AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.1.2.3

# Stem cells

## Past-paper questions

| | |
|---|---|
| Tier | **Higher** |
| Question groups | **4** |
| Available paper years | **2018–2025** |

## 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.

### 4.1.2.3 Stem cells

**Question 01**

June 2018 | 8464/B/1H | Original Q6

**0 6** This question is about stem cells.

**0 6 . 1** Give **one** place in a plant where stem cells are found.

**[1 mark]**

**0 6 . 2** What is **one** economic use of plant stem cells?

**[1 mark]**

Tick **one** box.

- To create genetically modified crops ☐
- To create new species of plants ☐
- To increase variation in plants ☐
- To produce large numbers of identical plants ☐

**Question 6 continues on the next page**

4.1.2.3 Stem cells

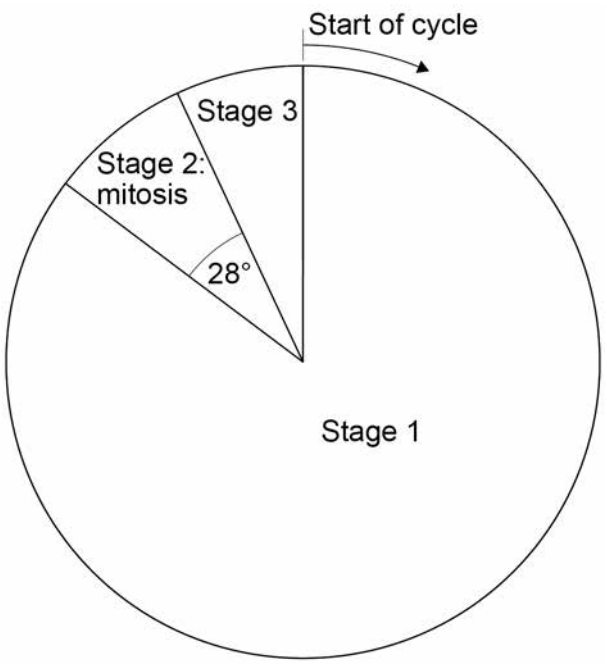
Question 01 · continued



Embryonic stem cells divide by mitosis.

**Figure 9** represents a cell cycle for a human embryonic stem cell.

**Figure 9**




**0 6 . 3** The mass of DNA in the cell at the start of the cycle is 6 picograms.

A picogram is $10^{-3}$ nanograms.

Convert 6 picograms to grams.

Give your answer in standard form.

**[1 mark]**

Mass = _____ g

4.1.2.3 Stem cells

Question 01 · continued



**0 6 . 4** The time taken for this complete cell cycle is 15 hours.

Calculate how many hours the cell spent in mitosis.

Give your answer to 3 significant figures.

