AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.1.3

Cell specialisation

Past-paper questions

Tier	**Higher**
Question groups	**13**
Available paper years	**2010–2022**

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.

4.1.1.3 Cell specialisation

Question 01

January 2010 | BLY2H | Original Q5 | Legacy

5 (a) Mr and Mrs Smith both have a history of cystic fibrosis in their families.
Neither of them has cystic fibrosis.
Mr and Mrs Smith are concerned that they may have a child with cystic fibrosis.

Use a genetic diagram to show how they could have a child with cystic fibrosis.

Use the symbol **A** for the dominant allele and the symbol **a** for the recessive allele.

(3 marks)

4.1.1.3 Cell specialisation

Question 01 · continued January 2010 | BLY2H | Original Q5 | Legacy

for mark

5 (b) Mr and Mrs Smith decided to visit a genetic counsellor who discusses embryo screening.

Read the information which they received from the counsellor.

- Under an anaesthetic five eggs will be removed from Mrs Smith's ovary.
- The eggs will be fertilised in a dish using Mr Smith's sperm cells.
- The embryos will be grown in the dish until each embryo has about thirty cells.
- One cell will be removed from each embryo and tested for cystic fibrosis.
- A suitable embryo will be placed into Mrs. Smith's uterus and she may become pregnant.
- Any unsuitable embryos will be killed.

5 (b) (i) Suggest why it is helpful to take five eggs from the ovary, rather than just one.

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(1 mark)

5 (b) (ii) Evaluate the use of embryo screening in this case.

Remember to give a conclusion as part of your evaluation.

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(4 marks)

8

4.1.1.3 Cell specialisation

Question 02

March 2010 | BLY1BP | Original Q1 | Legacy

QUESTION ONE

Tasmanian tigers are similar to Tasmanian devils. Tasmanian tigers became extinct in the 20th century.

The picture shows a Tasmanian tiger.



Scientists are trying to create living Tasmanian tigers. They are using cells from the well-preserved remains of a pregnant Tasmanian tiger. They are trying several methods.

4.1.1.3 Cell specialisation

Question 02 · continued

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

A sexual reproduction

B tissue culture

C embryo transplants

D adult cell cloning

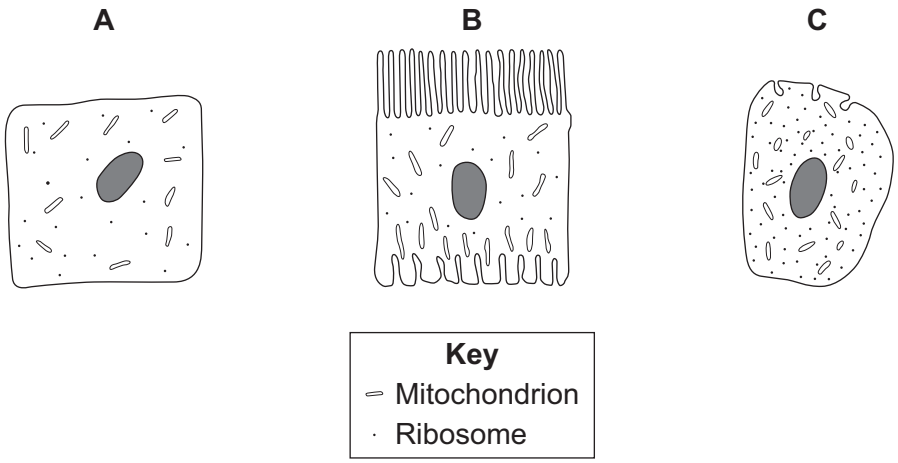
	Description
1	Splitting cells from the Tasmanian tiger embryo and transplanting them into the womb of a Tasmanian devil.
2	Joining female gametes from the Tasmanian tiger with male sperm cells from a Tasmanian devil.
3	Growing small groups of cells in a special nutrient solution.
4	Transferring the nucleus from a Tasmanian tiger skin cell into a Tasmanian devil egg cell. After the cell is given an electric shock, it is transferred to the womb of a female Tasmanian devil.

