

Cell Division & Stem Cells

Mark Scheme



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1. Cell division is a vital biological process that drives growth, repairs tissues, and ensures the inheritance of genetic information across generations.

- a) The figures below show the different stages of mitosis.

Put the stages of mitosis into the correct order. Circle the letter of the correct order.

D – is the only correct answer.	1 mark
	Total: 1 mark

- b) During which phase of the cell cycle does DNA replication occur?

B – is the only correct answer.	1 mark
	Total: 1 mark

- c) What is the primary purpose of mitosis in **multicellular** organisms?

C – is the only correct answer.	1 mark
	Total: 1 mark

- d) How many daughter cells are produced at the end of meiosis?

D – is the only correct answer.	1 mark
	Total: 1 mark

- e) If a cell has 46 chromosomes before mitosis, how many chromosomes will each daughter cell have after mitosis? Circle the letter of the correct answer.

B – is the only correct answer.	1 mark
	Total: 1 mark

(Total for Question 1 is 5 marks)

2. This question is about stem cells.

- a) Describe the possible medical benefits of this research.

A description to include the following:	
The repair or regeneration of tissues or a named tissue.	1 mark
Personalised medicine for example treatments for auto immune conditions.	1 mark
Development of new drugs.	1 mark
	Total: 3 marks

b) Where could adult stem cells be found in a human?

Any of the following locations:	
Bone marrow. Blood. Skin. Muscle. Liver.	1 mark
	Total: 1 mark

c) Explain the differences between embryonic stem cells and adult stem cells.

An explanation <u>linking</u> the following:	
Adult stem cells are <u>multipotent</u> . Meaning they can only <u>differentiate into a limited range of cells</u> .	1 mark
Embryonic stem cells are <u>pluripotent</u> . Meaning they can <u>differentiate into any type of body cell</u> .	1 mark
	Total: 2 marks

d) Stem cells can produce more cells using mitosis.

Identify the **four** phases of mitosis in the correct order.

Prophase, metaphase, anaphase and then telophase.	2 marks
Marking note: 1 mark for each correct pair in the correct order.	
	Total: 2 marks

(Total for Question 2 is 8 marks)

3. The figure below shows four stages of mitosis, labelled A, B, C and D.

a) Place the stages of mitosis into the correct order. Circle the letter of the correct order.

B – is the only correct answer.	1 mark
	Total: 1 mark

b) Interphase is part of the cell cycle but it is **not** part of mitosis.

Describe what happens within the cell during interphase.

A description to include the following:	
DNA replicates.	1 mark
Centrioles replicate.	1 mark
	Total: 2 marks

(Total for Question 3 is 3 marks)

4. This question is about meiosis.

a) What is meiosis?

A description to include the following:	
Meiosis is a process of <u>cell division</u>	1 mark
That produces <u>four genetically different</u> . Accept that it produces gametes.	1 mark
<u>Haploid daughter cells</u> .	1 mark
	Total: 2 marks

b) Describe what happens to chromosomes during Prophase 1 of meiosis.

A description to include the following:	
Crossing over occurs	1 mark
Genetic recombination occurs.	1 mark
	Total: 2 marks

(Total for Question 4 is 4 marks)

5. The figure below shows the process to produce sperm cells.

a) Four phases of the figure above have been labelled as A, B, C and D.

Match each phase of meiosis to a letter on the figure above.

i. A	1 mark
ii. B	1 mark
iii. B	1 mark
	Total: 3 marks

b) The function of sperm cells is to fertilise ovum cells to form a zygote.

The zygote divides to form an embryo containing embryonic stem cells.

Describe what is meant by the term **embryonic stem cell**?

A description to include the following:	
A stem cell taken from an embryo.	1 mark
Embryonic stem cells are totipotent. Meaning they can only differentiate any type of tissue.	1 mark
	Total: 2 marks

c) Discuss **one** ethical concern associated with the use of embryonic stem cells in medical research.