**[2 marks]**

Time spent in mitosis = _____ hours

**0 6 . 5** Describe what happens in each of the three stages of the cell cycle.

**[5 marks]**

**Question 6 continues on the next page**

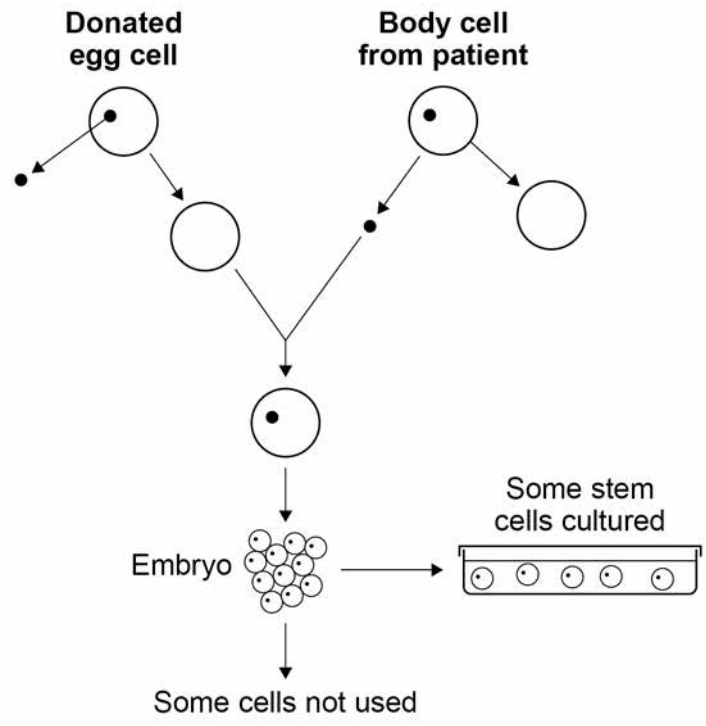
4.1.2.3 Stem cells

Question 01 · continued



**0 6 . 6** **Figure 10** shows how embryonic stem cells are produced in therapeutic cloning for use in patients.

**Figure 10**




Give **two** advantages and **two** disadvantages of therapeutic cloning in medical treatments.

Use **Figure 10** to help you.

**[4 marks]**

Advantage 1 _____

_____

Advantage 2 _____

_____

Disadvantage 1 _____

_____

Disadvantage 2

_____

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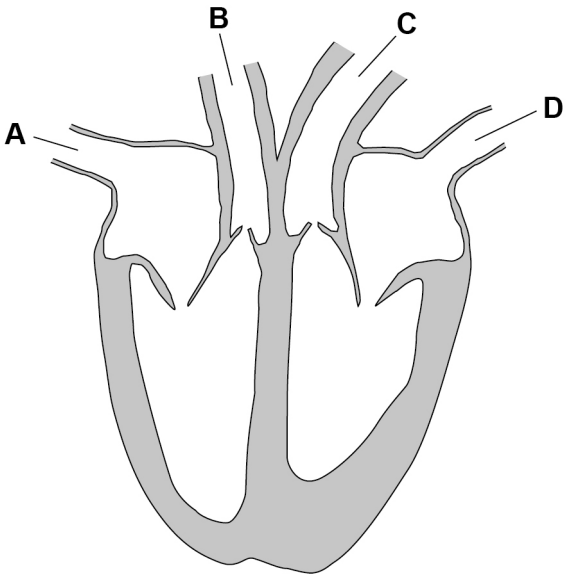
4.1.2.3 Stem cells

Question 02

November 2021 | 8464/B/1H | Original Q5

**0 5** **Figure 5** shows the human heart.

**Figure 5**




**0 5 . 1** Which blood vessel transports blood with the highest oxygen concentration **into** the heart?

**[1 mark]**

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐ **D** ☐

**0 5 . 2** Blood pressure is a measure of the force of the blood against the walls of the blood vessels.

Which blood vessel transports blood at the highest pressure?

**[1 mark]**

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐ **D** ☐

4.1.2.3 Stem cells

Question 02 · continued



**0 5 . 3** What is the correct order for blood flowing through the heart to the lungs?

**[1 mark]**

Tick (✓) **one** box.

left atrium → left ventricle → pulmonary artery ☐

left atrium → left ventricle → pulmonary vein ☐

right atrium → right ventricle → pulmonary artery ☐

right atrium → right ventricle → pulmonary vein ☐

**Question 5 continues on the next page**

4.1.2.3 Stem cells

Question 02 · continued



Every year thousands of people in the UK have heart attacks.

A heart attack is caused when the heart muscle cells do **not** get enough oxygen, causing the cells to die.

**0 5 . 4** Statins and stents are two treatments used to reduce the risk of someone having a heart attack.

Evaluate the use of statins compared with the use of a stent to reduce the risk of a heart attack.

**[6 marks]**

4.1.2.3 Stem cells

Question 02 · continued



**0 5 . 5** Many people who survive a heart attack get out of breath easily when they exercise gently.

Explain why heart attack survivors get out of breath easily.

**[4 marks]**

**Question 5 continues on the next page**

4.1.2.3 Stem cells

Question 02 · continued



Scientists have developed patches of beating heart cells to repair damaged heart tissue.

The patches are placed onto areas of the heart where cells have died. New cells grow to replace the dead cells.

