



B1F Cell Biology: Foundation Tier Practice

AQA 8461 · Calculator allowed · about 90 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 Cells are the basic building blocks of living organisms.

(a) Give the name for the type of cell that contains chloroplasts and a cell wall. (1)

(b) Give the name for the cell type that commonly has many small vacuoles and no chloroplasts. (1)

(c) Name the organelle where aerobic respiration mainly happens in cells. (1)

(Total for Question 1 is 3 marks)

2 Complete the sentence: the cytoplasm is the part of the cell where many chemical reactions occur.

(a) State two functions of the cell membrane. (2)

(Total for Question 2 is 2 marks)

3 A student looks at onion cells under a light microscope and sees a clear rectangular shape with a darker small circle inside each cell.

(a) Identify the structure that appears as the clear rectangular outline of each onion cell. (1)

(b) Identify the darker small circle seen inside each cell. (1)

(Total for Question 3 is 2 marks)

4 Microscopes have an eyepiece lens and objective lens. The magnification of the image equals magnification of eyepiece times magnification of objective lens.

- (a) If the eyepiece is 10x and the objective lens is 20x, calculate the total magnification. (2)

- (b) A cell measures 4 mm on the image under 200x magnification. Calculate the real size of the cell in micrometres (micrometres). (1)

(Total for Question 4 is 3 marks)

5 A second cell is viewed using the same microscope setup as question 4 (total magnification 200x). This cell has a real size of 15 micrometres. Calculate the size of its image, giving your answer in millimetres.

- (a) Calculate the image size in micrometres, using image size = real size x magnification. (2)

- (b) Convert your answer to millimetres. (1)

(Total for Question 5 is 3 marks)

6 Cells may be specialised for particular jobs. The diagram shows a simple drawing of three specialised cells: a red blood cell, a sperm cell and a root hair cell.

- (a) State one feature of a red blood cell that helps it carry oxygen. (1)

- (b) State one feature of a sperm cell that helps it reach an egg. (1)

- (c) State one feature of a root hair cell that helps it absorb water from the soil. (1)

(Total for Question 6 is 3 marks)

- 7** Cells divide by different processes. In growth and repair of body tissues, cells divide to make two identical daughter cells.

Explain, in simple terms, why cell division by mitosis is important for growth and repair in multicellular organisms. Give two linked points: what happens during the division and why it matters for the organism.

(Total for Question 7 is 6 marks)

- 8** Diffusion is the movement of particles from an area of higher concentration to an area of lower concentration. Consider a setup where a cube of agar jelly contains a pH indicator and is placed in acid solution; the indicator changes colour as acid diffuses into the jelly.

(a) Describe what you would observe in the agar jelly over time as the acid diffuses in, and explain why the change spreads from the surface towards the centre. (4)

(b) Give one variable that should be controlled in this practical to make the results fair, and say how to control it. (2)

(Total for Question 8 is 6 marks)

9 Plants and animals exchange gases with their environment. A simple investigation measures how the rate of gas exchange changes with the surface area of a respiratory surface.

- (a)** A student measures the time taken for a small organism to absorb a dye across a respiratory surface. With surface area 2 cm² the time is 120 s; with surface area 4 cm² the time is 60 s. Calculate the relationship between surface area and rate (rate = 1 / time). Give the two rates and explain the pattern. **(4)**

- (b)** Suggest one limitation of this simple investigation and one way to improve it. **(2)**

(Total for Question 9 is 6 marks)

10 Organisms are made of different types of cells organised into tissues and organs. Consider a leaf: it contains tissues such as palisade mesophyll, spongy mesophyll and epidermis.

