Topic B1 — Cell Biology

Cells and Cell Differentiation

1 Herbicides are chemicals that are used to kill plants.

1.1 Some herbicides stop a plant's growth by disrupting the cell cycle of meristem cells.
For example, they may interfere with DNA replication.
For each of the following stages of the cell cycle, suggest one **other** way in which herbicides
may disrupt a plant's growth:

Before mitosis: ....

During mitosis: ....

[2]

1.2 Dinitroanilines are herbicides that prevent meristem cells from multiplying, but still
allow them to differentiate. Bipyridiliums are herbicides that destroy cell membranes.
Explain why plants treated with dinitroanilines may survive longer than those treated
with bipyridiliums.

....

....

....

....

[4]

[Total 6 marks]

2 Stem cells can be used in medicine to treat diseases.

Scientists think it may be possible to treat diabetes with stem cells by replacing beta cells
in the pancreas. Beta cells are specialised cells that secrete the protein insulin.

2.1 Suggest **one** subcellular structure that there are likely to be many of in each beta cell.

....

[1]

2.2 Hematopoietic stem cells (HSCs) are found in the core of most human bones.
Suggest why HSCs can't be used to treat diabetes.

....

....

[1]

2.3 Research has shown that adult body cells can be changed into cells that have the same features
as embryonic stem cells. These are called iPS cells. Using iPS cells to treat diseases would have
fewer medical risks than using stem cells produced in therapeutic cloning.
Explain one **other** reason why using iPS cells may be preferable to therapeutic cloning.

....

....

....

[2]

[Total 4 marks]

3   In an investigation, a microbiologist inoculated 10 000 mm³ of a nutrient broth
    solution with 10 000 bacterial cells. He then incubated the broth for 1 hour.
    Figure 1 shows the bacteria that were found in 1 mm³ of the nutrient broth solution after
    incubation. The bacteria were viewed on a microscope slide using a light microscope.

Figure 1

magnification x 1500
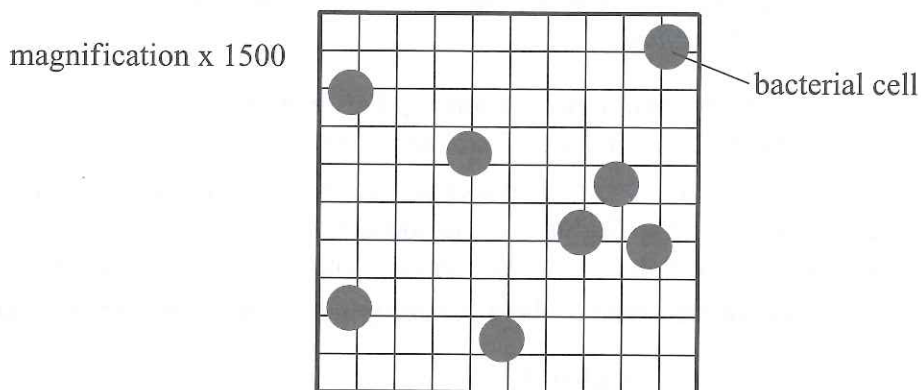
bacterial cell

3.1 Estimate the number of bacterial cells in 1 mm³ of the nutrient broth solution before incubation.

....

[1]

3.2 Use **Figure 1** to calculate the area on the slide taken up by each bacterial cell.
    Give your answer in micrometres squared (μm²) to 2 significant figures.
    Use the following equations to help you:

$$\text{magnification} = \frac{\text{image size}}{\text{real size}}$$

area of a circle $= \pi r^2$

.... μm²
[6]

3.3 It was not necessary for the scientist to use an electron microscope in his investigation.
    Suggest **one** possible explanation for this.

....

....

[2]

[Total 9 marks]

Score: [   ] / **19**

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