4.1.1.3 Cell specialisation

Question 03

June 2010 | BLY2H | Original Q4 | Legacy

4 Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



4 (a) Which cell, **A**, **B** or **C**, appears to have adaptations to increase diffusion into or out of the cell? ☐

Give **one** reason for your choice.

.....

.....

(1 mark)

4 (b) (i) Cell **C** is found in the pancreas.

Name **one** useful substance produced by the pancreas.

.....

(1 mark)

4 (b) (ii) Use information from the diagram to explain how cell **C** is adapted for producing this substance.

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(2 marks)

4

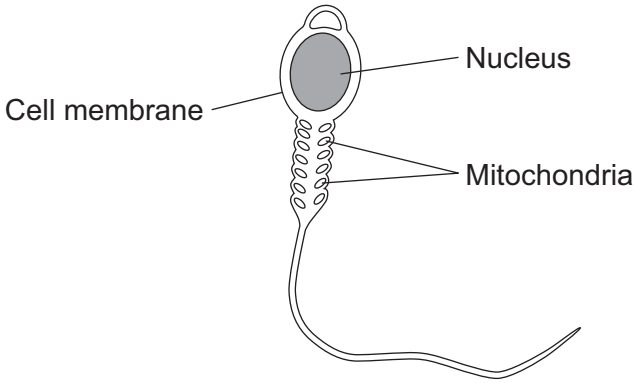
4.1.1.3 Cell specialisation

Question 04

June 2011 | BLY2H | Original Q4 | Legacy

4 Cells in the human body are specialised to carry out their particular function.

4 (a) The diagram shows a sperm cell.



The sperm cell is adapted for travelling to, then fertilising, an egg.

4 (a) (i) How do the mitochondria help the sperm to carry out its function?

.....

.....

(1 mark)

4 (a) (ii) The nucleus of the sperm cell is different from the nucleus of body cells.

Give **one** way in which the nucleus is different.

.....

.....

(1 mark)

4 (b) Stem cells from human embryos are used to treat some diseases in humans.

Explain why.

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.....

.....

(2 marks)

4

4.1.1.3 Cell specialisation

Question 05

June 2015 | BL1HP | Original Q8 | Legacy

8 As embryos develop, some genes in cells are turned off and some genes are turned on. This allows cells to become specialised for particular functions.

Usually, after cells have become specialised, they cannot change again into different types of cells.

8 (a) What is a gene?

[2 marks]

.....

.....

.....

.....

8 (b) Scientists have developed a way to change specialised cells back into embryo-like cells by a method called iPS.

Read the information in the box.

> Cells made using iPS can be changed into different types of cells.
>
> Scientists plan to take skin cells from an endangered species of monkey called a drill and change these cells into iPS cells. These iPS cells can then be changed into egg cells or sperm cells.
>
> After fertilisation, the embryo can be inserted into the womb of a female of a non-endangered species called a mandrill. The mandrill is closely related to the drill.

Describe similarities and differences between the iPS method and adult cell cloning.

[4 marks]

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4.1.1.3 Cell specialisation

Question 05 · continued

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8 (c) Suggest **one** advantage of trying to preserve endangered species such as the drill.

[1 mark]

.....

.....

7

Turn over for the next question

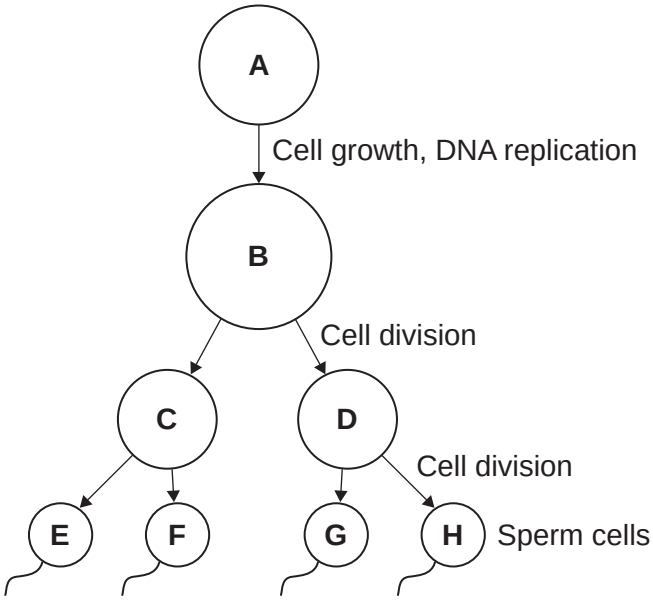
4.1.1.3 Cell specialisation

Question 06

June 2016 | BL2HP | Original Q5 | Legacy

5 **Figure 4** shows the production of human sperm cells.

