

# Cell Division, Cell Diversity & Cellular Organisation

## Model Answers 3

|            |   |
|------------|---|
| Level      | A Level   |
| Subject    | Biology   |
| Exam Board | OCR   |
| Module     | Foundations in Biology                                |
| Topic      | Cell Division, Cell Diversity & Cellular Organisation |
| Booklet    | Model Answers 3                                       |

**Time allowed:** 39 minutes

**Score:** /29

**Percentage:** /100

**Grade Boundaries:**

| A*   | A   | B   | C   | D   | E   |
|------|-----|-----|-----|-----|-----|
| >69% | 56% | 50% | 42% | 34% | 26% |

## Question 1

Which statement explains the significance of mitosis in the development of whole organisms?

- A** Mitosis can be controlled at certain points in development, which will change body plans.
- B** Sex cells are produced by mitosis, which allows new organisms to be produced.
- C** Mitosis limits the total number of cells in an organism, which will change its shape.
- D** Budding in yeast is an example of mitosis, producing new multicellular organisms.

[1]

Body plans are controlled by homeobox genes. If mitosis is controlled then it will happen in some places more than others.

Sex cells are made by meiosis

Mitosis will not change the shape, it will change the plan

Yeast is a single celled organism

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## Question 2

(a) Name the type of nuclear division that produces two genetically identical nuclei.

[1]

The type of division that produces two identical nuclei is called

- **Mitosis**

(b) There are a number of stages during cell division.

The list, **J** to **N**, describes some processes that occur during the division of an animal cell.

|          |  |
|----------|--|
| <b>J</b> | the cell surface membrane is constricted |
| <b>K</b> | the nuclear envelope reforms             |
| <b>L</b> | sister chromatids are pulled apart       |
| <b>M</b> | the chromosomes condense                 |
| <b>N</b> | the chromosomes move to the equator      |

Match each letter, **J** to **N**, with a stage of cell division in the list below.

[4]

The first one has been completed for you.

prophase ..... **M** .....

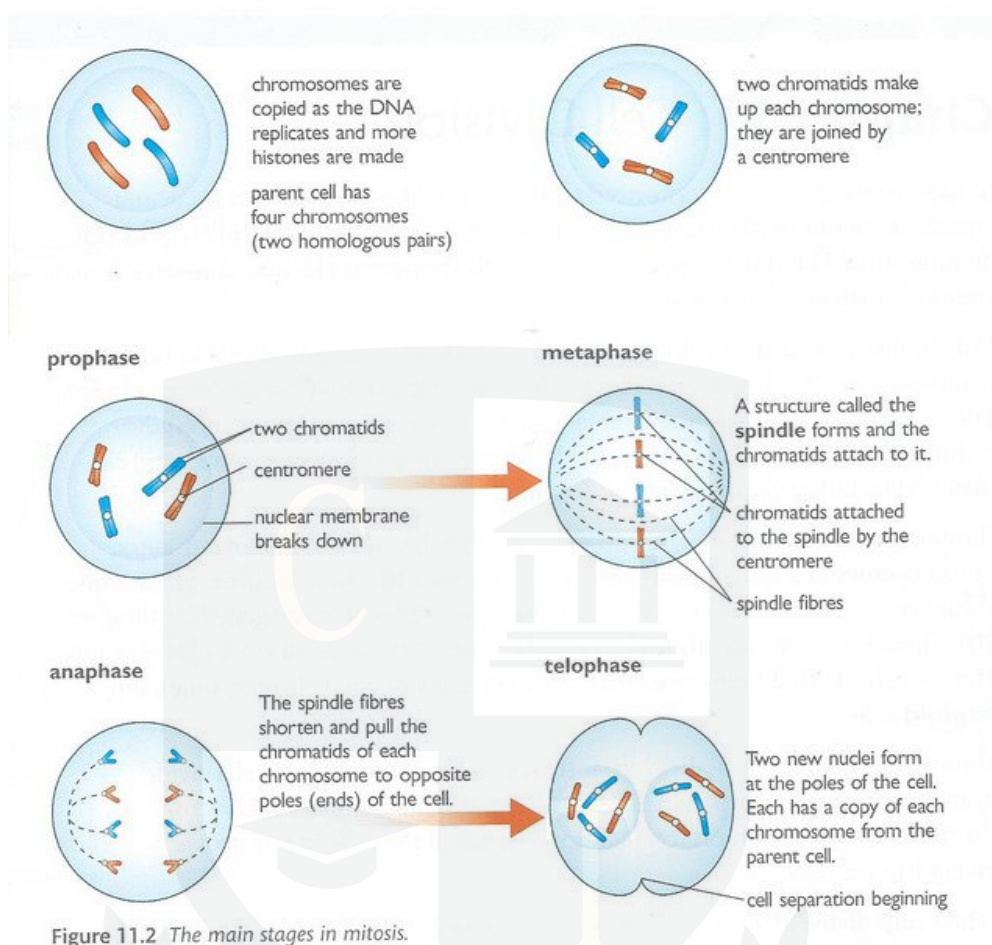
Metaphase: **N** (the chromosomes move to the equator)

