50% ☐ 75% ☐ 100% ☐

4.6.1.6 Genetic inheritance

Question 19 · continued

0 3 . 8 A genetic disorder develops as a result of a change in a gene.

What scientific term describes a change in a gene?

[1 mark]

0 3 . 9 People with a family history of some genetic disorders are offered embryo screening.

Suggest **one** way embryo screening can help people with a family history of a genetic disorder.

[1 mark]

10

Turn over for the next question

4.6.1.6 Genetic inheritance

Question 20

November 2020 | 8461/2F | Original Q7

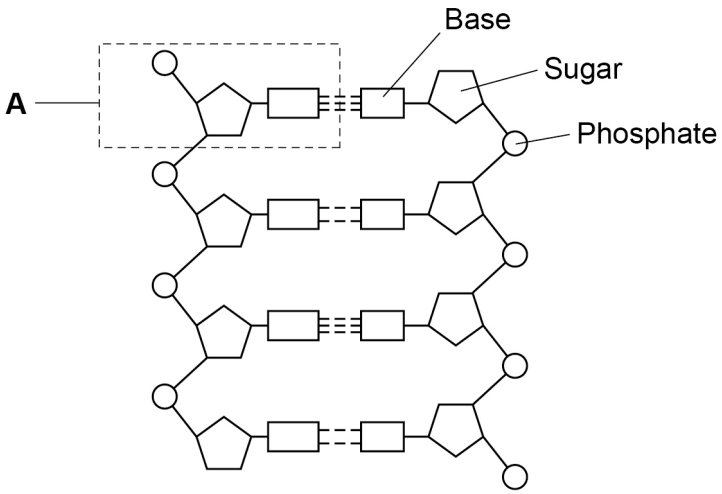
0 7 This question is about DNA.

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 ☐

4.6.1.6 Genetic inheritance

Question 20 · continued

November 2020 | 8461/2F | Original Q7

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

Question 20 · 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

4.6.1.6 Genetic inheritance

Question 21

November 2021 | 8461/2F | Original Q5

0 5 Potato blight is a disease of potato plants.

Potato blight is caused by the fungus *Phytophthora infestans.*

0 5 . 1 What is the genus of the fungus that causes potato blight?

[1 mark]

Tick (✓) **one** box.

infestans ☐

Phytophthora ☐

Phytophthora infestans ☐

0 5 . 2 The fungus grows near the surface of the potato.

How does growing near the surface help the fungus to respire?

[1 mark]

Tick (✓) **one** box.

The fungus can get nitrogen from the soil. ☐

The fungus can get oxygen from the air. ☐

The fungus can get water from the potato. ☐

Question 5 continues on the next page

Question 21 · continued

A farmer sprays his potato plants with a pesticide.

The pesticide kills the fungus that causes potato blight.

Spraying the crop with a pesticide could decrease biodiversity in a river flowing through his farm.

0 5 . 3 What does 'biodiversity in a river' mean?

[1 mark]

Tick (✓) **one** box.

- The variety of species of animals in the river. ☐
- The variety of species of organisms in the river. ☐
- The variety of species of plants in the river. ☐

0 5 . 4 The farmer sprayed pesticide on his potato plants. The next day it rained heavily.

Explain why the biodiversity in the river decreased.

[2 marks]

Another method of preventing potato blight is to breed potatoes that are resistant to blight.

Resistance to potato blight is controlled by two alleles:

R = a dominant allele for having resistance to blight.

r = a recessive allele for **not** having resistance to blight.

A scientist crosses two potato plants. Each plant has the genotype **Rr**.

4.6.1.6 Genetic inheritance

Question 21 · continued

0 5 . 5 Complete **Figure 9** to show the possible genotypes of the offspring produced.

[2 marks]

Figure 9

		Male gametes: R	Male gametes: r
Female gametes	R	RR	
Female gametes	r		

0 5 . 6 Draw a ring around **one** of the homozygous genotypes in **Figure 9**.

[1 mark]

0 5 . 7 What percentage of the offspring in **Figure 9** will be resistant to potato blight?