The patches are made using a person's own cells that are converted into stem cells.

**0 5 . 6** Explain why stem cells are used to make the patches.

**[2 marks]**

**0 5 . 7** The scientists could have used human embryonic stem cells to make the patches.

Give **two** advantages of using stem cells made from the person's own cells, rather than using embryonic stem cells.

**[2 marks]**

1

2

17

4.1.2.3 Stem cells

Question 03

June 2023 | 8464/B/1H | Original Q7

**0 7** Antibiotics are drugs used to treat bacterial infections.

Mutations in bacteria produce new strains.

Some strains of bacteria are resistant to antibiotics.

**0 7 . 1** Where do mutations happen in a **bacterial** cell?

**[1 mark]**

A scientist investigated which antibiotics (**A**, **B**, **C**, **D** and **E**) killed *Staphylococcus aureus* (*S. aureus*) bacteria.

This is the method used.

1. Grow *S. aureus* bacteria in a Petri dish.

2. Cut five small discs of paper.

3. Soak each paper disc in a different antibiotic solution.

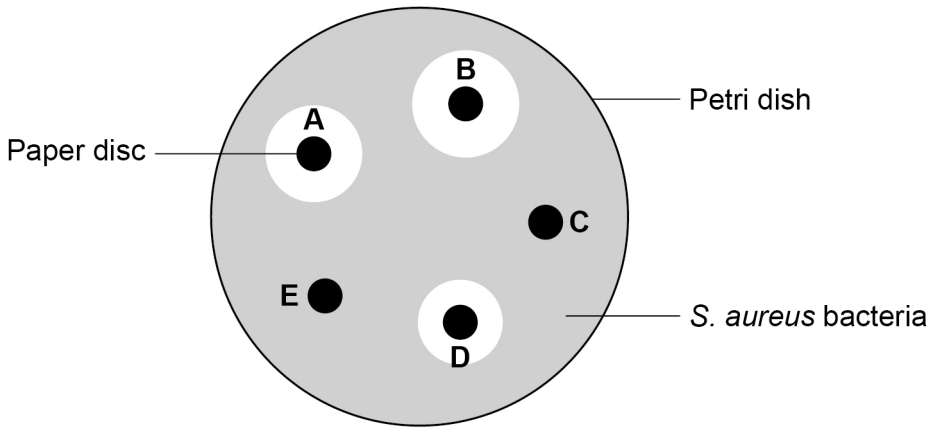
4. Put the five paper discs into the Petri dish.

5. Keep the Petri dish at 37 °C for 24 hours.

**Figure 9** shows the results.

A clear area around a disc shows where the bacteria have been killed.

**Figure 9**



4.1.2.3 Stem cells

Question 03 · continued



**0 7 . 2** The scientist concluded:

'*S. aureus* is resistant to antibiotics **C** and **E**'.

Explain the evidence for this conclusion.

Use **Figure 9**.

**[2 marks]**

**0 7 . 3** The scientist later discovered that *S. aureus* is **not** resistant to antibiotic **E**.

Suggest how the method was developed and showed that *S. aureus* is **not** resistant to antibiotic **E**.

**[2 marks]**

**Question 7 continues on the next page**

**Question 03 · continued**



Broken bones are sometimes repaired using a metal implant.

The area around an implant can become infected with *S. aureus* bacteria.
The infection is usually treated with a long-term course of antibiotics.

Long-term use of antibiotics has led to the development of antibiotic resistant bacteria.
Research is being carried out into alternative treatments.

Stem cells from bone marrow and from fat tissue have antimicrobial properties.

A scientist investigated the effect of four treatments on the area of infection around metal implants. Each treatment was injected into the area around the implant.

The four treatments were:

- unreactive solution
- antibiotic solution
- stem cells from fat tissue
- stem cells from fat tissue containing antibiotic.

Each treatment was tested on 5 patients where an infection had developed around their metal implant.

After 7 days of treatment, the scientist calculated the ratio:

area of infection **:** total tissue area

**0 7 . 4** What was the independent variable in this investigation?

**[1 mark]**

Tick (✓) **one** box.

