

GCSE Combined Science: Trilogy

Worksheet: Stem cells

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Stem cells

NAME

CLASS

DATE

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

01

Stem cells are found in human embryos, in adult bone marrow and in the meristems of plants.

Table 1

Source of stem cells	Can form most types of human cell	Can form some types of cell, e.g. blood cells	Can form any type of plant cell
Human embryo			
Adult bone marrow			
Plant meristem			

01.1

Complete Table 1 by putting **one** tick (✓) in each row.

[3 marks]

0 1 . 2

What is meant by an **undifferentiated** cell?

Tick (✓) **one** box.

A cell that cannot divide

☐

A cell that has become specialised

☐

A cell that has no nucleus

☐

A cell that has not become specialised

☐

[1 mark]

0 1 . 3

Explain why stem cells may be useful for treating damaged tissue.

.....

.....

[1 mark]

0 2

Stem cells are found in animals and plants.

0 2 . 1

Which statement describes a stem cell?

Tick (✓) **one** box.

A cell that has no nucleus

☐

A specialised cell that can no longer divide

☐

An undifferentiated cell that can give rise to many more cells of the same type

☐

A cell that is found only in plant stems

☐

[1 mark]

0 2 . 2

Name the tissue in plants that contains stem cells.

.....

.....

.....

[1 mark]

0 2 . 3

Name **one** type of cell that stem cells from adult bone marrow can form.

.....

.....

[1 mark]

0 2 . 4

Give **one** medical condition that treatment with stem cells may be able to help.

.....

.....

[1 mark]

0 3

Therapeutic cloning can be used to produce stem cells for a patient. The steps are listed below, but they are not in the correct order.

- **A** Stem cells are removed from the embryo.
- **B** The nucleus is removed from an egg cell from a donor.
- **C** The egg cell divides to form an embryo.
- **D** The nucleus from one of the patient's body cells is put into the egg cell.
- **E** The stem cells are made to differentiate into the type of cell the patient needs.

0 3 . 1

Write the letters **A** to **E** in the correct order.

.....

.....

.....

.....

[2 marks]

0 3 . 2

Explain why cells produced in this way are not rejected by the patient's body.

.....

.....

.....

.....

[2 marks]

0 3 . 3

Give **one** risk of using stem cells in medical treatment and **one** ethical or religious objection to therapeutic cloning.

.....

.....

.....

.....

[2 marks]

0 4

The bananas that are grown for food do not produce seeds. Growers produce new banana plants from the meristem tissue of a parent plant.

In one laboratory:

- a small piece of meristem tissue is placed on sterile agar containing nutrients and plant hormones
- after 4 weeks it has grown into a clump that can be split into 5 pieces
- each piece is grown for another 4 weeks and then split into 5 pieces again, and so on.

0 4 . 1

Explain why meristem tissue can be used to produce a whole new plant.

.....

.....

.....

.....

[2 marks]

0 4 . 2

Calculate the number of plants that can be produced from one piece of meristem tissue after 20 weeks.

.....

.....

.....

.....

Number of plants =

[2 marks]

0 4 . 3

Suggest **two** reasons why growers use this method instead of waiting for the parent plant to produce new shoots naturally.

.....

.....

.....

.....

[2 marks]

0 4 . 4

All the banana plants on a large farm were produced from one parent plant. Explain why a new disease could destroy all of the plants on the farm.

.....

.....

.....

.....

[2 marks]

0 5

Scientists grew stem cells from adult bone marrow in a culture. They started with 2.5×10^4 cells. The number of cells doubled every 24 hours.

0 5 . 1

Calculate the number of cells after 3 days.
Give your answer in standard form.

.....

.....

.....

.....

.....

Number of cells =

[3 marks]

0 6

Scientists grew embryonic stem cells in a culture. They started with 2.5×10^4 cells. The number of cells doubled every 36 hours.

0 6 . 1

Calculate the number of cells after 9 days.
Give your answer in standard form.