Figure 4



5 (a) Name the organ where the processes shown in **Figure 4** take place.

[1 mark]

_____

5 (b) (i) Not every cell in **Figure 4** contains the same amount of DNA.

Cell **A** contains 6.6 picograms of DNA (1 picogram = 10^{-12} grams).

How much DNA is there in each of the following cells?

[2 marks]

Cell **B** _____ picograms

Cell **C** _____ picograms

Cell **E** _____ picograms

5 (b) (ii) How much DNA would there be in a fertilised egg cell?

[1 mark]

_____ picograms

5 (b) (iii) A fertilised egg cell divides many times to form an embryo.

Name this type of cell division.

[1 mark]

_____

4.1.1.3 Cell specialisation

Question 06 · continued

5 (c) After a baby is born, stem cells may be collected from the umbilical cord. These can be frozen and stored for possible use in the future.

5 (c) (i) What are stem cells?

[2 marks]

5 (c) (ii) Suggest why it is ethically more acceptable to take stem cells from an umbilical cord instead of using stem cells from a 4-day-old embryo produced by In Vitro Fertilisation (IVF).

[1 mark]

5 (c) (iii) Stem cells taken from a child's umbilical cord could be used to treat a condition later in that child's life.

Give **one** advantage of using the child's own umbilical cord stem cells instead of using stem cells donated from another person.

[1 mark]

5 (c) (iv) Why would it **not** be possible to treat a genetic disorder in a child using his own umbilical cord stem cells?

[1 mark]

10

4.1.1.3 Cell specialisation

Question 07

June 2016 | BL3HP | Original Q1 | Legacy

1 Cells, tissues and organs are adapted to take in different substances and get rid of different substances.

Table 1 shows the concentration of four ions outside cells and inside cells.

Table 1

Ion	Concentration outside cells in mmol per dm^3	Concentration inside cells in mmol per dm^3
Sodium	140	9
Potassium	7	138
Calcium	2	27
Chloride	118	3

1 (a) Use information from **Table 1** to complete the following sentences.

[2 marks]

Sodium ions will move into cells by the process

of _____ .

Potassium ions will move into cells by the process

of _____ .

1 (b) Some students investigated the effect of the different concentrations of sugar in four drinks, **A**, **B**, **C** and **D**, on the movement of water across a partially permeable membrane.

The students:

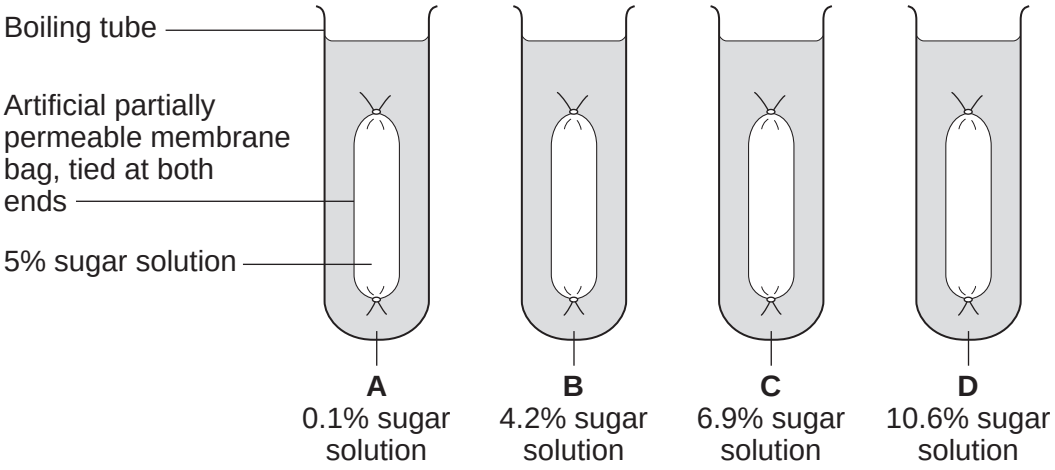
- made four bags from artificial partially permeable membrane
- put equal volumes of 5% sugar solution in each bag
- weighed each bag containing the sugar solution
- placed one bag in each of the drinks, **A**, **B**, **C** and **D**
- after 20 minutes removed the bags containing the sugar solution and weighed them again.

