

This is the **Foundation Combined Science** version. Only Foundation-level content is included. Higher Tier and Separate-only questions have been removed.

Cell Structure (4.1.1)

Specification reference: 4.1.1.1–4

Q1. State ONE difference between a eukaryotic cell and a prokaryotic cell.

[1 mark]

Q2. Describe the function of THREE organelles found in plant cells only.

[3 marks]

Q3. A student observes a cell with a nucleus, mitochondria and a large permanent vacuole, but no chloroplasts. State the type of cell and explain your reasoning using THREE features.

[4 marks]

Q4. Explain how cells become specialised. Give ONE named example of a specialised cell and describe how its structure is adapted for its function.

[3 marks]

Microscopy (4.1.1.5)

Specification reference: 4.1.1.5

Q5. Write the formula used to calculate the magnification of a microscope image.

[1 mark]

Q6. A student draws a cell with a length of 54 mm. The actual cell is 0.03 mm long. (a) Calculate the magnification. Show your working. (b) Convert the actual cell size to μm .

[3 marks]

Cell Division — Mitosis (4.1.2.1–2)

Specification reference: 4.1.2

Q7. State TWO uses of mitosis in the human body.

[2 marks]

Q8. Describe the sequence of events that occurs during mitosis, starting with DNA replication.

[4 marks]

Q9. Explain how cancer results from changes in the cell cycle.

[3 marks]

Stem Cells (4.1.2.3)

Specification reference: 4.1.2.3

Q10. Define the term stem cell and explain why stem cells are medically important.

[2 marks]

Q11. Compare embryonic stem cells and adult stem cells in terms of their properties and source.

[4 marks]

Diffusion (4.1.3.1)

Specification reference: 4.1.3.1

Q12. Define diffusion and state whether energy is required.

[2 marks]

Q13. Describe how THREE factors affect the rate of diffusion.

[3 marks]

Osmosis (4.1.3.2)

Specification reference: 4.1.3.2

Q14. Define osmosis precisely, using the terms water potential and partially permeable membrane.

[2 marks]

Q15. A student places potato cylinders in different concentrations of sucrose solution and records % change in mass. In a 1.0 mol/dm³ solution the potato lost 15% of its mass. Explain this result.

[3 marks]

Q16. Explain the difference between a turgid and a plasmolysed plant cell. State why turgidity is important for plants.

[3 marks]

Active Transport (4.1.3.3)

Specification reference: 4.1.3.3

Q17. State ONE difference between active transport and diffusion.

[1 mark]

Q18. Explain why root hair cells use active transport to absorb mineral ions from soil water.

[3 marks]

Q19. Glucose is absorbed from the small intestine into the blood by active transport. Explain why diffusion alone would not be sufficient.

[3 marks]

Total: 50 marks

Cell Structure (4.1.1)

Q1 (1 mark)

State ONE difference between a eukaryotic cell and a prokaryotic cell.

- Eukaryotic cells have a membrane-bound nucleus; prokaryotic cells do not [1] — accept any other correct difference e.g. prokaryotic have circular DNA / no membrane-bound organelles

Q2 (3 marks)

Describe the function of THREE organelles found in plant cells only.

- Cell wall (cellulose): provides rigid structural support, prevents cell from bursting [1]
- Chloroplasts: contain chlorophyll, site of photosynthesis [1]
- Permanent vacuole: filled with cell sap, maintains turgidity/turgor pressure [1]

Q3 (4 marks)

A student observes a cell with a nucleus, mitochondria and a large permanent vac...

- Plant cell [1]
- Has a permanent vacuole — characteristic of plant cells [1]
- Has a nucleus — eukaryotic cell [1]
- Absence of chloroplasts suggests it is not a leaf palisade cell but is still a plant cell (e.g. root cell) [1] — accept any three valid structural reasons

Q4 (3 marks)

Explain how cells become specialised. Give ONE named example of a specialised ce...

- Cells differentiate — genes are switched on or off [1]
- Named example: e.g. red blood cell — biconcave shape increases surface area for O₂ diffusion, no nucleus gives more space for haemoglobin [1+1] — accept any valid specialised cell with two linked adaptations

Microscopy (4.1.1.5)

Q5 (1 mark)

Write the formula used to calculate the magnification of a microscope image.

- Magnification = Image size ÷ Actual size [1]

Q6 (3 marks)

A student draws a cell with a length of 54 mm. The actual cell is 0.03 mm long. ...