Anaphase: **L** (sister chromatids are pulled apart)

Telophase: **K** (the nuclear envelope reforms)

Cytokinesis: **J** (The cell surface membrane is constricted)

Mitosis is the type of cell division that produces genetically identical cells. It is made up of several stages: Prophase, Metaphase, Anaphase, Telophase and Cytokinesis. Before division, the cell is in Interphase, where the DNA replicated and chromosomes are each comprised of two chromatids. Mitosis lines these chromosomes up in the middle of the cell (equator) and pulled each identical chromatid apart from one another. The diagram below shows what happens in each of the stages of mitosis. Cytokinesis is not shown; this is where the cell surface membrane pinches off and two separate cells are produced.



(c) During interphase the genetic material is copied.

State **two** other processes that occur during interphase.

[2]

Two processes that occur during Interphase are:

- Protein synthesis
- Synthesis of organelles
- ATP production
- Cell growth
- Checking of DNA

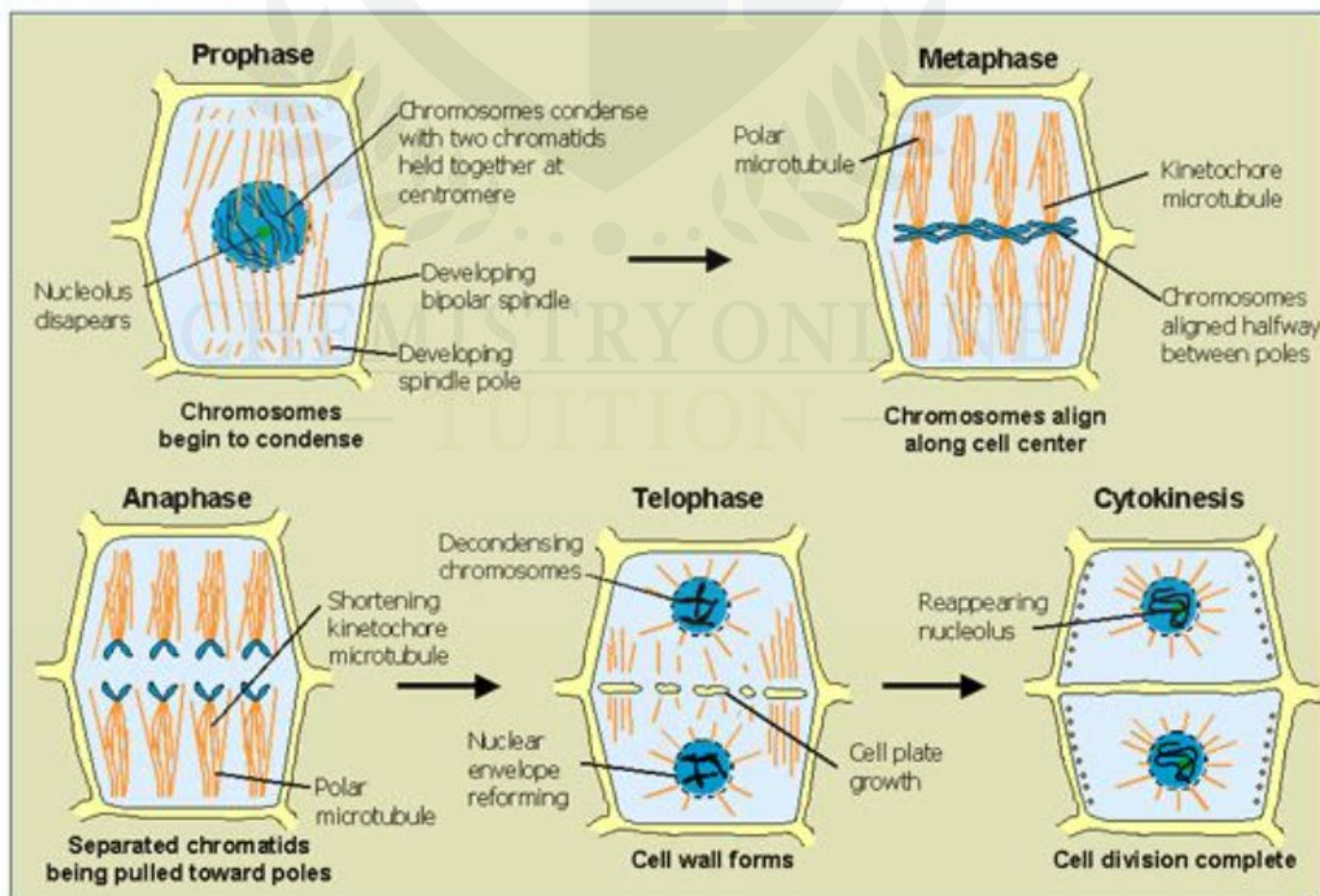
(d) Suggest **two** ways that cell division in plants differs from cell division in animals.