An answer to include one of the following:	
<u>Destruction of Human Embryos</u> – getting and using human embryos as stem cells typically results in the destruction of the embryo, which some consider morally equivalent to taking a human life.	1 mark
<u>Status of the Embryo</u> – there is debate over whether an embryo should be considered a human being with rights or merely a cluster of cells.	1 mark
	Total: 2 marks

(Total for Question 5 is 7 marks)

6. Mitosis and meiosis are both different forms of cell division.
Compare and contrast mitosis and meiosis.

Marking guidance		
Level	Marks	Descriptor
Level 1	1 - 2	<u>Basic understanding.</u> States <u>one or two relevant comparisons between mitosis and meiosis.</u> May be vague or lack detail.
Level 2	3 - 4	<u>Good understanding.</u> Describes <u>two or three relevant comparisons between mitosis and meiosis</u> with some detail. Begins to contrast them.
Level 3	5 - 6	<u>Excellent understanding.</u> Fully compares and contrasts mitosis and meiosis.

An answer to include the following:	
Mitosis is a type of cell division that produces <u>two genetically identical diploid daughter cells in one division.</u> Mitosis is used for growth and repair of tissues as well as a method of asexual reproduction.	
Meiosis is a type of cell division that produces <u>four genetically different haploid daughter cells in two divisions.</u> Meiosis is used to produce gametes for sexual reproduction.	
	Total: 6 marks

(Total for Question 6 is 6 marks)

7. The figure below shows one of the stages of mitosis.

- a) Which stage of mitosis is shown in the figure above?

<u>Metaphase.</u>	1 mark
	Total: 1 mark

- b) Meiosis is another form of cell division that occurs.

Explain what happens in meiosis prophase 1 that increases genetic variation.

An explanation to include:	
1. Crossing over occurs – homologous chromosome line up next to each other.	1 mark
2. Recombination occurs – sections of genes are swapped between homologous chromosomes.	1 mark
3. Recombination increases variation as it creates a new genetic combination.	1 mark
	Total: 3 marks

(Total for Question 7 is 4 marks)

8. A fertilised egg cell divides many times to form an embryo.

- a) Name this type of cell division.

<u>Mitosis.</u>	1 mark
	Total: 1 mark

- b) What are stem cells?

A description to include the following:	
Stem cells are unspecialised cells	1 mark
Which can differentiate into more specialised cells.	1 mark
	Total: 2 marks

(Total for Question 8 is 3 marks)

9. The figure below shows a number of animal cells showing different stages of cell division.

a) Cancer can manifest in different forms.

Identify **two** different categories of cancer and explain the key difference between them.

Two categories: <u>benign</u> and <u>malignant</u> .	2 marks
Award 1 mark for each correct category.	
Difference: Benign tumours are usually contained within a membrane and do not invade other parts of the body.	
Malignant tumours invade neighbouring tissues and spread to different parts of the body in the blood to form secondary tumours.	1 mark
	Total: 3 marks

b) Describe how uncontrolled cell division can lead to the development of cancer **and** explain why early detection is important.

A description to include the following:	
Description: cancer develops when cells divide uncontrollably, forming a mass of abnormal cells called a tumour.	1 mark
Award 1 mark for each of the correct points of explanation below:	
Early detection is important for the following reasons: - It can prevent the spread of the cancer. - Make treating the cancer more straightforward. - It can give patients a higher survival rate.	3 marks
	Total: 4 marks

c) State **two** risk factors that can increase the chance of developing cancer.

Any two of the following:	
Smoking. Ultraviolet light (accept sun beds of this point). Exposure to significant radiation. Exposure to certain chemicals.	
	Total: 2 marks

d) Suggest one method of treating cancer.

Any one of the following:	
Chemotherapy.	
Radiotherapy.	
Surgery.	
	Total: 1 mark

(Total for Question 9 is 10 marks)