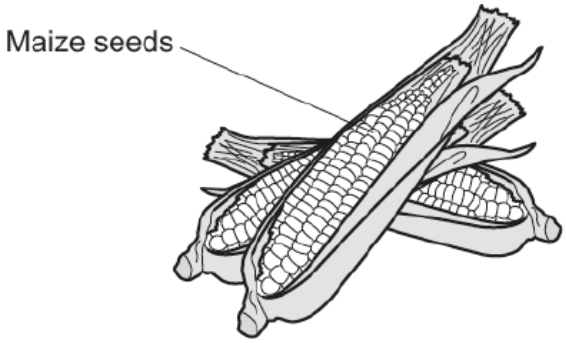
You and your genes – 2022 GCSE 21st Biology Combined Science B

1. June/2022/Paper_J260/05/No.4

Maize is an important food crop.



Folic acid helps the body to make healthy red blood cells, and is found in certain foods.
However, maize seeds do not provide people with enough folic acid.

(a) Beans have high levels of folic acid.

Scientists want to genetically engineer maize to produce more folic acid by using genes from beans.

(i) Describe why this is an example of genetic engineering.

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..... **[1]**

(ii) Describe the main steps in the process of genetically engineering the maize.

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.....

.....

..... **[3]**

(b) Suggest the next step that the scientists should take to investigate whether the modified maize could improve people's diets.

.....

..... **[1]**

(c) Suggest **one** benefit and **one** possible risk of genetically engineering maize in this way.

Benefit .....

.....

Risk .....

.....

[2]

2. June/2022/Paper_J260/05/No.5

Scientists think that two species of a plant called small cordgrass and smooth cordgrass bred to produce a new species called Townsend's cordgrass.

(a) **Fig. 5.1** shows the number of chromosomes in the cells of three species of cordgrass.

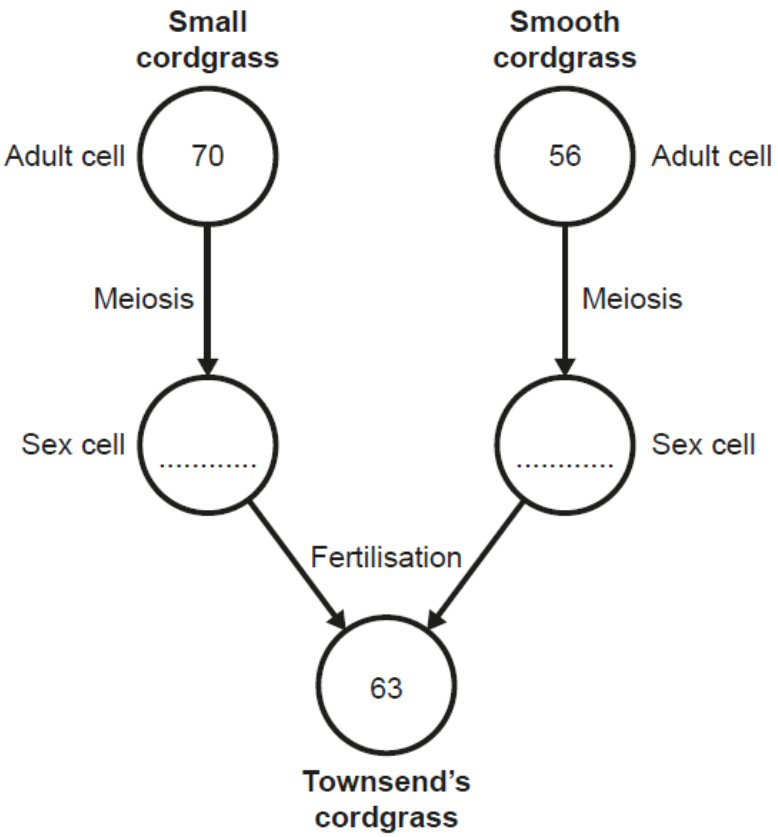

Fig. 5.1

(i) Complete **Fig. 5.1** by writing in the number of chromosomes that would be found in each **sex cell**. **[1]**

(ii) Explain why **Fig. 5.1** supports the idea that Townsend's cordgrass is produced when small and smooth cordgrass are bred.

.....

.....

.....

..... **[2]**

(b) Another species called common cordgrass has evolved.

A survey in Ireland found common cordgrass in 156 of 200 salt marshes.

Calculate the percentage of salt marshes with common cordgrass found in Ireland.

Percentage = ... % **[2]**

(c) In Ireland it is considered an invasive species which reduces biodiversity.

Define biodiversity.

.....

