

**SAMPLE TEXTBOOK ANSWERS****Chapter 3 Cells**

The following are sample answers only. Other answers to the same questions may also be correct.

**Science inquiry****Activity 3.1 Observing cells***Studying your observations*

- 1** What happens to the light intensity when you adjust the iris diaphragm or wheel diaphragm?  
*Answer:* As the iris diaphragm is closed the light intensity is reduced: the smaller the opening in the wheel diaphragm the lower the light intensity.
- 2** How does focusing the condenser affect the light intensity?  
*Answer:* The focus of the condenser lens makes little apparent difference unless used on very high magnifications. At magnifications of  $\times 400$  or more, focusing the condenser lens will make the image appear sharper.
- 3** When you move the slide on the stage from right to left, which way does the image move?  
*Answer:* The image moves in the opposite direction – from left to right.
- 4** When you move the slide towards you, which way does the image move?  
*Answer:* The image moves in the opposite direction – away from you.
- 5** Compare what you can see with high power and low power. On which magnification do you see more of the specimen?  
*Answer:* More of the specimen can be seen on low power.
- 6** On which magnification is the image brighter?  
*Answer:* The image is brightest on the lowest magnification.
- 7** Multiply the magnification of each of the objective lenses by the magnification of each of the eyepieces. List the magnifications that are possible with your microscope.  
*Answer:* Answers will depend on the magnification of the lenses on the particular microscope.
- 8** What was the field diameter on low power?  
*Answer:* Answers will depend on the particular microscope used.
- 9** Estimate the diameter of the cheek cells in millimetres on the prepared slide.  
*Answer:* Answers will depend on the magnification used to view the cells.
- 10** One millimetre equals 1000 micrometres ( $\mu\text{m}$ ). What is your estimate of the diameter of an average cheek cell in micrometres?  
*Answer:* It will be the answer to Question 9 multiplied by 1000.
- 11** Draw a large, labelled diagram showing one or two cheek cells.  
*Answer:* Cheek cells are irregular in shape and each has a single nucleus.

**12** The cheek cells that you observed had been stained. Why would biologists stain cells?

*Answer:* Most cells are transparent. The staining enables the cells and their internal structures to be clearly seen.

### Activity 3.3 What size is it?

**1** If the field diameter is 0.5 mm, what is the approximate length and breadth of cell A in millimetres and in micrometres?

*Answer:*

Length = 0.25–0.28 mm, or 250–280  $\mu\text{m}$ , depending on accuracy of measurement.

Breadth = 0.10–0.12 mm, or 100–120  $\mu\text{m}$ , depending on accuracy of measurement.

**2** If the objective lens was changed from  $\times 40$  to  $\times 10$ , what would be the new field diameter?

*Answer:* 2 mm

**3** How many cells like cell A would fit end-to-end across the field with this new field diameter?

*Answer:* Approximately 7.7 cells ( $2 \div 0.26$ )

**4** What is the magnification of the student's drawing?

*Answer:* Actual length of drawing = 38 mm or 38 000  $\mu\text{m}$ ;  $38\,000 \div 100 =$  magnification of  $\times 380$

**5** Estimate the length and width of the cell shown in Figure 3.16.

*Answer:* 100  $\mu\text{m}$  = 8 mm on the page.

The length of cell on the page is approximately 38 mm, therefore:

$$38 \div 8 \times 100 = 475 \mu\text{m}$$

The width of cell on the page is 16 mm, therefore:

$$16 \div 8 \times 100 = 200 \mu\text{m}$$

Student answers will depend on how accurately they measure the 100  $\mu\text{m}$  scale on Figure 3.16. The important point is the method used for the calculations.

**6** Estimate the diameter of the nucleus of the cell.

*Answer:* The nucleus has a 5 mm diameter on the page.

$$5 \div 8 \times 100 = 62.5 \mu\text{m}$$

**7** How many of these cells would fit side by side across a field of view that has a diameter of 1.6 mm?

*Answer:* The field diameter converts to 1600  $\mu\text{m}$  and the width of cell to 200  $\mu\text{m}$ , therefore:

$$1600 \div 200 = 8 \text{ cells side by side}$$

## Review questions

**1** Describe the main parts of a cell.

*Answer:*

- Cell membrane
- Cytoplasm
- Various organelles, of which a major one is the nucleus
- A cytoskeleton

**2** Explain the difference between the cytosol and cytoplasm.

*Answer:* Cytoplasm is the thick fluid inside the cell membrane and all the structures that are suspended in the fluid, while the cytosol is the liquid part of the cytoplasm.