[2]

Plant cell division differs to animal cell division as:

- During cell division in plants, **plates** form between new cells. (This is where the new cell wall will form)
- In plants, **cytokinesis** starts from the **middle** of the cell (whereas in animal cell division, cytokinesis starts at the outer edge)
- In plants, cell division only occurs in the **meristem** (whereas it occurs all over in animals)
- Plant cells do not have centrioles (so no spindle fibres form) Plants have a different kind of microtubule that pulls the chromatids apart, which are not created by centrioles.

Diagram to show mitosis in a plant cell:



[Total: 9]

### Question 3

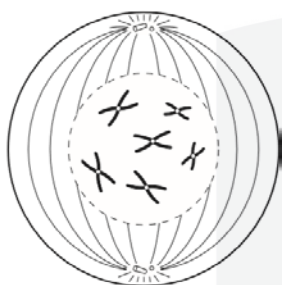
(a) Fig. 5.1, on the insert, shows some drawings of a cell during different stages of mitosis.

Place stages **P**, **Q**, **R**, **S** and **T** in the correct sequence.

[4]

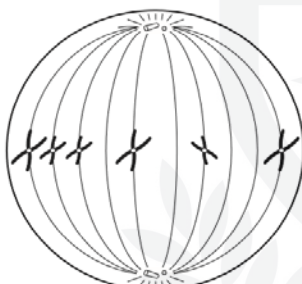
The first stage has been identified for you.

**S Q T P R**



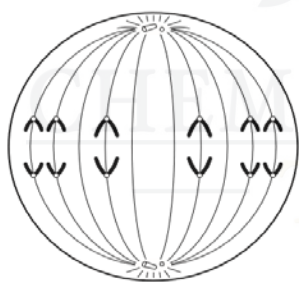
Q

This is **Prophase**. The DNA is in chromosomes and the nuclear membrane is beginning to break down.  
Spindle fibres have formed.



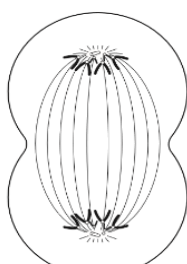
T

This is **Metaphase**. The chromosomes  
. have lined up at the equator.



P

This is Anaphase. The chromatids are being pulled  
apart from one another by the spindle fibres.



R

This is the end of Anaphase, going into  
**Telophase**. The cell begins to divide in two.