..... **[1]**

(d) Common cordgrass:
- reduces the populations of native salt marsh plants
- grows over open mudflats where birds feed.

Common cordgrass can be removed by:
- digging it up by hand
- use of poisonous chemicals.

Explain the benefits **and** challenges of maintaining the biodiversity of Irish salt marshes.

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..... **[3]**

(e) **Fig. 5.2** is a flow diagram showing stages in an organism's development after fertilisation.

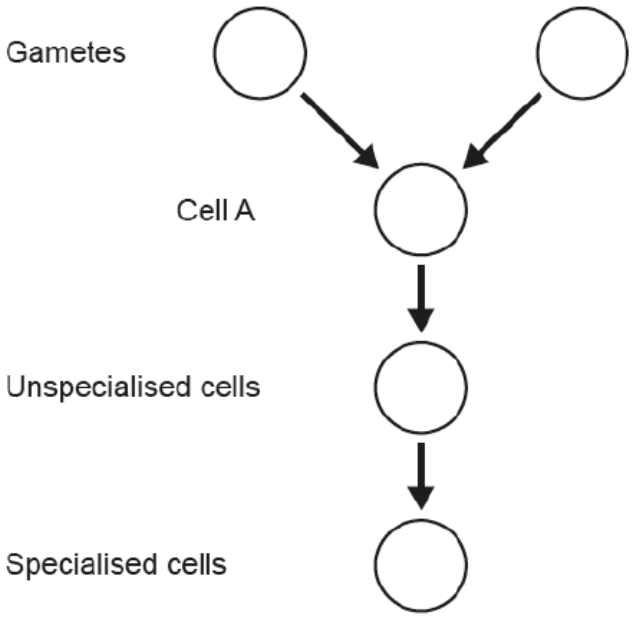

Fig. 5.2

(i) What is the scientific name for cell **A**?

Tick (✓) **one** box.

Egg ☐

Nucleus ☐

Sperm ☐

Zygote ☐

[1]

(ii) Label an **X** on **Fig. 5.2** to show where the process of differentiation occurs. **[1]**

(iii) Which cells in **Fig. 5.2** will be genetically identical?

Tick (✓) **one** box.

All of the cells. ☐

All of the cells **except** the two gametes. ☐

Cell **A** and the unspecialised cells. ☐

Just the two gametes. ☐

[1]

3. June/2022/Paper_J260/05/No.8

Humans have a gene that instructs cells how to make an enzyme called lactase.

(a) Mutations can happen in the lactase gene.

Give **two** reasons why most of these mutations will have no effect on the lactase protein.

1 .....

.....

2 .....

.....

[2]

(b) The probability of someone having the lactase mutation is 0.3.

In 2021 the human adult world population was estimated to be 5.85 billion.

Calculate the number of people **without** the mutation in 2021.

Number of people = ... billion **[3]**

(c) The enzyme lactase allows humans to digest milk.

Approximately 10 000 years ago:

- the lactase gene in most humans was switched on when they were a baby but then switched off permanently after that
- some humans had a mutation that caused the lactase gene to remain switched on
- humans started farming animals for milk.

Now, many humans have the mutation that causes the lactase gene to remain switched on.

Describe the evidence that suggests the spread of this mutation was an example of evolution by natural selection.

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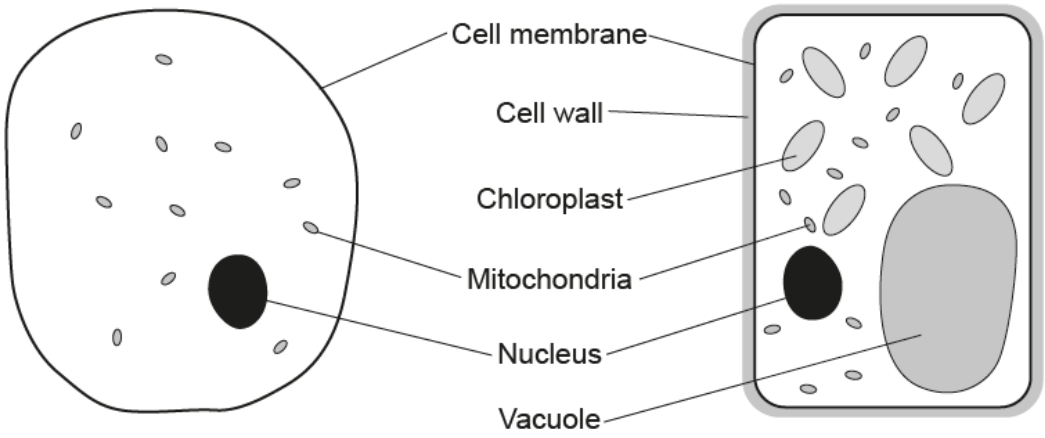
..... **[2]**

4. June/2022/Paper_J260/01/No.1

The diagram shows two cells.