4.1.1.3 Cell specialisation

Question 07 · continued

Figure 1 shows how they set up the investigation.

Figure 1



1 (b) (i) The bag in drink **A** got heavier after 20 minutes.

Explain why.

[3 marks]

1 (b) (ii) In which drink, **A**, **B**, **C** or **D**, would you expect the bag to show the smallest change in mass?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

1 (b) (iii) Explain why you think the bag you chose in part **(b)(ii)** would show the smallest change.

[2 marks]

8

4.1.1.3 Cell specialisation

Question 08

June 2017 | BL1HP | Original Q7 | Legacy

7 Reproduction may be sexual or asexual.

7 (a) Describe **one** advantage to a species of sexual reproduction rather than asexual reproduction.

[1 mark]

_____

_____

7 (b) Mitochondria contain genes. The genes control some of the reactions in respiration.

In a person with mitochondrial disease, genes in the mitochondria are faulty. The person may have muscle weakness, blindness and heart failure.

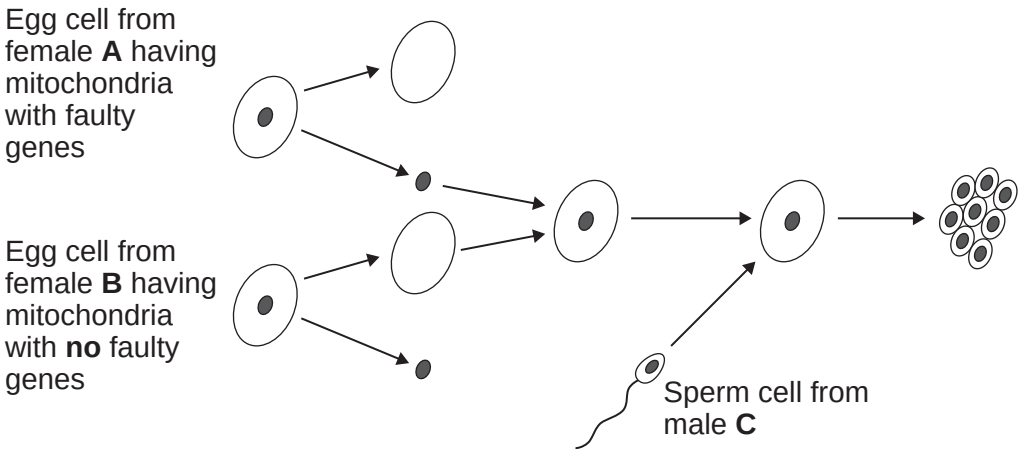
In human reproduction, an embryo will have mitochondria from the cytoplasm of the mother's egg cell.

Scientists have developed a way of solving the problem of a child inheriting mitochondrial disease.

Figure 6 shows the process.

The cells involved come from three different people, **A**, **B** and **C**.

Figure 6



4.1.1.3 Cell specialisation

Question 08 · continued

7 (b) (i) Describe the process shown in **Figure 6**.

Use your knowledge of sexual reproduction and adult cell cloning.

[4 marks]

7 (b) (ii) Explain why the embryo formed from the process shown in **Figure 6** will **not** have mitochondrial disease.

[2 marks]

7 (b) (iii) Suggest **one** ethical objection to this process being used for reproduction in humans.

[1 mark]

8

4.1.1.3 Cell specialisation

Question 09

June 2017 | BL2HP | Original Q6 | Legacy

6 Alkaptonuria (AKU) is a rare, inherited condition. A person with AKU produces brownish-black urine. Further health problems develop later in life.

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

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

[1 mark]

_____

6 (a) (ii) What are alleles?

[1 mark]

_____

_____

6 (a) (iii) What does recessive mean?