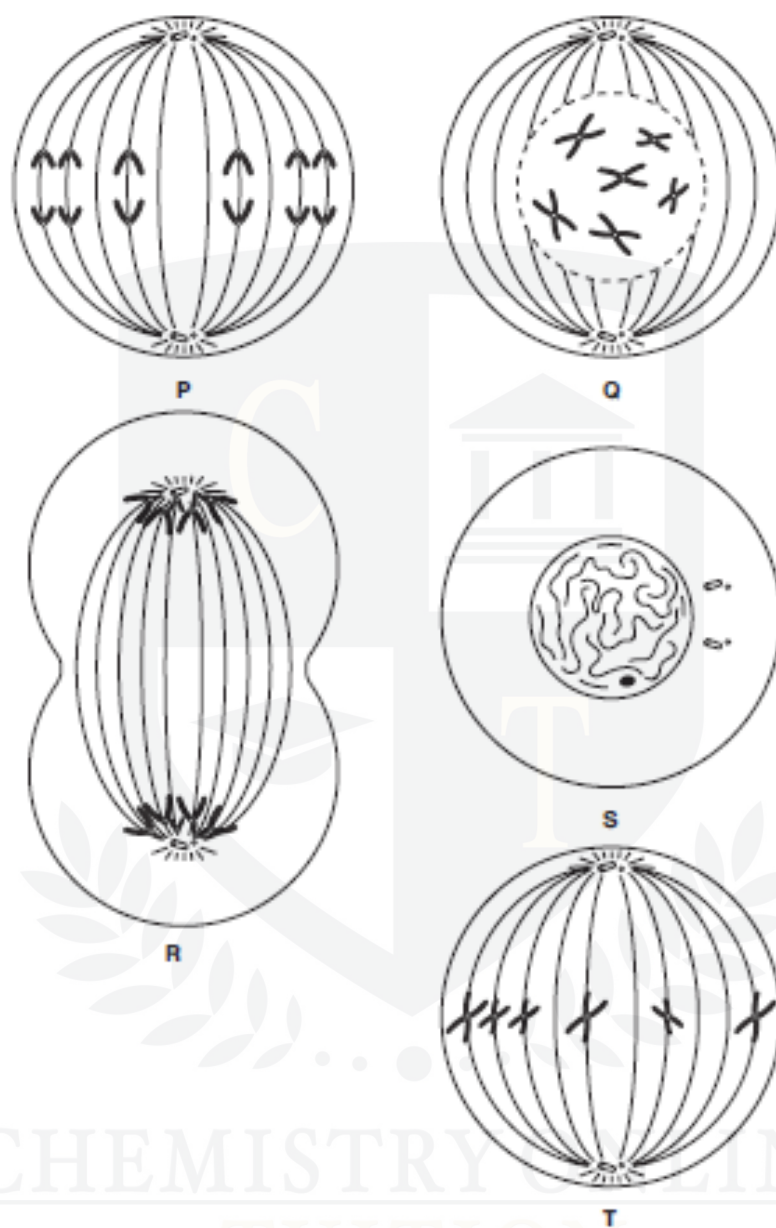


Fig. 5.1

(b) Mitosis is part of the cell cycle.

Fig. 5.2 shows a diagram of the cell cycle.

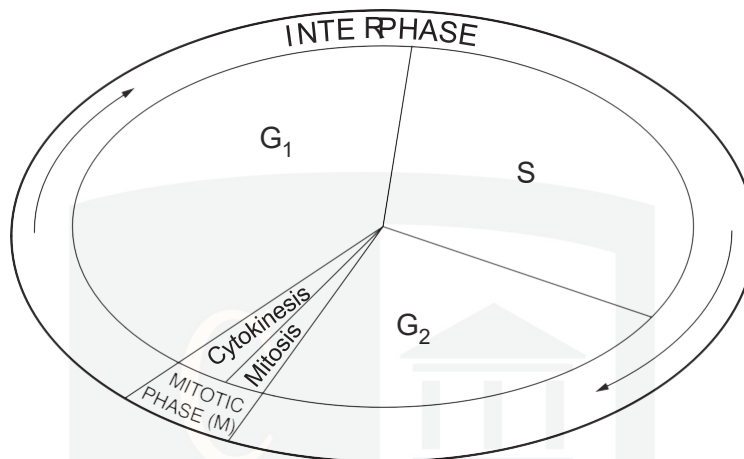


Fig. 5.2

(i) Name **one** process that occurs during stages  $G_1$  and  $G_2$ .

[1]

A process that occurs during  $G_1$  and  $G_2$  is (any from):

- cell growth
- growth of organelles
- protein synthesis

$G_1$  and  $G_2$  are phases during Interphase, where the cell is making preparations for division. During these stages, the cell undergoes growth.