[1 mark]

Tick (✓) **one** box.

25% ☐ 50% ☐ 75% ☐ 100% ☐

0 5 . 8 Potatoes can also reproduce asexually.

Potatoes from one plant can be planted in the ground to produce new potato plants.

All the new plants from a parent plant that is resistant to blight will also be resistant to blight.

Explain why.

[2 marks]

11

4.6.1.6 Genetic inheritance

Question 22

June 2022 | 8461/2F | Original Q1

0 1 Maple syrup urine disease (MSUD) is a rare inherited human condition.

The allele for MSUD is recessive.

0 1 . 1 What is a recessive allele?

[1 mark]

Tick (✓) **one** box.

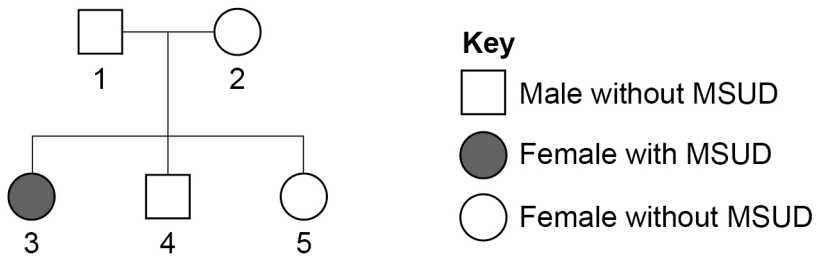
An allele expressed only if a person has two copies of the allele ☐

An allele expressed only if it is inherited from the male parent ☐

An allele expressed when it is found on only one of the chromosomes ☐

Figure 1 shows the inheritance of MSUD in one family.

Figure 1



0 1 . 2 The symbol ■ is **not** in the key for **Figure 1**.

What would this symbol represent?

[1 mark]

_____

Question 22 · continued

Persons **1** and **2** in **Figure 1** have a child with MSUD and some children without MSUD.

0 1 . 3 Complete **Figure 2** to show the possible genotypes of the children.

Use the following symbols:

N = allele for **not** having MSUD
n = allele for MSUD

[2 marks]

Figure 2

		Person 2	
		N	**n**
Person 1	**N**		**Nn**
	n		

0 1 . 4 What is the phenotype of a person with the genotype **Nn**?

[1 mark]

0 1 . 5 What percentage of the offspring in **Figure 2** will have MSUD?

[1 mark]

Tick (✓) **one** box.

25% ☐ 50% ☐ 75% ☐ 100% ☐

Question 1 continues on the next page

4.6.1.6 Genetic inheritance

Question 22 · continued

0 1 . 6 Which scientific term describes the allele **N**?

[1 mark]

Tick (✓) **one** box.

- Dominant ☐
- Genetic ☐
- Heterozygous ☐

0 1 . 7 Alleles are found in the nucleus of a cell.

What chemical substance are alleles made from?

[1 mark]

_____

0 1 . 8 People with MSUD must eat a special diet to reduce their intake of some types of amino acid.

Which component of the diet is made of amino acids?

[1 mark]

Tick (✓) **one** box.

- Carbohydrates ☐
- Minerals ☐
- Proteins ☐

9

4.6.1.6 Genetic inheritance

Question 23

June 2023 | 8461/2F | Original Q9

0 9 Reproduction can produce offspring which are:

- genetically different

  or

- genetically identical.

Farmers grow tomato plants in greenhouses.

The tomatoes are sold in supermarkets.

0 9 . 1 Suggest **one** advantage of growing tomato plants that are genetically different.

[1 mark]

0 9 . 2 Suggest **one** advantage of growing tomato plants that are genetically identical.

[1 mark]

0 9 . 3 Scientists can grow genetically identical tomato plants using tissue culture.

What is tissue culture?

[1 mark]

0 9 . 4 Genetically identical tomato plants growing in the same garden do **not** all grow to the same height.

Give **one** reason why.