- (a)** Describe two features of palisade mesophyll cells that make them adapted for photosynthesis and explain how each feature helps. **(6)**

(Total for Question 10 is 6 marks)

- 11** Osmosis is the movement of water across a partially permeable membrane from a region of higher water potential to a region of lower water potential. A student places a potato cylinder in pure water and another identical cylinder in a sugar solution and measures mass before and after 30 minutes.
- (a) Predict and explain what will happen to the mass of the potato cylinder in pure water. (2)
- (b) The potato cylinder in sugar solution lost 0.8 g mass over 30 minutes. If its original mass was 12.0 g, calculate the percentage change in mass (percentage change = change / original x 100). Give your answer to 2 significant figures. (3)

(Total for Question 11 is 5 marks)

- 12** Microscopes and staining are used to see cell structures. A simple stain improves contrast so structures like the nucleus are easier to see.
- (a) State one reason why a stain is used when preparing slides of cells for light microscopy. (1)
- (b) Give one safety precaution when using stains and sharp instruments while preparing slides, and explain why it is needed. (4)

(Total for Question 12 is 5 marks)

Mark scheme · B1F Cell Biology: Foundation Tier Practice

Question 1

- (a) **B1** plant cell cao
- (a) **Answer: Plant cell**
- (b) **B1** animal cell cao
- (b) **Answer: Animal cell**
- (c) **B1** mitochondrion (accept mitochondria) cao
- (c) **Answer: Mitochondrion**

Question 2

- (a) **B1** controls movement of substances in and out of the cell, oe
- (a) **B1** acts as a barrier/separates cell from its surroundings or allows recognition/communication, oe
- (a) **Answer: Controls movement of substances in and out of the cell; acts as a barrier between the cell and its surroundings or enables cell communication.**

Question 3

- (a) **B1** cell wall cao
- (a) **Answer: Cell wall**
- (b) **B1** nucleus cao
- (b) **Answer: Nucleus**

Question 4

- (a) **M1** substitutes: total magnification = 10×20
- (a) **A1** 200x cao
- (a) **Answer: 200x**
- (b) **B1** 20 micrometres cao
- (b) **Answer: 20 micrometres**

Question 5

- (a) **M1** substitutes: image size = 15×200
- (a) **A1** 3000 micrometres cao
- (a) **Answer: 3000 micrometres**
- (b) **B1** 3 mm cao
- (b) **Answer: 3 mm**

Question 6

- (a) **B1** has no nucleus so more space for haemoglobin or biconcave shape to increase surface area for gas exchange, oe
- (a) **Answer: Has no nucleus so more space for haemoglobin (or biconcave shape to increase surface area).**
- (b) **B1** has a tail (flagellum) for swimming or many mitochondria to provide energy for movement, oe
- (b) **Answer: Has a tail (flagellum) for swimming or many mitochondria for energy.**
- (c) **B1** long hair-like extension increases surface area for absorption, oe
- (c) **Answer: Has a long hair-like extension to increase surface area for absorption.**

Question 7

- **Level 3** (5-6): Detailed explanation that links the process of mitosis (replication of genetic material and division to produce two identical cells) to growth or repair, with clear reasoning and at least two correct points.
- **Level 2** (3-4): Partial explanation describing either the steps (replication and division) or the consequence (growth or repair) with some linkage between process and function.
- **Level 1** (1-2): Simple statements about cell division or that it makes more cells, without clear link to growth or repair.
- **Indicative content:**
 - mitosis copies the chromosomes so each daughter cell has the same genetic information
 - the cell divides to produce two identical cells
 - this increases the number of cells for growth
 - this replaces damaged or dead cells during repair
 - ensures daughter cells can perform the same functions as the original cell