- (a) Magnification = $54 \div 0.03 = \times 1800$ [2] — award 1 for correct substitution, 1 for correct answer
- (b) $0.03 \text{ mm} = 30 \mu\text{m}$ [1]

Cell Division — Mitosis (4.1.2.1–2)

Q7 (2 marks)

State TWO uses of mitosis in the human body.

- Growth — increasing the number of cells [1]
- Repair — replacing damaged or worn-out cells [1]

Q8 (4 marks)

Describe the sequence of events that occurs during mitosis, starting with DNA re...

- DNA replicates so each chromosome is copied [1]
- Chromosomes condense and become visible [1]
- Chromosomes line up at the equator of the cell [1]
- Spindle fibres pull chromosomes to opposite poles; cell divides → two genetically identical daughter cells each with the same chromosome number as parent [1]

Q9 (3 marks)

Explain how cancer results from changes in the cell cycle.

- Mutations occur in genes that normally control cell division [1]
 - Normal cell cycle checkpoints fail — cells no longer respond to signals to stop dividing [1]
 - Cells divide continuously and uncontrollably → tumour forms [1]
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Stem Cells (4.1.2.3)

Q10 (2 marks)

Define the term stem cell and explain why stem cells are medically important.

- An undifferentiated cell that can divide and differentiate into specialised cell types [1]
- Can potentially be used to replace damaged or diseased tissue (e.g. treating leukaemia with bone marrow transplant, or future treatments for Parkinson's, diabetes) [1]

Q11 (4 marks)

Compare embryonic stem cells and adult stem cells in terms of their properties a...

- Embryonic: can differentiate into any cell type (totipotent); adult: more limited range of cell types [1]
 - Embryonic: from early embryos (blastocyst); adult: from specific tissues e.g. bone marrow [1]
 - Embryonic: more versatile for therapy; adult: less ethically controversial [1]
 - Both can divide repeatedly by mitosis [1]
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Diffusion (4.1.3.1)

Q12 (2 marks)

Define diffusion and state whether energy is required.

- Net movement of particles from high to low concentration (down a concentration gradient) [1]
- Passive process — no energy (ATP) required [1]

Q13 (3 marks)

Describe how THREE factors affect the rate of diffusion.

- Concentration gradient: steeper gradient → faster diffusion [1]
 - Temperature: higher temperature → more kinetic energy → faster diffusion [1]
 - Surface area: larger surface area → more particles crossing at once → faster diffusion [1] — accept: thickness of membrane
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Osmosis (4.1.3.2)

Q14 (2 marks)

Define osmosis precisely, using the terms water potential and partially permeabl...

- Net movement of water molecules [1]
- From a region of high water potential to low water potential through a partially permeable membrane [1]

Q15 (3 marks)

A student places potato cylinders in different concentrations of sucrose solutio...

- The 1.0 mol/dm³ solution has a lower water potential than inside the potato cells [1]
- Water moves out of the potato cells by osmosis down the water potential gradient [1]
- Potato cells lose water → mass decreases by 15% [1]

Q16 (3 marks)

Explain the difference between a turgid and a plasmolysed plant cell. State why ...

- Turgid: water has entered by osmosis → vacuole presses cytoplasm against cell wall → cell is firm [1]
 - Plasmolysed: water has left by osmosis → cell membrane pulls away from cell wall → cell is limp [1]
 - Turgidity supports plant structure (without a skeleton) — prevents wilting [1]
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Active Transport (4.1.3.3)

Q17 (1 mark)

State ONE difference between active transport and diffusion.

- Active transport moves substances against the concentration gradient / requires energy (ATP); diffusion is passive and moves substances down the concentration gradient [1] — accept either difference

Q18 (3 marks)

Explain why root hair cells use active transport to absorb mineral ions from soil...

- The concentration of mineral ions in the soil water is often lower than inside the root cells [1]
- The ions need to move against the concentration gradient (from low to high) [1]
- Active transport uses energy (ATP from respiration) and carrier proteins to move ions against the gradient [1]

Q19 (3 marks)

Glucose is absorbed from the small intestine into the blood by active transport...

- After a meal, blood glucose concentration rises rapidly [1]
- The concentration of glucose in the blood may be higher than in the intestine — so diffusion would move glucose OUT of the blood, not in [1]
- Active transport allows glucose to be absorbed even against the concentration gradient [1]