

# Answers

## Topic B1 — Cell Biology

### Pages 2-3 — Cells and Cell Differentiation

- 1.1 Before mitosis: by preventing the growth of the cell / the production of new subcellular structures (e.g. ribosomes and mitochondria) [1 mark].  
During mitosis: by preventing chromosomes from separating / the nucleus from dividing [1 mark].
- 1.2 Plants treated with dinitroanilines would still have specialised cells [1 mark], meaning that they may still be able to perform some specific functions essential for survival [1 mark].  
However, the cells of plants treated with bipyridiliums are unlikely to be able to function at all [1 mark], as without a cell membrane they would die/fall apart [1 mark].

Remember, one of the main functions of a cell membrane is to hold the cell together.

- 2.1 ribosomes [1 mark]

Remember, ribosomes are where proteins are made in a cell.

- 2.2 HSCs are unlikely to be able to differentiate into all specialised cell types, such as beta cells [1 mark].

You should realise that HSCs are likely to be found in bone marrow, as you're told that they are found in the core of human bones.

- 2.3 Unlike therapeutic cloning, using iPS cells does not involve the use/destruction of embryos [1 mark], which some people may object to for ethical/religious reasons [1 mark].

- 3.1 Figure 1 represents  $1 \text{ mm}^3$  of the nutrient broth so:  
 $10\,000 \text{ cells} \div 10\,000 \text{ mm}^3 = 1 \text{ cell}$  [1 mark]

- 3.2 E.g. radius of bacterium in image =  $3 \text{ mm} = 3000 \mu\text{m}$   
Real size = image size  $\div$  magnification  
Real radius =  $3000 \div 1500 = 2 \mu\text{m}$   
Area of bacterium =  $\pi \times 2^2 = 4\pi = 12.5663\dots$   
=  $13 \mu\text{m}^2$  (2 s.f.) [6 marks for correct answer, otherwise 1 mark for correct measurement of bacterial cell, 1 mark for correct conversion of mm to  $\mu\text{m}$ , 1 mark for correct use of magnification formula, 1 mark for correct use of area formula, 1 mark for 12.5663...]

- 3.3 E.g. bacterial cells only needed to be counted in this study / the scientist did not need to see the cells' subcellular structures [1 mark], so a light microscope had a high enough resolution / magnification [1 mark].

### Pages 4-5 — Exchanging Substances

- 1.1 How to grade your answer:  
Level 0: There is no relevant information. [No marks]  
Level 1: There is a brief description of a suitable method but the answer is lacking in detail. There is little or no mention of what should have been measured or the variables that should have been controlled. [1 to 2 marks]  
Level 2: There is some description of a suitable method, including some detail on what should have been measured and the variables that should have been controlled. [3 to 4 marks]  
Level 3: There is a clear and detailed description of a suitable method, including a detailed description of what should have been measured and the variables that should have been controlled. [5 to 6 marks]

Here are some points your answer may include:

The student could have used the scalpel to cut the agar into cubes of different sizes. She should have cut at least three cubes of each size.  
She could have then placed one agar cube into a beaker, and added enough hydrochloric acid to cover the cube.  
She should have then timed how long it took for the cube to become completely clear.

She should have repeated this at least three times, using a different agar cube of the same size each time.  
She should have then calculated a mean result.  
She should have repeated the whole experiment with the different sized cubes and compared the results.  
She should have made sure that the experiments were carried out at the same temperature, that the same concentration of hydrochloric acid was used, that the same type of agar block was used, that she started recording the time at the same point after adding the acid to the beaker and that she was consistent in when she judged the agar block had become clear.

1.2 Any two from: e.g. the agar blocks were not the same shape as a bacterial cell [1 mark]. / The agar blocks were bigger than bacterial cells [1 mark]. / Exchange of substances across the outer surface of a bacterial cell may involve active transport as well as diffusion [1 mark]. / The agar blocks did not have a cell membrane [1 mark].

- 1.3  $1 \times 10^{-3} \text{ mm}$  [1 mark]

If you measure the height of each cell, cell A is roughly 9 mm high and cell B is roughly 22 mm high. So cell B is roughly 2.5 times taller than cell A. This means it would be about 1  $\mu\text{m}$  tall, which is the same as  $1 \times 10^{-3} \text{ mm}$ .

- 1.4 Cell A, because it has a bigger surface area to volume ratio than cell B [1 mark]. This means it will be able to absorb the substances it needs for metabolic reactions more quickly than cell B, so it will have a faster metabolic rate [1 mark].

- 2 In both types of cell, water molecules would have moved into the cells via osmosis [1 mark] because the sugar concentration in the beakers was lower than it was in the cells / because the sugar solution in the beakers had a higher water concentration than the cells [1 mark]. The animal cells may have become so swollen that they burst, whereas the plant cells had cell walls to support/strengthen them, which may have prevented them from bursting [1 mark].

## Topic B2 — Organisation

### Pages 6-9 — Organisation and Non-Communicable Diseases

- 1.1 By flattening the villi, coeliac disease reduces the surface area of the small intestine [1 mark]. This means that fewer products from the digestion of fat/fatty acids and glycerol molecules would be absorbed into blood [1 mark].
- 1.2 Pancreatitis may cause less lipase to be secreted from the pancreas [1 mark], meaning that less fat is digested/broken down (into fatty acids and glycerol) [1 mark]. Therefore, more fat will pass through the body and be present in the stools [1 mark].
- 1.3 The enzymes may be denatured when exposed to a high temperature [1 mark].
- 1.4 An obstruction in the tubes leading from the gallbladder could mean that less bile reaches the small intestine [1 mark]. This would mean that fats are not emulsified/broken down into tiny droplets as quickly [1 mark], so there is less surface area for enzymes to work on [1 mark]. This would reduce the rate at which fat is digested and absorbed [1 mark].
- 1.5 Too much LDL cholesterol in the blood can lead to fatty material building up [1 mark] inside arteries [1 mark]. This causes the arteries to become narrower, meaning that blood flows through them at a higher pressure [1 mark].
- 2.1 The right ventricle only pumps blood to the lungs (rather than the whole body) [1 mark]. Therefore, it does not need to pump blood with as great a force as the left ventricle, so is less likely to need support from a mechanical device [1 mark].