Cell A **Cell B**

(a) State **two** pieces of evidence from the diagram that show that cell **B** is a plant cell.

1 .....

2 .....

[2]

(b) Which structure stores the genetic material in an animal cell?

Put a (ring) around the correct answer.

Cell membrane **Cell wall** **Nucleus** **Vacuole**

[1]

(c) Complete the sentences to describe the genetic material.

Use words from the list.

alleles	**chromosomes**	**DNA**	**helix**	**lipids**	**nucleotides**	**protein**

In a human body cell, the genetic material is stored as 46 structures called

..... .

Each of these 46 structures is a long molecule of ..... .

These molecules have a double ..... structure and are polymers made from ..... .

[4]

5. June/2022/Paper_J260/01/No.8

(a) The cell cycle has two phases, interphase and mitosis.

The table describes events in the cell cycle.

Complete the table to show if each event occurs in interphase or mitosis.

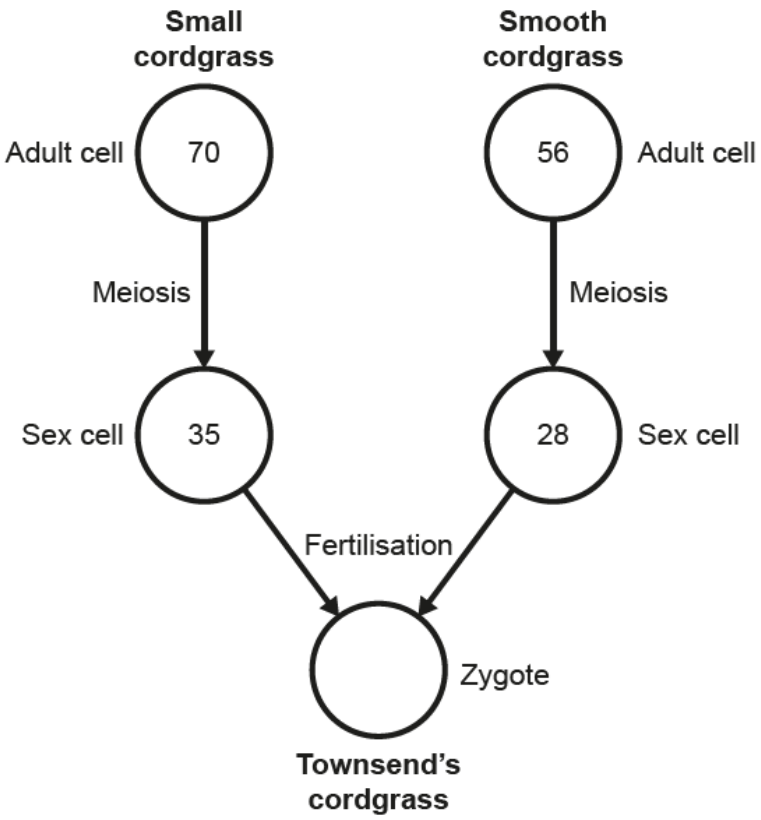
Tick (✓) **one** box in each row.

Event	Interphase	Mitosis
The cell grows larger.		
Chromosomes are copied.		
Chromosomes divide.		
More organelles form.		
The nucleus divides.		

[4]

(b) Two species of a plant called small cordgrass and smooth cordgrass are bred to produce a new species called Townsend's cordgrass.

The diagram shows the number of chromosomes in the cells of small cordgrass and smooth cordgrass.



(i) After meiosis, the number of chromosomes in the cordgrass sex cells is half the number in the adult cells.

Why is this important?

.....

..... **[1]**

(ii) How many chromosomes will be in the Townsend's cordgrass zygote?

Put a (ring) around the correct answer.

28 **35** **56** **63** **70**

[1]

(iii) The zygote will enter the cell cycle to form an adult Townsend's cordgrass plant.

How many chromosomes will each adult cell have?

Put a (ring) around the correct answer.

28 **35** **56** **63** **70**

[1]

(c) Plant roots contain unspecialised cells, and specialised cells such as root hair cells.

Which statement explains how the unspecialised cells in a root become specialised?

Tick (✓) **one** box.

Cell growth becomes uncontrolled. ☐

Genes are turned off and on. ☐

New genes are made. ☐

Proteins are turned off and on. ☐

[1]

(d) Explain why it is important for plants to have specialised root hair cells rather than only unspecialised cells.

.....

..... **[1]**