The ratio of area of infection **:** total tissue area ☐

The treatment injected around the implant ☐

The type of antibiotic used ☐

The type of bacterial infection ☐

4.1.2.3 Stem cells

Question 03 · continued



**0 7 . 5** Suggest **one** advantage of using stem cells from fat tissue, rather than using stem cells from bone marrow.

**[1 mark]**

**0 7 . 6** Stem cells containing antibiotic were produced by growing the cells for 24 hours in a solution containing the antibiotic.

How did the antibiotic enter the stem cells from the solution?

Give a reason for your answer.

**[2 marks]**

Tick (✓) **one** box.

By active transport ☐

By diffusion ☐

By osmosis ☐

By translocation ☐

Reason

**Question 7 continues on the next page**

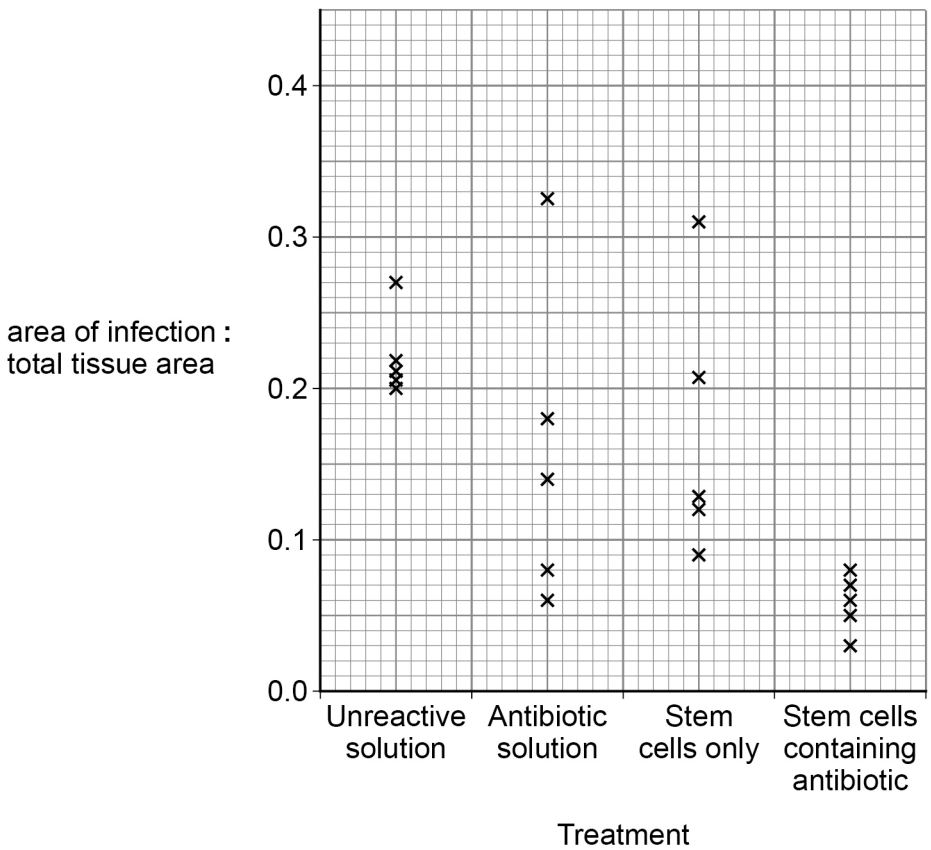
4.1.2.3 Stem cells

Question 03 · continued



**Figure 10** shows the results.

**Figure 10**




**0 7 . 7** What is the range of results for the treatment with stem cells only?

**[1 mark]**

From _____ to _____

4.1.2.3 Stem cells

Question 03 · continued



**0 7 . 8** A student looked at the results and concluded:

‘Injections of stem cells containing antibiotic should be used to treat **all** implant-related infections’.

Evaluate the student’s conclusion.

Use **Figure 10**.