[1 mark]

Question 23 · continued

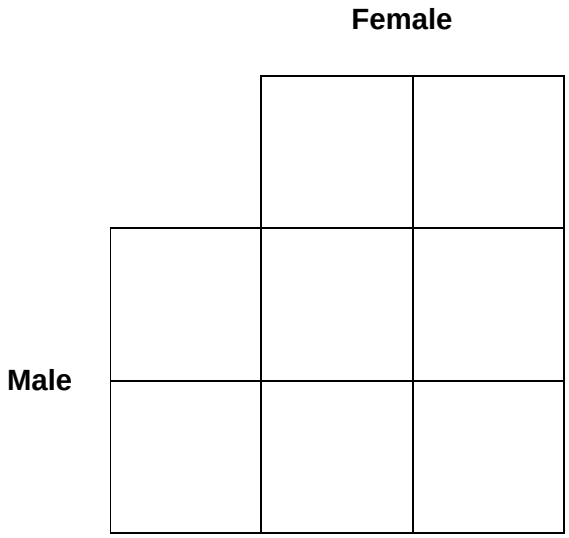
The sex of dogs is determined by **X** and **Y** chromosomes in the same way as in humans.

0 9 . 5 Complete the Punnett square diagram in **Figure 15** to show the inheritance of sex in dogs.

Use the symbols **X** and **Y**.

[3 marks]

Figure 15



0 9 . 6 A female dog gave birth to six offspring.

Why would you expect there to be three male offspring and three female offspring?

Use your answer to Question **09.5**.

[1 mark]

Question 9 continues on the next page

Question 23 · continued

Farmers keep chickens for:

- meat production
- egg production.

Some varieties of chicken grow more quickly and are more suitable for meat production.

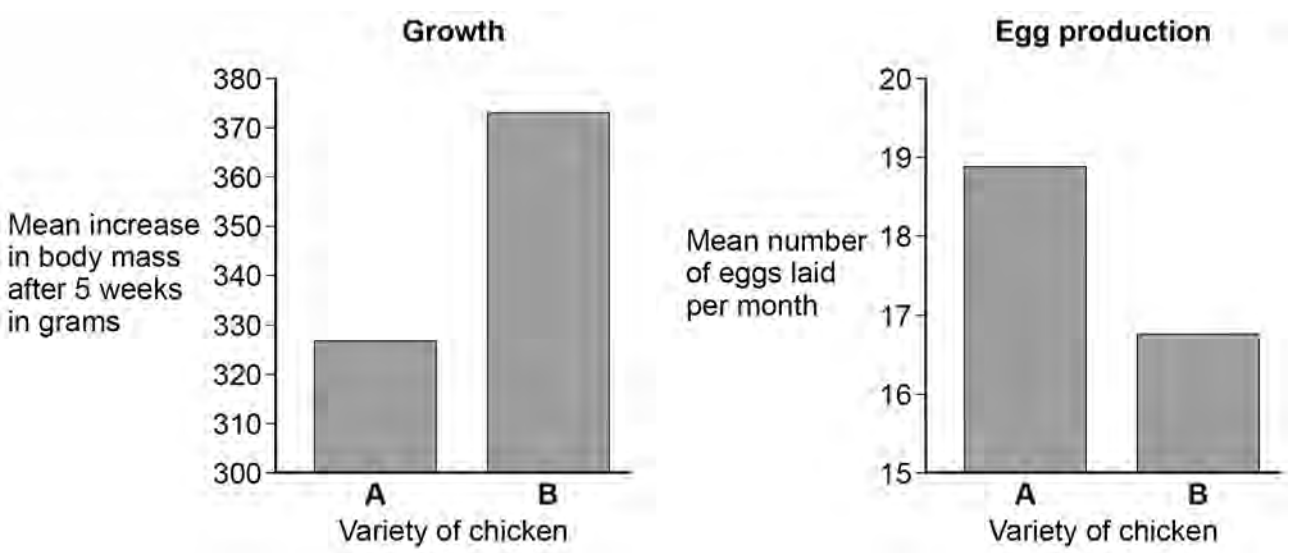
Other varieties of chicken produce more eggs.

A farmer keeps two varieties of chicken, **A** and **B**.

The farmer investigated the growth rates and egg-production rates of both varieties.

