**Questions are for both separate science and combined science students**

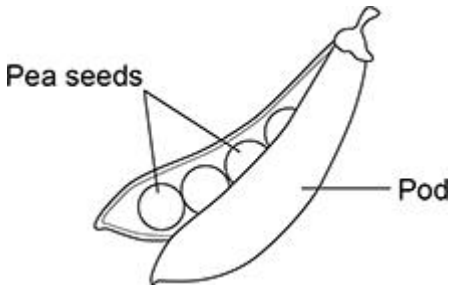
## Q1.

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 1** shows a pea pod.

**Figure 1**

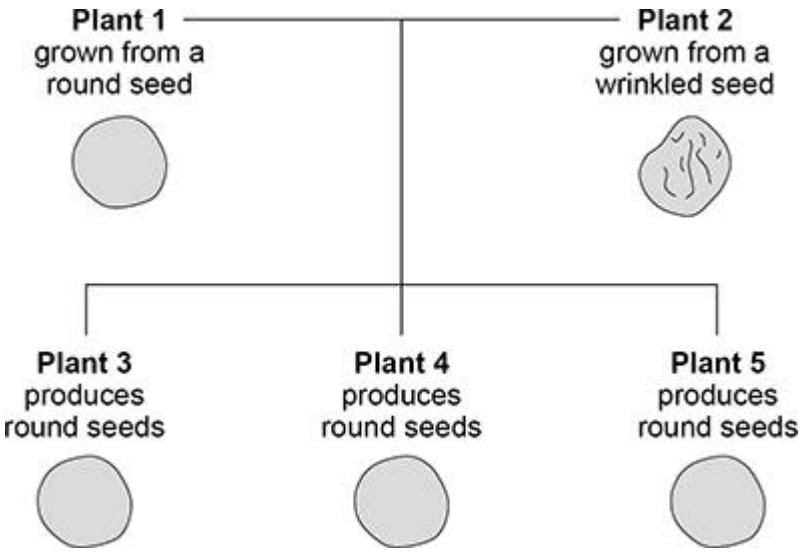



Pea seeds can be round or wrinkled in shape.

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

**Figure 2** shows the results.

**Figure 2**




In parts (a) to (c) use the following symbols to represent the alleles:

**R** = dominant allele for round seeds

**r** = recessive allele for wrinkled seeds.

(a) In **Figure 2**, the genotype of plant **1** is **RR**.

Give the genotype of plant **2**.

_____

**(1)**

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

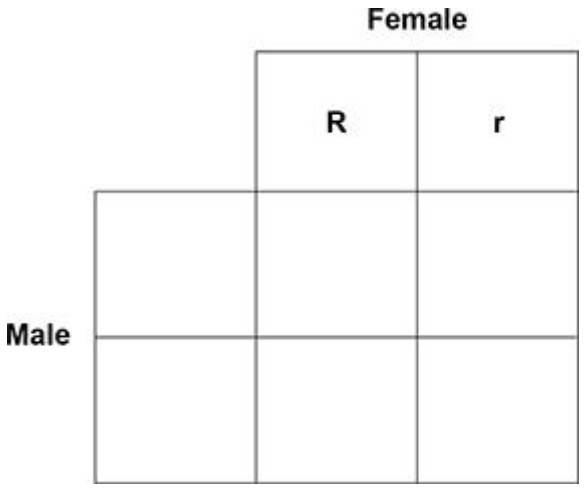
Mendel crossed the new plants.

(b) Complete the Punnett square diagram in **Figure 3**.

You should show:

- the male gametes
- the offspring genotypes.

**Figure 3**




**(3)**

(c) Give the ratio of round seeds to wrinkled seeds in the offspring in **Figure 3**.

Ratio of round seeds to wrinkled seeds = _____ : _____

**(1)**

(d) Some of the offspring in **Figure 3** are homozygous and some are heterozygous.

What does 'heterozygous' mean?

_____

_____

**(1)**

(e) Mendel published his work in 1866.

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

1 _____

_____

2 _____

_____

**(2)**

**(Total 8 marks)**

## Q2.

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

The allele for MSUD is recessive.

(a) What is a recessive allele?

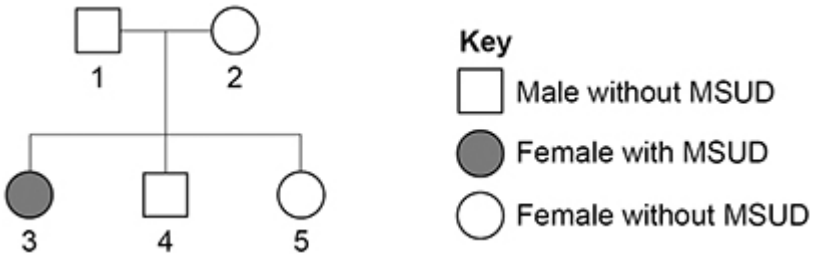
Tick (✓) **one** box.

| | |
|---|---|
| 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 | ☐ |

**(1)**

**Figure 1** shows the inheritance of MSUD in one family.

**Figure 1**




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

What would this symbol represent?