Question 8

- (a) **M1** describes colour change starting at the outside surface and moving inwards (observation)
- (a) **M1** states particles move from higher to lower concentration (definition of diffusion) or acid particles move into jelly
- (a) **A1** explains gradient causes net movement from outside to inside, so outer regions change first
- (a) **A1** explains over time indicator changes nearer the centre as acid diffuses further in, oe
- (a) **Answer: The colour change starts at the surface and spreads inward because acid particles diffuse from the higher concentration outside the jelly into the lower concentration inside; the outer regions change first and, over time, the acid reaches nearer the centre so the colour change progresses inward.**
- (b) **B1** identifies a variable e.g. temperature, concentration of acid, size of agar cube, or volume of solution
- (b) **B1** gives how to control it e.g. keep temperature constant using a water bath, use same acid concentration, cut cubes the same size, use same volume of solution for each test, oe
- (b) **Answer: Control the size of the agar cube by cutting all cubes to the same dimensions; also use the same acid concentration for each trial.**

Question 9

- (a) **M1** calculates rate for 2 cm²: $1 / 120 = 0.0083 \text{ s}^{-1}$ (or 0.0083 per s)
- (a) **M1** calculates rate for 4 cm²: $1 / 60 = 0.0167 \text{ s}^{-1}$
- (a) **A1** states pattern: doubling surface area doubles the rate or rate increases as surface area increases
- (a) **A1** links to diffusion: larger surface area gives more area for exchange so faster rate, oe
- (a) **Answer: Rate at 2 cm² = 0.0083 s^{-1} ; rate at 4 cm² = 0.0167 s^{-1} . Doubling surface area doubles the rate because more area allows more exchange.**
- (b) **B1** identifies a limitation e.g. temperature not controlled, measurement of time imprecise, dye diffusion not identical to gas exchange, small sample size, oe
- (b) **B1** gives an improvement e.g. keep temperature constant, use a stopwatch with more precise timing, use more repeats and take an average, use a gas sensor, oe
- (b) **Answer: Limitation: temperature not controlled which affects rate. Improvement: keep temperature constant using a water bath and repeat trials to average results.**

Question 10

- (a) **M1** states feature 1: many chloroplasts
- (a) **A1** explains feature 1: many chloroplasts absorb more light so more photosynthesis
- (a) **M1** states feature 2: tall, column-shaped cells packed near the upper surface
- (a) **A1** explains feature 2: packing increases number of cells in region receiving light so increases light capture
- (a) **M1** alternative feature could be thin cell walls or large vacuole
- (a) **A1** explains alternative feature: thin walls reduce diffusion distance or large vacuole positions chloroplasts nearer periphery, oe
- (a) **Answer: Any two explained features: many chloroplasts so more light absorbed; tall, column-shaped cells packed near the top so many cells absorb light; or thin walls/large vacuole reducing diffusion distance or positioning chloroplasts.**

Question 11

- (a) **B1** predicts mass will increase
- (a) **B1** explains because water moves into the potato by osmosis from higher water potential outside to lower inside, oe
- (a) **Answer: Mass will increase because water moves into the potato by osmosis from the pure water (higher water potential) into the potato cells (lower water potential).**
- (b) **M1** substitutes and calculates: percentage = $(0.8 / 12.0) \times 100$
- (b) **A1** 6.7% cao
- (b) **B1** gives correct rounding to 2 significant figures or states 6.7% explicitly
- (b) **Answer: 6.7%**

Question 12

- (a) **B1** to increase contrast so cell structures are easier to see
- (a) **Answer: To increase contrast so cell structures are easier to see.**
- (b) **B1** identifies a precaution e.g. wear gloves, avoid splashes, use scissors not scalpels, handle slides carefully, dispose of stain correctly
- (b) **B1** explains reason e.g. gloves protect skin from stain, avoiding splashes prevents stains in eyes, careful handling avoids cuts, oe
- (b) **B1** identifies a second related precaution or detail e.g. use staining in well-ventilated area or wash hands after, oe
- (b) **B1** explains second reason or links to safety e.g. ventilation reduces inhalation risk or washing hands removes chemical residue
- (b) **Answer: Wear gloves and avoid splashes because stains can irritate or damage skin and eyes; handle slides carefully to avoid cuts, and work in a ventilated area to avoid breathing fumes.**