[1 mark]

_____

_____

Question 6 continues on the next page

4.1.1.3 Cell specialisation

Question 09 · continued

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

These two parents are heterozygous.

6 (b) (i) What does heterozygous mean?

[1 mark]

_____

_____

6 (b) (ii) Draw a genetic diagram to find the probability that the parents' next child will have AKU.

[4 marks]

You should identify in your diagram any children with AKU.

Use the following symbols: **N** = allele for **not** having AKU (non-AKU)
n = allele for AKU

Probability of having a child with AKU = _____

4.1.1.3 Cell specialisation

Question 09 · continued

6 (c) The parents do not want to have another child with AKU.

A genetic counsellor tells the parents that this would be possible if they use IVF followed by embryo screening.

The procedure is:

1. several eggs from the woman are fertilised in a glass dish using sperm cells from the man (IVF)
2. each fertilised egg divides to form an embryo
3. at the 16-cell stage, one cell is removed from each embryo and the cell's DNA is tested (embryo screening)
4. one embryo, which does not have the recessive allele for AKU, is placed in the woman's uterus to develop into a baby
5. some of the other embryos may be frozen and stored.

In **Steps 2** and **3**, a 16-cell embryo is produced by cell division of the original fertilised egg cell.

6 (c) (i) Name the type of cell division in **Step 2**.

[1 mark]

_____

6 (c) (ii) How many cell divisions are needed to make 16 cells from one cell?

[1 mark]

_____

6 (d) Some people have ethical objections to embryo screening.

6 (d) (i) Suggest **one** ethical objection to embryo screening.

[1 mark]

_____

_____

6 (d) (ii) Suggest **one** reason in favour of embryo screening.

[1 mark]

_____

_____

12

4.1.1.3 Cell specialisation

Question 10

November 2020 | 8461/1H | Original Q2

0 2 Diffusion is an important process in animals and plants.

0 2 . 1 What is meant by the term diffusion?

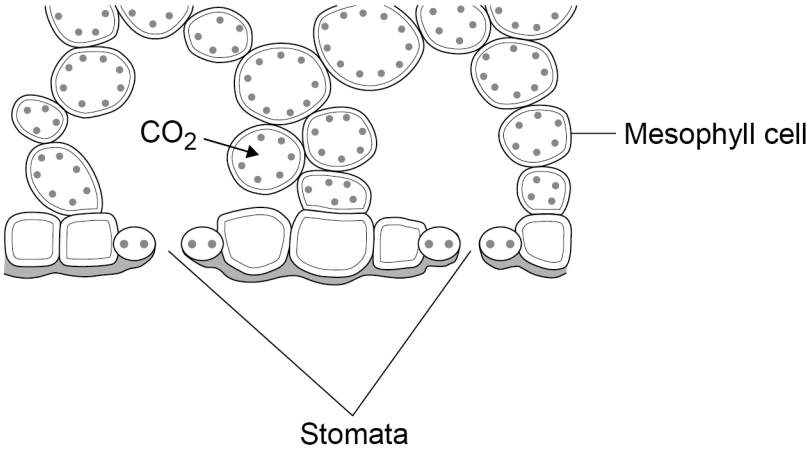
[2 marks]

4.1.1.3 Cell specialisation

Question 10 · continued

0 2 . 2 **Figure 2** shows part of a leaf.

Figure 2



Molecules of carbon dioxide diffuse from the air into the mesophyll cells.

Which **two** changes will increase the rate at which carbon dioxide diffuses into the mesophyll cells?

[2 marks]

Tick (✓) **two** boxes.

- Decreased number of chloroplasts in the cells ☐
- Decreased surface area of cells in contact with the air ☐
- Increased carbon dioxide concentration in the air ☐
- Increased number of stomata that are open ☐
- Increased oxygen concentration in the air ☐

