

(Genetic inheritance (alleles, Punnett squares, genetic crosses, family trees))

Q1.(2018)

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.

What is the name of this scientist?

[1 mark]

Tick **one** box.

Alfred Russel Wallace

☐

Charles Darwin

☐

Gregor Mendel

☐

Jean-Baptiste Lamarck

☐

Q2.(2018)

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

☐

Q3.(2018)

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

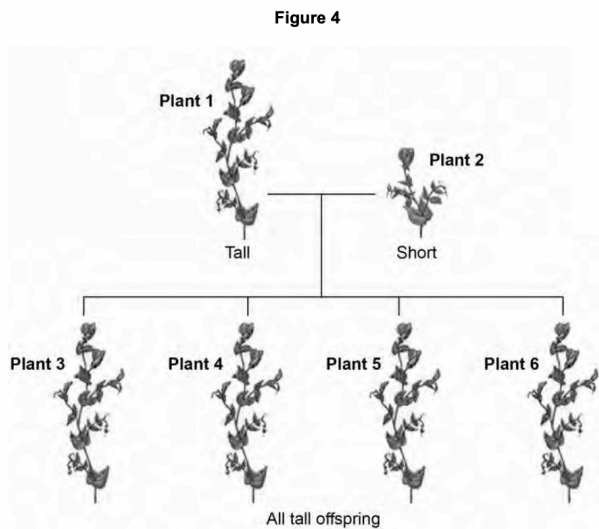
☐

Q4.a)(2018)

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.



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.

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

Give the genotype of plant 2.

[1 mark]

Q4.b)(2018)

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	t
Female gametes	T	TT	
	t		

Q4.c)(2018)

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

[1 mark]

Q4.d)(2018)

What is the ratio of tall plants : short plants in the offspring in **Figure 5**?

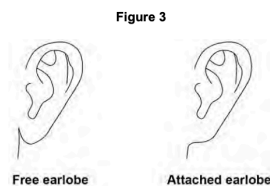
[1 mark]

Ratio of tall plants : short plants = _____ :

Q5.a)(2019)

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

Figure 3 shows two types of earlobe.



A dominant allele codes for free earlobes.

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

☐

Q5.b)(2019)

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	
		e	e
Man	E	Ee	
	e		

Q5.c)(2019)

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 ☐

Q6.(2020)

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**).

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

☐

Q7.(2020)

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

Which word describes the man's genotype?

[1 mark]

Tick (✓) **one** box.

Heterozygous

☐

Homozygous

☐

Phenotype

☐

Q8.a)(2020)

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

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

[2 marks]

Q8.b)(2020)

Figure 4

		Woman	
		d	d
Man	D	Dd	
	d		

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

[1 mark]

Q8.c)(2020)

What is the chance of the child having Dupuytren's?

[1 mark]

Tick (✓) **one** box.

25% ☐ 50% ☐ 75% ☐ 100% ☐

Q9.(2022)

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

The allele for MSUD is recessive.

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

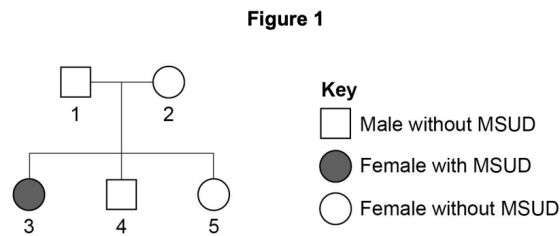
☐

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

☐

Q10.a)(2022)

Figure 1 shows the inheritance of MSUD in one family.



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

What would this symbol represent?

[1 mark]

Q10.b)(2022)

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

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		

Q10.c)(2022)

What is the phenotype of a person with the genotype **Nn**?

[1 mark]

Q10.d)(2022)

What percentage of the offspring in **Figure 2** will have MSUD?

[1 mark]

Tick (✓) **one** box.

25% ☐ 50% ☐ 75% ☐ 100% ☐

Q10.e)(2022)

Which scientific term describes the allele **N**?

[1 mark]

Tick (✓) **one** box.

Dominant ☐
Genetic ☐
Heterozygous ☐

Q10.f)(2022)

Alleles are found in the nucleus of a cell.

What chemical substance are alleles made from?

[1 mark]

Q10.g)(2022)

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 ☐

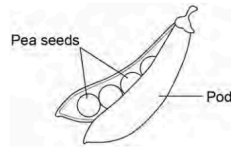
Q11.a)(2024)

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

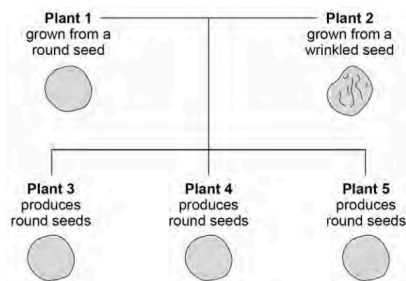


Pea seeds can be round or wrinkled in shape.

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

Figure 10 shows the results.

Figure 10



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.

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

Give the genotype of plant 2.

[1 mark]

Q11.b)(2024)

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

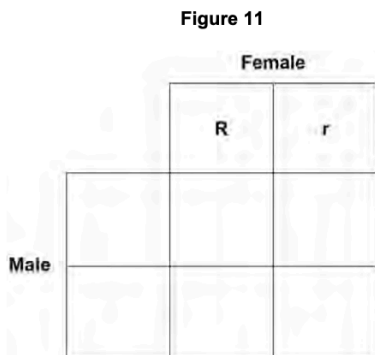
Mendel crossed the new plants.

Complete the Punnett square diagram in **Figure 11**.

You should show:

- the male gametes
- the offspring genotypes.

[3 marks]



Q11.c)(2024)

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

[1 mark]

Ratio of round seeds to wrinkled seeds = _____ : _____

Q11.d)(2024)

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

What does 'heterozygous' mean?

[1 mark]

Q11.e)(2024)

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 _____