**[4 marks]**

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4.1.2.3 Stem cells

Question 04



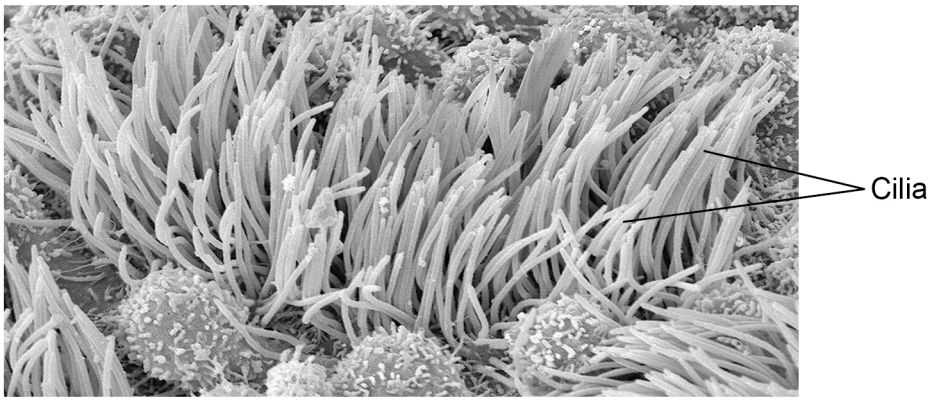
**0 6** Ciliated cells have small hair-like structures called cilia on the cell surface.

Ciliated cells are found in the trachea and in the oviducts.

Oviducts are part of the female reproductive system.

**Figure 7** shows cilia lining an oviduct.

**Figure 7**




**0 6 . 1** Give **one** piece of evidence that an electron microscope was used to produce the image shown in **Figure 7**.

Do **not** refer to colour in your answer.

**[1 mark]**

**0 6 . 2** Describe the function of ciliated cells in the **oviduct**.

**[1 mark]**

4.1.2.3 Stem cells

Question 04 · continued



**0 6 . 3** The mean length of the cilia in an image was 6 mm.

The cilia were viewed at a magnification of $1.5 \times 10^3$

Calculate the real mean length of the cilia.

Give your answer in micrometres (μm).

**[5 marks]**

Real mean length = _____ μm

**Question 6 continues on the next page**

4.1.2.3 Stem cells

**Question 04 · continued**



Red blood cells are a type of cell found in humans.

People with anaemia do **not** have enough red blood cells.

**0 6 . 4** Explain why a person with anaemia is likely to experience muscle fatigue.

**[2 marks]**

4.1.2.3 Stem cells

Question 04 · continued



Scientists have produced red blood cells from stem cells in a laboratory.

The scientists:

- collected a sample of blood from a donor
- extracted $5 \times 10^5$ stem cells from the sample.

Each stem cell was developed into 100 000 red blood cells.

35% of the red blood cells made from stem cells are suitable to use in a patient.

**0 6 . 5** Calculate the number of red blood cells made from the donor's sample that could be used in a patient.

Give your answer in standard form.

**[4 marks]**

Number of red blood cells (in standard form) = _____

**Question 6 continues on the next page**

Question 04 · continued



**0 6 . 6** Patients with anaemia are sometimes given a blood transfusion.

A blood transfusion is when a patient is given blood.

The patient can be given red blood cells:

- produced from stem cells in a laboratory

  **or**

- from a whole blood donation.

**Table 2** gives information about the two sources of red blood cells.

**Table 2**

| Red blood cells produced from stem cells | Red blood cells from a whole blood donation |
|---|---|
| • A small sample of blood is collected from the patient.<br>• The total cost is £15 per 10 $cm^3$ of cells produced.<br>• All of the new cells can function for 120 days. | • 470 $cm^3$ of blood is collected from a donor.<br>• The blood donation is separated into its different parts.<br>• Red blood cells make up 45% of whole blood.<br>• The total cost of a blood donation is £130.<br>• The cells can function for between 1 and 120 days. |

4.1.2.3 Stem cells

**Question 04 · continued**



Evaluate the use of red blood cells:

- produced from stem cells in a laboratory
- from a whole blood donation.

You should refer to costs in your answer.

**[6 marks]**

Extra Space

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