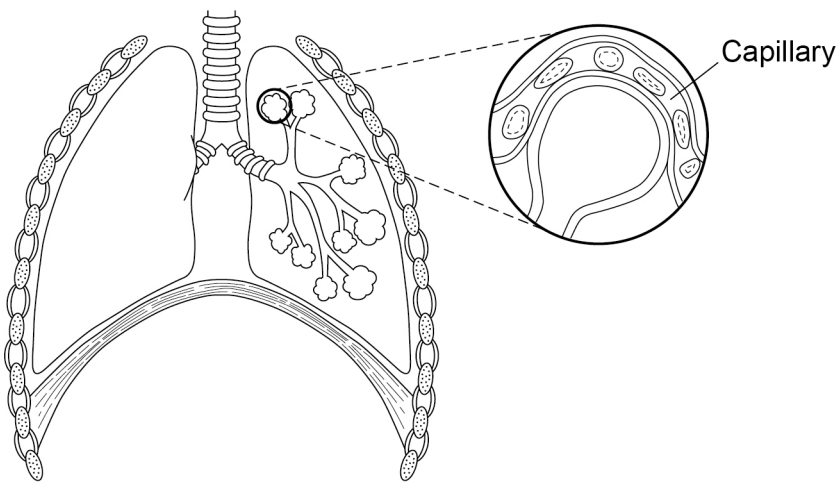
4.1.1.3 Cell specialisation

Question 10 · continued

0 2 . 3 Diffusion also happens in the human lungs.

Figure 3 shows the human breathing system.

Figure 3



Explain how the human lungs are adapted for efficient exchange of gases by diffusion.

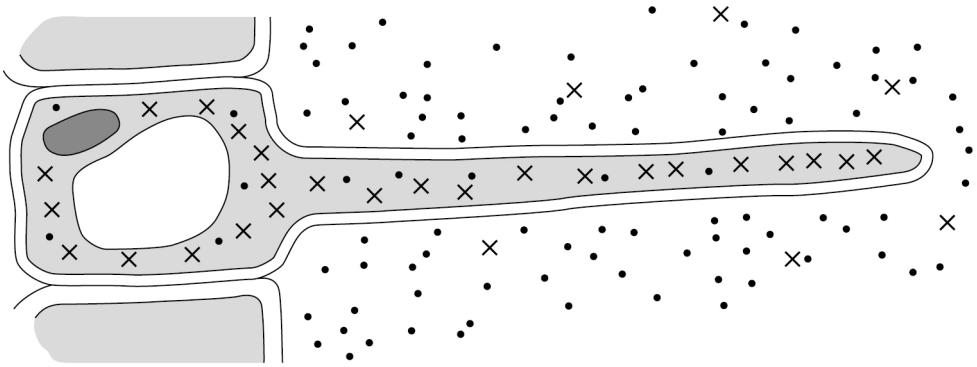
[6 marks]

4.1.1.3 Cell specialisation

Question 10 · continued

Figure 4 shows a root hair cell.

Figure 4



Key

Water molecules

Nitrate ions

0 2 . 4 Name the process by which water molecules enter the root hair cell.

[1 mark]

_____

0 2 . 5 Nitrate ions need a different method of transport into the root hair cell.

Explain how the nitrate ions in **Figure 4** are transported into the root hair cell.

Use information from **Figure 4** in your answer.

[3 marks]

Name of process _____

Explanation _____

_____

_____

_____

_____

14

4.1.1.3 Cell specialisation

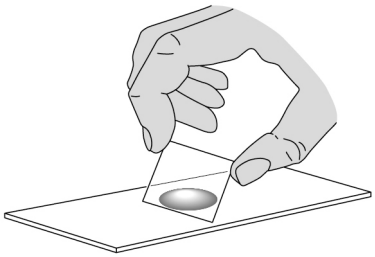
Question 11

November 2021 | 8461/1H | Original Q1

0 1 A student prepared some animal cells to view using a microscope.

Figure 1 shows the student preparing the cells.

Figure 1



0 1 . 1 Name **two** pieces of laboratory equipment the student could have used to **prepare** cells to view using a microscope.

[2 marks]

1 _____

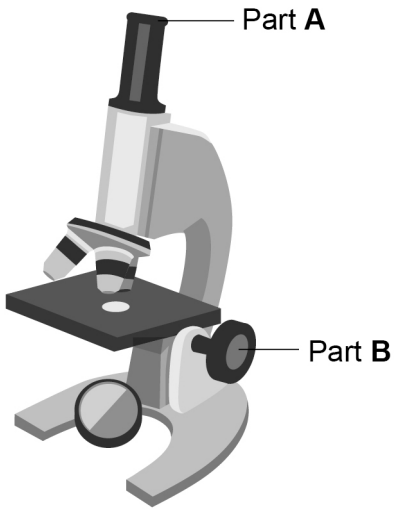
2 _____

4.1.1.3 Cell specialisation

Question 11 · continued

Figure 2 shows the student's light microscope.