.....

.....

.....

.....

.....

Number of cells =

[3 marks]

0 7

Scientists grew stem cells from a patient's own tissue in a culture. They started with 2.5×10^4 cells. The number of cells doubled every 36 hours.

0 7 . 1

Calculate the number of cells after 6 days.
Give your answer in standard form.

.....

.....

.....

.....

.....

Number of cells =

[3 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Stem cells · 32 marks

Question 1 (5 marks)

01.1 [3 marks]

Answer: human embryo – most types of human cell; adult bone marrow – some types, e.g. blood cells; plant meristem – any type of plant cell

- human embryo: can form most types of human cell (1)
 - adult bone marrow: can form some types of cell, e.g. blood cells (1)
 - plant meristem: can form any type of plant cell (1)
-

01.2 [1 mark]

Correct: A cell that has not become specialised

01.3 [1 mark]

- they can divide to make more cells and differentiate into the specialised cells that are needed to replace damaged cells (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Correct: An undifferentiated cell that can give rise to many more cells of the same type

02.2 [1 mark]

Answer: meristem

- meristem (tissue) (1)
-

02.3 [1 mark]

- blood cells / red blood cells / white blood cells / platelets (1)
-

02.4 [1 mark]

- diabetes / paralysis (1)

Notes: Allow other suitable examples, e.g. leukaemia, damaged heart muscle.

Question 3 (6 marks)

03.1 [2 marks]

Answer: B, D, C, A, E

- B, D at the start (in this order) (1)
 - C, A, E at the end (in this order) (1)
-

03.2 [2 marks]

- the embryo / stem cells have the same genes as the patient (because the nucleus came from the patient) (1)
 - so the patient's immune system does not recognise the cells as foreign / does not attack them (1)
-

03.3 [2 marks]

- risk: transfer of a viral infection / the cells may divide uncontrollably (and form a tumour) (1)
 - objection: an embryo is created and then destroyed / the embryo could have developed into a person / it interferes with nature or goes against religious beliefs (1)
-

Question 4 (8 marks)

04.1 [2 marks]

- meristem tissue contains stem cells / undifferentiated cells (1)
- which can differentiate into any type of plant cell, e.g. root, stem and leaf cells (1)

04.2 [2 marks]

Answer: 3125

- $20 \div 4 = 5$ rounds of splitting (1)
- $5^5 = 3125$ (1)

Notes: An answer of 25 (5×5) scores 1 mark.

04.3 [2 marks]

- large numbers of plants are produced quickly (1)
- it is economical / cheap (1)
- all the new plants are genetically identical to the parent, so they all have its useful features, e.g. high yield / disease resistance (1)
- plants can be produced at any time of year / free from disease (1)

Any 2 of the points above.

04.4 [2 marks]

- the plants are genetically identical / clones / there is no genetic variation (1)
- so if one plant is not resistant to the disease, none of them are (1)

Question 5 (3 marks)

05.1 [3 marks]

Answer: 2×10^5

- 3 days = 72 hours, so $72 \div 24 = 3$ doublings (1)
- $2.5 \times 10^4 \times 2^3$ (1)
- 2×10^5 (1)

Notes: 200 000 (not in standard form) scores 2 marks.

Question 6 (3 marks)

06.1 [3 marks]

Answer: 1.6×10^6

- 9 days = 216 hours, so $216 \div 36 = 6$ doublings (1)
- $2.5 \times 10^4 \times 2^6$ (1)
- 1.6×10^6 (1)

Notes: 1 600 000 (not in standard form) scores 2 marks.

Question 7 (3 marks)

07.1 [3 marks]

Answer: 4×10^5

- 6 days = 144 hours, so $144 \div 36 = 4$ doublings (1)
- $2.5 \times 10^4 \times 2^4$ (1)
- 4×10^5 (1)

Notes: 400 000 (not in standard form) scores 2 marks.