(ii) The genetic information is copied and checked during stage **S**.

[2]

Suggest what might happen if the genetic information is not checked.

If the genetic information is not checked it could result in (any two of):

- a **mutation**
- daughter cells will not receive identical genetic information
- daughter cells not made/ don't function



(c) A cell undergoes two divisions during **meiosis**.

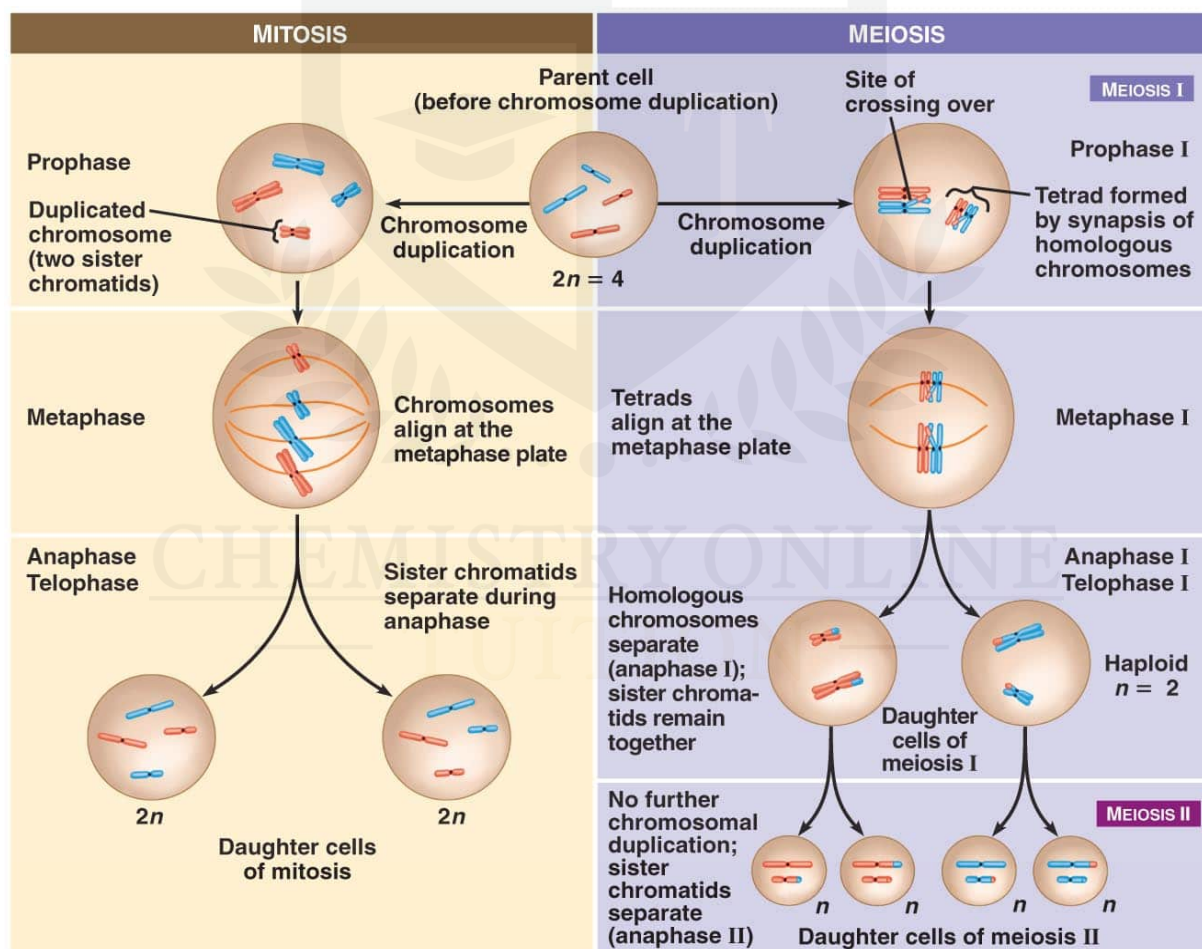
Suggest how cells produced by meiosis may differ from those produced by mitosis.