Figure 2



0 1 . 2 Name part **A**.

[1 mark]

0 1 . 3 What is the function of part **B**?

[1 mark]

0 1 . 4 The student tried to look at the cells using the microscope.

Suggest **one** reason why the student could **not** see any cells when looking through part **A**.

[1 mark]

Question 1 continues on the next page

4.1.1.3 Cell specialisation

Question 11 · continued

0 1 . 5 Red blood cells are specialised animal cells.

Compare the structure of a red blood cell with the structure of a plant cell.

[6 marks]

0 1 . 6 When placed into a beaker of water:

- a red blood cell bursts
- a plant cell does **not** burst.

Explain why the red blood cell bursts but the plant cell does **not** burst.

[2 marks]

13

4.1.1.3 Cell specialisation

Question 12

November 2021 | 8461/2H | Original Q1

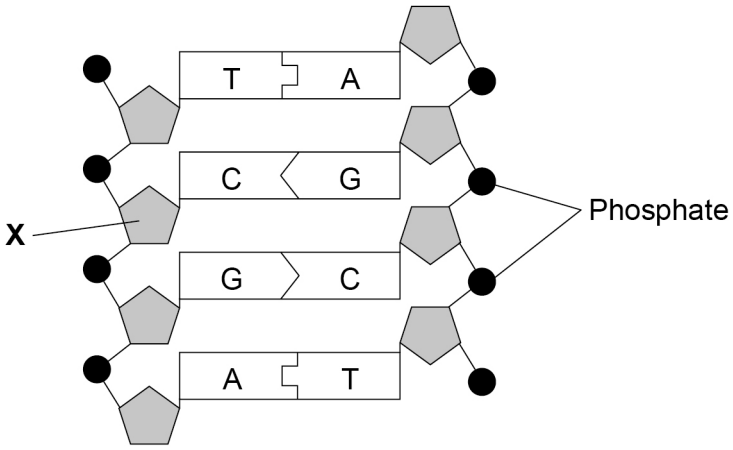
0 1 The nucleus of a cell contains DNA.

0 1 . 1 Name the structures inside the cell nucleus that contain DNA.

[1 mark]

Figure 1 shows part of a DNA molecule.

Figure 1



0 1 . 2 Name the part of the DNA molecule labelled **X**.

[1 mark]

0 1 . 3 What type of substances are labelled **A**, **C**, **G** and **T** in **Figure 1**?

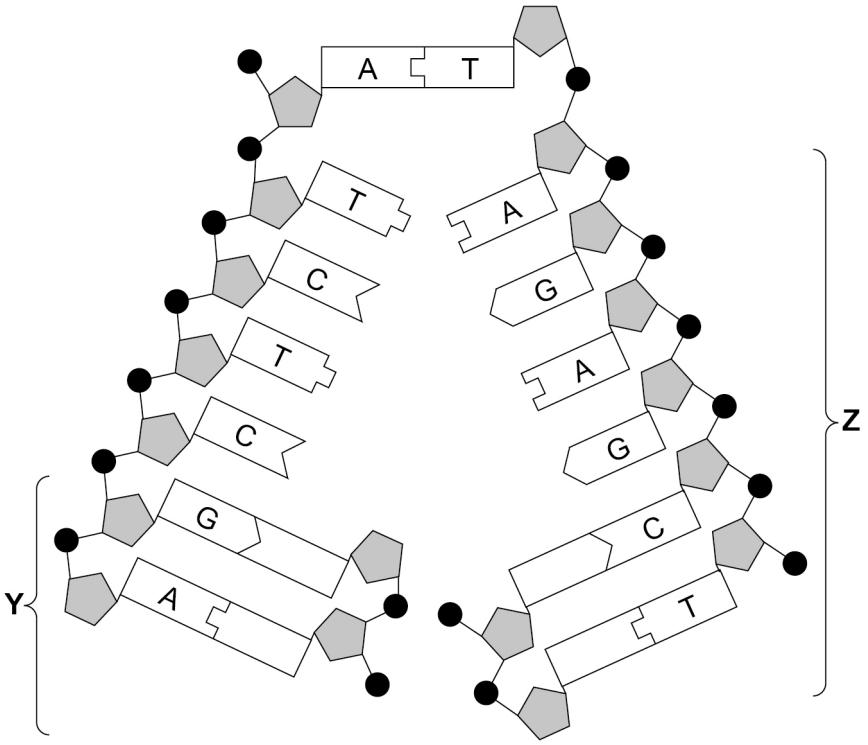
[1 mark]