**3** What are organelles?

*Answer:* Organelles are structures suspended in the cytoplasm. Each type of organelle has a specific function.

**4** Describe the functions of the following organelles:

- mitochondria

*Answer:* The site where some of the chemical reactions of cellular respiration occur, making energy available to the cell

- endoplasmic reticulum

*Answer:* Membranes that provide a surface for chemical reactions and form channels for transporting or storing substances

- ribosomes

*Answer:* The sites where amino acids are joined to make proteins

- nucleus.

*Answer:* Contains DNA that determines the type of proteins a cell can make

**5** The nuclear membrane has large gaps in it. What is the importance of these gaps?

*Answer:* The nuclear pores allow large molecules to pass through the nuclear membrane.

**6** What is a vesicle? Describe two ways in which vesicles can be formed.

*Answer:*

- a Vesicles are bubbles of liquid in the cytoplasm. The bubble is surrounded by a membrane.
- b Some vesicles are formed at the edges of the membranes of the Golgi bodies; others are formed when particles or liquids are taken into the cell.

**7** Many cells have inclusions. Give two examples of inclusions.

*Answer:*

- a The haemoglobin in red blood cells
- b The pigment melanin, which is found in the pigmented cells in the skin, hair and iris of the eye

**8** Why are most cells microscopic?

*Answer:* The microscopic nature of most cells gives them a very large surface area in relation to their volume. Substances must pass into and out of the cell at the surface so small cells are able to exchange materials efficiently.

**9** Unlike plant cells, animal cells have no cell wall. How is the shape of a human cell maintained?

*Answer:* Human cells have a framework of protein fibres in the form of microfilaments and microtubules. These maintain the shape of the cell.

## Apply your knowledge

- 1 Draw up a three-column table to summarise the parts of a cell and their functions. In the left-hand column list the cell parts (include all the organelles); in the centre column describe the location of the part in the cell; in the right-hand column describe the function of the parts.

*Answer:*

Cell part	Location within cell	Function
Cell membrane	Around the outside	Determines which substances will enter or leave the cell
Cytoplasm	Fills the inside of the cell	Medium in which organelles are suspended
Nucleus	Usually near the centre	Contains DNA
Golgi body	Usually near the nucleus	Modifies and packages proteins for secretion
Mitochondria	Spread throughout the cytoplasm	Site of some of the reactions of cellular respiration
Ribosomes	Free in the cytoplasm or attached to the endoplasmic reticulum	Join amino acids to make proteins
Cytoskeleton	Throughout the cell	Maintains cell shape and assists movement
Endoplasmic reticulum	Extends from the cell membrane to the nuclear membrane	Stores and transports substances; site of many chemical reactions
Lysosomes	Suspended in the cytoplasm	Contain enzymes able to break down large molecules
Centrioles	Usually near the nucleus	Involved in cell reproduction

- 2 Imagine that you are the size of a large molecule and that you are taking a group of tiny human biology students on a guided tour through a typical cell. Describe what you would tell them about the structure and function of the various parts of the cell that they would see. Introduce them to the scientific terms that are used for the parts of the cell and their functions.

*Answer:* The tour should mention:

- all of the cell structures listed in the above table
- the form and location of each of the structures
- the contribution that each structure makes to cell functioning.

- 3 List the part/s of the body in which you would expect to find cells with:

- a particularly large numbers of mitochondria

*Answer:* Cells that require large amounts of energy, such as muscle cells

- b a very well-developed Golgi body

*Answer:* Cells that secrete large amounts of protein, such as cells of the digestive system that secrete digestive enzymes

- c very large numbers of ribosomes.

*Answer:* Cells that produce large amounts of proteins, such as the cells that produce digestive enzymes

Give reasons for your answer in each case.

- 4 Would you expect the cells of a large mammal, such as an elephant, to be larger than those of a small mammal, such as a mouse? Explain your answer.

*Answer:* The cells of a mouse and an elephant would be of similar size because all cells must be small so that they have a large surface area in relation to their volume. The large surface area is essential for efficient exchange of materials between the cell and its surroundings.

- 5 Some experts do not regard the nucleus as an organelle. Suggest possible reasons why they believe that the nucleus should be classified separately from other organelles.

*Answer:* The nucleus is much larger than the other organelles. It makes up about 10 per cent of the volume of the cell. It also contains structures within it such as the nucleolus, and it is filled with nucleoplasm. For these reasons some experts prefer not to think of the nucleus as an organelle.