[2]

Meiosis differs to mitosis in that:

- There are 4 cells produced by meiosis (2 in mitosis)
- Haploid cell produced (diploid in mitosis)
- Daughter cells are not genetically identical (genetically identical in mitosis)

Diagram to show the differences between meiosis and mitosis:



[Total: 9]

## Question 4

The division of stem cells by mitosis produces cells that are genetically identical.

(a) (i) State what is meant by the term *stem cell*.

[2]

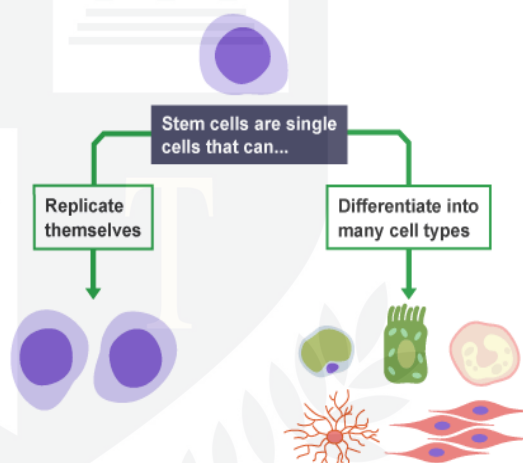
Stem cells are:

- undifferentiated
- able to undergo mitosis
- They can differentiate into many cell types

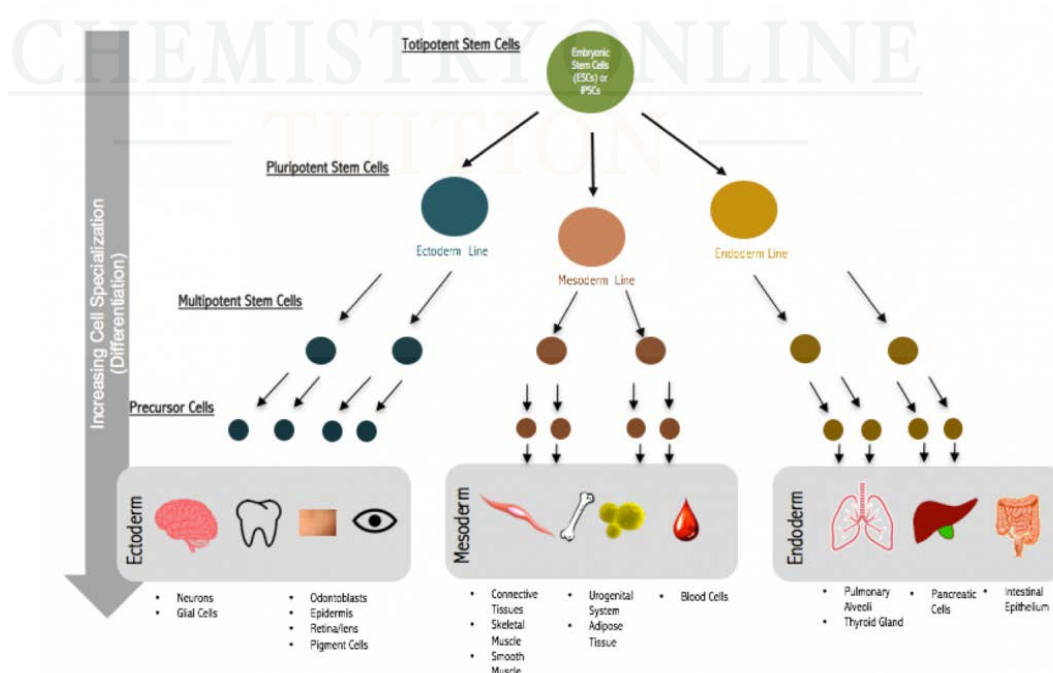
Stem cells are either totipotent, multipotent or pluripotent, depending on where they are found, and what type of cell they are able to specialise into.

[This diagram shows stem cell](#)

[differentiation:](#)



[This diagram shows the different degrees of specialisation:](#)



(ii) Name **one** tissue in **plants** that contains stem cells.