_____

**(1)**

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

(c) 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)**

**Figure 2**

| | | Person 2 | |
|---|---|---|---|
| | | **N** | **n** |
| Person 1 | **N** | | **Nn** |
| | **n** | | |

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

_____

**(1)**

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

Tick (✓) **one** box.

25% ☐ 50% ☐ 75% ☐ 100% ☐

**(1)**

(f) Which scientific term describes the allele **N**?

Tick (✓) **one** box.

Dominant ☐

Genetic ☐

Heterozygous ☐

**(1)**

(g) Alleles are found in the nucleus of a cell.

What chemical substance are alleles made from?

_____

**(1)**

(h) 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?

Tick (✓) **one** box.

Carbohydrates ☐

Minerals ☐

Proteins ☐

**(1)**

**(Total 9 marks)**

## Q3.

There are two types of reproduction:

- sexual reproduction
- asexual reproduction.

(a) Complete below table to compare sexual reproduction with asexual reproduction.

Write a tick (✓) in the box if the statement is true.

The first row has been completed for you.

| | **Sexual reproduction** | **Asexual reproduction** |
|---|---|---|
| Cell division occurs | ✓ | ✓ |
| Fertilisation occurs | | |
| Genes are passed on from parent to offspring | | |
| Offspring are genetically identical to each other | | |

**(2)**

(b) Gametes are formed in sexual reproduction.

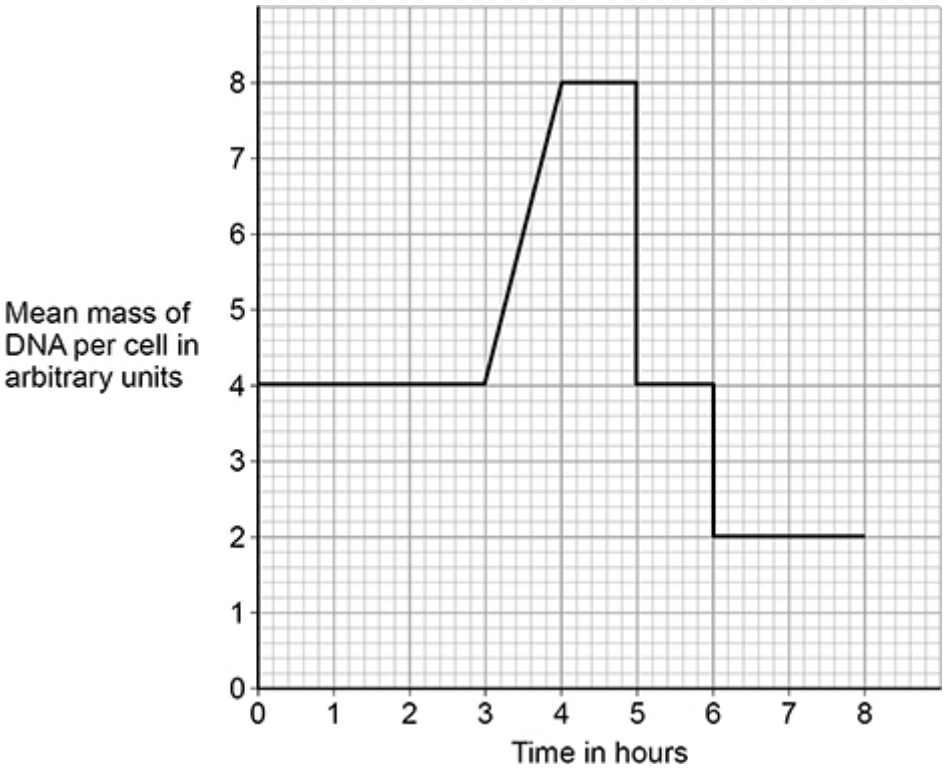
Name the male gamete formed in flowering plants.

_____

**(1)**

Cell division by meiosis forms gametes.

The figure below shows the mean mass of DNA per cell before, during and after meiosis.




Use information from the figure above to answer part (c) to (f).

(c) When is the DNA in the chromosomes being copied?

Tick (✓) **one** box.

Between 0 and 3 hours ☐

Between 3 and 4 hours ☐

Between 4 and 5 hours ☐

Between 5 and 6 hours ☐

**(1)**

(d) Cells divide twice during meiosis.

Which **two** times in above graph show one cell dividing into two cells?

Tick (✓) **two** boxes.

3 hours ☐

4 hours ☐

5 hours ☐

6 hours ☐

8 hours ☐

**(2)**

(e) What is the mean mass of DNA in arbitrary units in a sperm cell?

Tick (✓) **one** box.

2 ☐ 4 ☐ 8 ☐ 16 ☐

**(1)**

(f) What is the mean mass of DNA in arbitrary units in each cell in an embryo?

Tick (✓) **one** box.

2 ☐ 4 ☐ 8 ☐ 16 ☐

**(1)**

**(Total 8 marks)**