4.1.1.3 Cell specialisation

Question 12 · continued

Figure 2 shows another section of a DNA molecule.

Figure 2



0 1 . 4 Four of the substances you named in Question **01.3** are **not** labelled in part **Y** of **Figure 2**.

Label each of these substances with the correct letter, **A**, **C**, **G** or **T**.

Use information from other parts of **Figure 2** to help you.

[1 mark]

0 1 . 5 What is happening to the DNA in part **Z** of **Figure 2**?

[1 mark]

Tick (✓) **one** box.

- Differentiation ☐
- Evolution ☐
- Fertilisation ☐
- Replication ☐

4.1.1.3 Cell specialisation

Question 12 · continued

0 1 . 6 A gene is a length of DNA.

What type of substance does a gene code for?

[1 mark]

_____

0 1 . 7 Most human body cells contain 6×10^{-12} grams of DNA.

What mass of DNA will a human sperm cell contain?

[1 mark]

Tick (✓) **one** box.

- 6×10^{-6} grams ☐
- 6×10^{-12} grams ☐
- 3×10^{-6} grams ☐
- 3×10^{-12} grams ☐

0 1 . 8 What is the name of the type of cell division that produces sperm cells?

[1 mark]

Tick (✓) **one** box.

- Binary fission ☐
- Differentiation ☐
- Meiosis ☐
- Mitosis ☐

8

4.1.1.3 Cell specialisation

Question 13

June 2022 | 8461/1H | Original Q4

0 4 Plants and animals have many defence responses.

0 4 . 1 **Table 5** shows some plant defences.

Identify whether each defence is a chemical response or a physical response.

[2 marks]

Tick (✓) **one** box in each row.

Table 5

	Type of response	
Plant defence	**Chemical**	**Physical**
Thick, waxy layer on leaf surface		
Berries that are poisonous		
Bark on trees that falls off		

4.1.1.3 Cell specialisation

Question 13 · continued

Mimicry is a mechanical adaptation seen in both plants and animals.

Figure 5 shows two insects.

Figure 5



Hornet **Hornet Moth**

0 4 . 2 Hornets are insects that sting other animals and cause pain.

Hornet moths do **not** sting other animals.

Suggest how mimicry helps the **hornet moth** survive.

[1 mark]

Question 4 continues on the next page

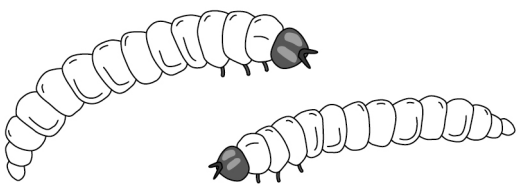
4.1.1.3 Cell specialisation

Question 13 · continued

Adult hornet moths lay eggs that hatch into larvae.

Figure 6 shows the larvae of a hornet moth.

Figure 6



0 4 . 3 The larvae of the hornet moth:

- live inside the roots of trees
- use the tree roots as a source of food
- cause damage to the tree roots.

Explain why a tree might die if the roots of the tree are damaged.

[6 marks]

4.1.1.3 Cell specialisation

Question 13 · continued

0 4 . 4 The larvae of the hornet moth form when fertilised eggs divide by mitosis.

Describe how mitosis produces two genetically identical cells.

[4 marks]

0 4 . 5 The cells which are first formed from the fertilised eggs of the hornet moth are stem cells.

Name the process by which these stem cells then form specialised cells.

[1 mark]

14