Figure 16 shows the results.

Figure 16



0 9 . 7 Suggest **two** control variables the farmer should have used in this investigation.

[2 marks]

1 _____

_____

2 _____

_____

4.6.1.6 Genetic inheritance

Question 23 · continued

0 9 . 8 **Figure 16** shows mean values from 500 chickens of each variety.

Give the reason the farmer used a large number of chickens.

[1 mark]

0 9 . 9 The farmer wants to produce a new variety of chicken that is good for **both** meat production **and** egg production.

Describe how selective breeding of chicken varieties **A** and **B** can produce the new variety of chicken.

[4 marks]

15

4.6.1.6 Genetic inheritance

Question 24

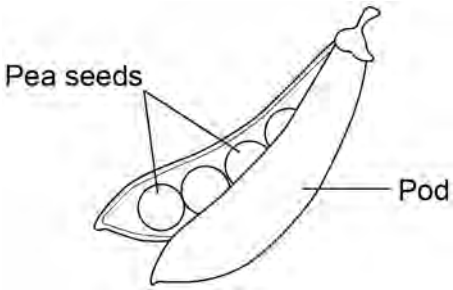
0 8

In 1866, a monk called Gregor Mendel published the results of his investigations into inheritance in pea plants.

Pea plants produce seeds in a pod.

Figure 9 shows a pea pod.

Figure 9

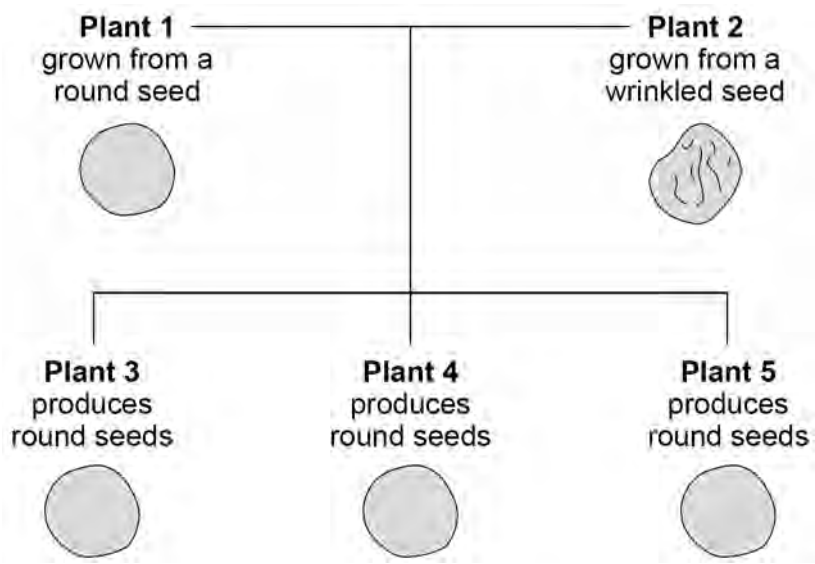


Pea seeds can be round or wrinkled in shape.

Mendel crossed pea plants that produced round seeds with pea plants that produced wrinkled seeds.

Figure 10 shows the results.

Figure 10



Question 24 · continued

In questions **08.1** to **08.3** use the following symbols to represent the alleles:

R = dominant allele for round seeds

r = recessive allele for wrinkled seeds.

0 8 . 1 In **Figure 10**, the genotype of plant **1** is **RR**.

Give the genotype of plant **2**.

[1 mark]

_____

Mendel collected the seeds from plants **3** and **4** and grew new plants from the seeds.

Mendel crossed the new plants.