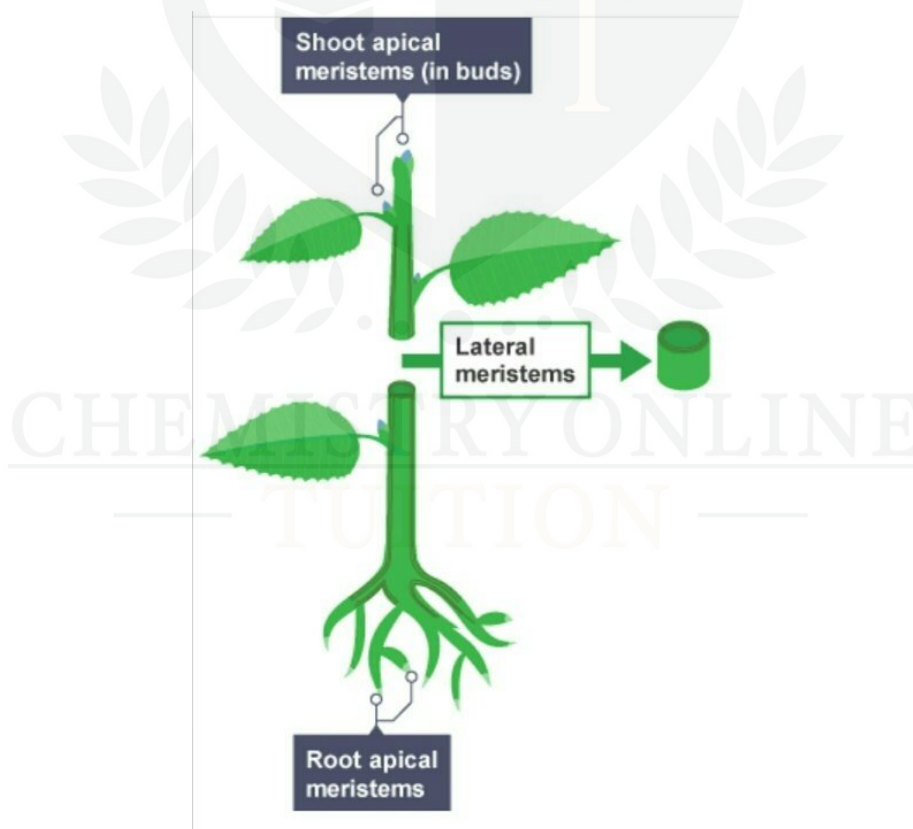
[1]

A tissue in plants that contains stem cells is called:

- Cambium
- Meristem
- Early embryonic cells

Plants do not have stem cells in the way that animals do, but they do have undifferentiated cells in these areas, which divide by mitosis and then specialise, depending on their location within the plant.

Diagram to show the location of meristematic tissue in plants:



(b) State **three** reasons why mitosis is important to organisms.

[3]

Three reasons why mitosis is important to organisms are:

- To repair damaged cells and tissues
- For tissue growth
- For asexual reproduction of cells, which produces identical cells
- To maintain the chromosome number of all cells

(c) Traditionally, stem cells from bone marrow have been used to treat patients with leukaemia.

Recent studies have shown that stem cells taken from umbilical cord blood may be more effective in treating leukaemia than stem cells taken from bone marrow.

Table 3.1 shows the probability of a patient remaining leukaemia-free for five years after being treated with stem cells from different sources.

**Table 3.1**

An extract has been removed due to third-party copyright restrictions.

Source: Miami Herald, [www.miamiherald.com](http://www.miamiherald.com)

- (i) Describe, using the information in Table 3.1, the evidence that **perfectly matched** umbilical cord blood stem cells are more effective than bone marrow stem cells in treating leukaemia.

[2]

Umbilical cord stem cells are more effective as:

- A larger percentage are leukaemia free for 5 years
- This is shown by the fact that 60% of those with umbilical cord blood stem cells remained free of the disease compared to 38% of bone marrow stem cells

*Note: this is a 'describe' question, which means you need to use the information given to support the statement in the question. You should **not** try to say **why** this might be the case. Remember to use physical data to support your answers.*

- (ii) Suggest **two** advantages, **other than an increased probability of survival**, of using umbilical cord blood stem cells instead of bone marrow stem cells in transplant procedures.

[2]

Two advantages of using umbilical cord stem cells are (any two of):

- Less intrusive and therefore, there is less pain for the donor
- Large number of cord cells available and these can be stored for use in the future
- Cells are at an earlier stage of development
- Cells can be used for future use of the donor
- Slightly mismatched cord cells work as well as marrow cells

[Total: 10]