1.10 Cell Division and Stem Cells: 30-minute Pack

AQA 8464 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A single zygote undergoes mitotic divisions to form a ball of cells. If the zygote divides 6 times, how many cells are present? Show your working.

(a) Calculate the number of cells after 6 divisions starting from one zygote. **(4)**

.....

(Total for Question 1 is 4 marks)

---

2 Stem cells can be classified as embryonic stem cells or adult stem cells. Answer briefly.

(a) State one characteristic of embryonic stem cells. **(1)**

(b) State one limitation of adult stem cells compared with embryonic stem cells. **(1)**

(Total for Question 2 is 2 marks)

© Revision Library | revisionlibrary.co.uk

3 Chromosomes carry the genetic information of a cell.

(a) Define the term 'chromosome'. **(1)**

(b) State how many chromosomes are found in a normal human body cell. **(1)**

(c) Human body cells are described as 'diploid'. State what this means. **(1)**

(Total for Question 3 is 3 marks)

---

4 Stem cells have a number of actual and potential uses in medicine.

(a) Give two examples of medical conditions that scientists are researching treatments for, using stem cells. **(2)**

(b) Bone marrow transplants, using stem cells from a donor, are already used to treat some blood disorders, such as certain types of leukaemia. Explain how the transplanted stem cells help to treat the patient. **(2)**

(Total for Question 4 is 4 marks)

---

5 Evaluate the use of embryonic stem cells to treat medical conditions such as paralysis. In your answer, you should consider: the potential medical benefits of embryonic stem cells; the scientific/practical issues involved; the ethical concerns raised by their use; and possible alternatives.

(Total for Question 5 is 6 marks)

© Revision Library | revisionlibrary.co.uk

6 Explain, using ideas about mitosis, how new skin cells are produced to repair the cut.

(Total for Question 6 is 3 marks)

---

7 A gardener takes a cutting from a healthy geranium plant and plants it in soil. Over the next few weeks, the cutting grows roots and shoots, developing into a complete new plant that is genetically identical to the parent plant.

(a) Name the type of cell division responsible for producing the new cells needed for the cutting to grow. **(1)**

(b) Explain how meristem tissue in the cutting allows it to develop into a complete new plant with roots and shoots. **(3)**

(Total for Question 7 is 4 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 1.10 Cell Division and Stem Cells: 30-minute Pack

Question 1

(a) correct method: cells = 1 x 2^6 **M1**

(a) evaluates 2^6 = 64 **M1**

(a) substitutes: 1 x 64 **M1**

(a) 64 cells cao **A1**

(a) Answer: 64 cells

Question 2

(a) pluripotent or can differentiate into many different cell types, oe cao **B1**

(a) Answer: Pluripotent; they can differentiate into many different cell types.

(b) less versatile or multipotent only, so can become fewer cell types, oe cao **B1**

(b) Answer: They are less versatile (multipotent) and can become fewer cell types.

Question 3

(a) a long, coiled structure made of DNA, found in the nucleus, that carries genetic information (organised into genes), oe **B1**

(a) Answer: A long, coiled structure made of DNA, found in the nucleus, which carries genetic information organised into genes.

(b) 46 (23 pairs) cao **B1**

(b) Answer: 46 chromosomes (23 pairs).

(c) the cell contains chromosomes in pairs / two complete sets of chromosomes, oe **B1**

(c) Answer: The cell contains its chromosomes arranged in pairs (two complete sets of chromosomes).

Question 4

(a) any one condition, e.g. type 1 diabetes / paralysis (spinal cord injury) / damaged retina / heart disease (damaged heart muscle) **B1**

(a) a second, different condition from the list above **B1**

(a) Answer: Any two of: type 1 diabetes; paralysis (spinal cord injury); damaged retina; heart disease.

(b) the transplanted (healthy) bone marrow stem cells can divide by mitosis, oe **B1**

(b) and differentiate to produce new, healthy blood cells, replacing the patient's faulty/cancerous blood cells, oe **B1**

(b) Answer: The transplanted, healthy bone marrow stem cells divide by mitosis and differentiate into new, healthy blood cells, replacing the patient's faulty blood cells.

Question 5

Level 3 A detailed and balanced evaluation that accurately covers medical benefits, scientific/practical issues and ethical concerns, and reaches a justified overall conclusion. Correct scientific terminology is used throughout and the answer is logically structured. **5-6**

Level 2 Some accurate points are made, covering at least two of the three areas (benefits, practical issues, ethical concerns), with mostly correct scientific terminology. The answer has some structure but the evaluation may be incomplete or one-sided. **3-4**

Level 1 Basic, isolated statements are given about stem cells or ethics, with little or no evaluation or linking of ideas. Scientific terminology may be limited or only partly correct. **1-2**

Level 0 No relevant content. **0**

Indicative content:

- Embryonic stem cells are pluripotent: they can differentiate into almost any type of human cell, unlike adult stem cells, which can only differentiate into a limited range of cell types.
- This means embryonic stem cells could potentially be used to grow replacement nerve cells or tissue, to repair damage caused by paralysis, or to treat other conditions such as type 1 diabetes or heart disease.
- Obtaining embryonic stem cells currently requires the destruction of the early embryo from which they were taken.
- Some people believe an embryo should be treated as a potential human life, and therefore object, on ethical or religious grounds, to embryos being destroyed for research or treatment.
- Others argue the potential medical benefits to seriously ill or paralysed patients justify the use of spare embryos (e.g. those donated from fertility clinics that would otherwise be discarded).
- There are also scientific/practical risks: transplanted stem cells could be rejected by the patient's immune system, or could transfer a viral infection.
- Embryonic stem cells are also harder to control in culture than adult stem cells, and there is a risk that transplanted cells could divide uncontrollably and form a tumour.
- Adult stem cells (e.g. from bone marrow) avoid the ethical concerns around embryo destruction, but can only differentiate into a limited range of cell types, so may not be able to treat every condition.
- Research into other alternatives, such as therapeutic cloning or reprogramming adult cells, may reduce reliance on embryonic stem cells in future, but is not yet fully developed.
- A balanced judgement should weigh the significant potential medical benefits against the ethical concerns and current scientific limitations/risks.

Question 6

cells at the edge of the wound divide by mitosis, oe **B1**

producing new cells that are genetically identical to the original skin cells, oe **B1**

the new cells fill the gap and repair the damaged tissue, oe **B1**

Answer: Cells at the edge of the wound divide by mitosis, producing new cells that are genetically identical to the original skin cells. These new cells fill the gap, repairing the damaged tissue.

© Revision Library | revisionlibrary.co.uk

Question 7

(a) mitosis **B1**

(a) Answer: Mitosis.

(b) meristem tissue contains unspecialised (stem) cells that can divide repeatedly by mitosis, oe **B1**

(b) these new cells can then differentiate into different types of specialised plant cell, oe **B1**

(b) forming the specialised tissues needed for new roots and shoots (e.g. root hair cells, xylem), oe **B1**

(b) Answer: Meristem tissue contains unspecialised stem cells that divide repeatedly by mitosis. The new cells then differentiate into different types of specialised plant cell, forming the tissues needed for new roots and shoots.

© Revision Library | revisionlibrary.co.uk