

GCSE / IGCSE Biology – Organisation and Physiology

GCSE / IGCSE (Edexcel / Cambridge style) · Total marks: 34 · Answers on the last page

Covers digestion, circulation, breathing, plant transport, coordination and homeostasis. A calculator is needed for a few numerical questions; otherwise write full-sentence explanations as required for exam-style biology questions.

Section A – Knowledge and Understanding

1. Name the enzyme that digests starch, and state two places in the human body where it is produced.
[3]
2. Describe the role of bile in digestion. [2]
3. State the function of red blood cells and explain one structural adaptation that helps them carry out this function. [3]
4. Name the type of blood vessel that carries blood away from the heart and describe one structural feature suited to this function. [2]
5. State three features of alveoli that adapt them for efficient gas exchange. [3]

Section B – Application (Calculator allowed)

6. A patient has a resting heart rate of 72 beats per minute and a stroke volume of 70 cm^3 . Calculate their cardiac output, in cm^3 per minute. [2]
7. Explain, using the term water potential, why plant root hair cells absorb water from the surrounding soil by osmosis. [3]
8. Describe the pathway taken by water through a plant, from the root to the leaf, naming the tissue involved. [3]
9. Explain how the body lowers blood glucose concentration after a meal, naming the hormone and organ involved. [3]
10. A student places potato pieces into a sucrose solution that is more concentrated than the potato cell sap. Explain, in terms of osmosis, what happens to the potato pieces. [2]

Section C – Extended and Data Response (Calculator allowed)

11. The image of a plant cell on a photograph has a measured length of 50 mm. The actual length of the cell is 0.05 mm. Calculate the magnification of the image. [2]
12. Explain, in terms of surface area to volume ratio, why multicellular organisms need specialised exchange surfaces and transport systems, while single-celled organisms do not. [3]
13. Explain how the structure of the small intestine wall is adapted to maximise the absorption of digested food, referring to at least three features. [3]

Answers

Check your working against these. If an answer does not match, try the question again before looking for the method.

1. Amylase; produced in the salivary glands and the pancreas.
2. Bile emulsifies fats, breaking large fat droplets into smaller droplets and increasing their surface area for lipase to act on; bile is also alkaline and neutralises stomach acid entering the small intestine, giving a suitable pH for enzyme action.
3. Function: to transport oxygen around the body, bound to haemoglobin. Adaptation: red blood cells have a biconcave disc shape, which increases their surface area to volume ratio, allowing faster diffusion of oxygen (accept: no nucleus, allowing more space for haemoglobin).
4. Arteries; they have thick, muscular and elastic walls, allowing them to withstand and maintain the high pressure of blood pumped from the heart.
5. Any three of: large surface area; walls one cell thick, giving a short diffusion distance; moist lining, which allows gases to dissolve; good blood supply (surrounded by capillaries), maintaining a steep concentration gradient for diffusion.
6. cardiac output = heart rate $\times$ stroke volume = $72 \times 70 = 5040 \text{ cm}^3$ per minute
7. The soil water has a higher (less negative) water potential than the cytoplasm/cell sap of the root hair cell, which contains dissolved solutes; water moves by osmosis from a region of higher water potential to a region of lower water potential, across the partially permeable cell membrane, into the root hair cell.
8. Water is absorbed by root hair cells, moves across the root cortex cells into the xylem, is then transported up the stem through xylem vessels (driven by transpiration pull, cohesion between water molecules, and adhesion to vessel walls), and passes into the leaf mesophyll cells, from where it evaporates and diffuses out through the stomata (transpiration).
9. The pancreas detects the rise in blood glucose concentration and secretes the hormone insulin into the blood; insulin causes liver and muscle cells to take up glucose from the blood and convert it into glycogen for storage (glycogenesis), lowering the blood glucose concentration back towards normal (negative feedback).
10. The sucrose solution has a lower water potential than the cells inside the potato pieces, so water moves out of the potato cells into the solution by osmosis, down the water potential gradient; the potato pieces lose mass and become flaccid (softer).
11. magnification = $\frac{\text{image size}}{\text{actual size}} = \frac{50}{0.05} = 1000\times$
12. As an organism increases in size, its volume increases faster than its surface area, so its surface area to volume ratio decreases; diffusion alone therefore cannot supply oxygen and nutrients to, or remove waste from, all the cells of a large multicellular organism quickly enough, so specialised exchange surfaces (e.g. lungs) and transport systems (e.g. the circulatory system) are needed. Single-celled organisms are very small and have a large surface area to volume ratio, so diffusion alone is fast enough to meet their needs.
13. Villi and microvilli greatly increase the surface area available for absorption; the wall is only one cell thick, giving a short diffusion distance; a good blood supply (dense capillary network) maintains a steep concentration gradient, speeding up diffusion and enabling active transport of nutrients; lacteals within the villi absorb fatty acids and glycerol into the lymphatic system.

Need this topic taught, not just practised? Book a trial lesson at 50% off with Mr. Ahmad — online worldwide or in person in Dubai.

WhatsApp **+971 55 373 5695** · mathandsciencetutor.com