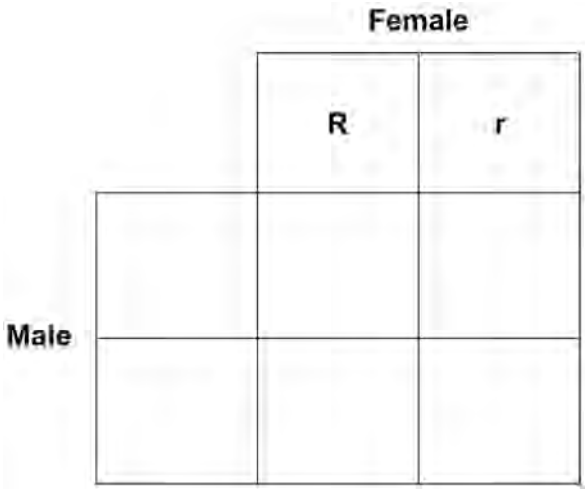
0 8 . 2 Complete the Punnett square diagram in **Figure 11**.

You should show:

- the male gametes
- the offspring genotypes.

[3 marks]

Figure 11



0 8 . 3 Give the ratio of round seeds to wrinkled seeds in the offspring in **Figure 11**.

[1 mark]

Ratio of round seeds to wrinkled seeds = _____ : _____

4.6.1.6 Genetic inheritance

Question 24 · continued

0 8 . 4 Some of the offspring in **Figure 11** are homozygous and some are heterozygous.

What does 'heterozygous' mean?

[1 mark]

0 8 . 5 Mendel published his work in 1866.

Suggest **two** reasons why the importance of Mendel's work was **not** recognised until the early 1900s.

[2 marks]

1

2

8

4.6.1.6 Genetic inheritance

Question 25

0 1 Some people keep rabbits as pets.

Figure 1 shows two types of rabbit.

Figure 1



Himalayan rabbit
has black patches



White rabbit
has no black patches

The fur colour pattern in the Himalayan rabbit is caused by a dominant allele.

0 1 . 1 What is a dominant allele?

[1 mark]

Tick (✓) **one** box.

An allele expressed only if a rabbit has two copies of the allele ☐

An allele expressed only if it is inherited from the male rabbit ☐

An allele expressed when a rabbit has only one copy of the allele ☐

Question 1 continues on the next page

Question 25 · continued

In Questions **01.2** and **01.3**, use the following symbols:

H = dominant allele for Himalayan fur pattern

h = recessive allele for white fur.

0 1 . 2 What is the genotype of a white rabbit?

[1 mark]

Tick (✓) **one** box.

HH ☐ **Hh** ☐ **hh** ☐

A male Himalayan rabbit was crossed with a female Himalayan rabbit.

The male rabbit and the female rabbit each had the heterozygous genotype **Hh**.

Some of the offspring were Himalayan rabbits and some of the offspring were white rabbits.

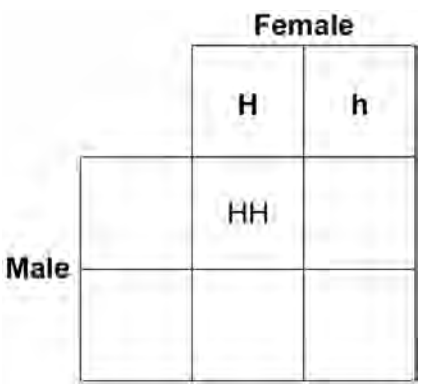
0 1 . 3 Complete the Punnett square diagram in **Figure 2**.

You should show:

- the male gametes
- the offspring genotypes.

[3 marks]

Figure 2



Question 25 · continued

0 1 . 4 Some of the offspring in **Figure 2** are homozygous and some are heterozygous.

Draw a ring around the genotype of **one homozygous** offspring in **Figure 2**.

[1 mark]

0 1 . 5 Four offspring were born.

How many of the four offspring would you expect to be Himalayan rabbits?

Use **Figure 2**.

[1 mark]

Tick (✓) **one** box.

1 ☐ 2 ☐ 3 ☐ 4 ☐

0 1 . 6 Inheritance of sex in rabbits is the same as inheritance of sex in humans.

A female rabbit has two X chromosomes in each body cell.

How many X chromosomes does a male rabbit have in each body cell?

[1 mark]

Tick (✓) **one** box.

0 ☐ 1 ☐ 2 ☐

0 1 . 7 Some of the offspring in **Figure 2** would be male and some of the offspring would be female.

How many of the four offspring in Question **01.5** would you predict to be female?

[1 mark]

9