



ANSWER BOOK

Digestion and absorption: one tube, four chemistries

Nutrition, digestion and health evidence · Unit B10

AQA 3.3.3 · OCR A 2.1.4, 2.1.5 (the enzymes and the transport, not digestion as a topic)
Edexcel A Topic 1.5-1.6 · CAIE 4.2 (membrane transport only)

5 questions · 17 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **B1** maltase, which hydrolyses maltose to two glucose molecules. **B1** it is built into the cell-surface membrane of the epithelial cells lining the ileum, with its active site facing the gut contents. [2]
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SECTION B · Standard, 3 to 5 marks

- B1** **B1** an exopeptidase hydrolyses the peptide bond at an end of a chain, removing one amino acid at a time, so it can only work where there is a free end. **B1** a chain of three hundred amino acids has only two ends, so the number of places an exopeptidase can start is very small however much enzyme is present. **B1** an endopeptidase hydrolyses peptide bonds in the interior of the chain, and each internal cut produces two more ends. **B1** far more ends means far more sites at which the exopeptidases can act at the same time, so the overall rate of hydrolysis rises. [4]
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- B2** **B1** bile salts are amphipathic, coating a lipid surface with the hydrophobic face inwards, so the droplets repel one another instead of merging and the churning of the gut can break them into much smaller ones that stay broken. **B1** that emulsification greatly increases the total surface area of lipid, so more ester bonds are accessible to water-soluble pancreatic lipase and the rate of hydrolysis rises, although bile itself breaks no bond. **B1** monoglycerides and fatty acids, with bile salts and any fat-soluble vitamins, assemble into micelles that carry them through the watery layer next to the epithelium and release them at the membrane, keeping the concentration of free products high there. **B1** the micelle itself is not absorbed: monoglycerides and fatty acids are small and non-polar, so they diffuse straight through the phospholipid bilayer by simple diffusion. [4]
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- B3** **B1** a sodium-potassium pump in the basal membrane hydrolyses ATP and moves three sodium ions out of the epithelial cell for every two potassium ions in, so the sodium concentration inside the cell falls below the concentration in the lumen. **B1** a co-transporter protein in the apical membrane binds one glucose molecule together with two sodium ions. **B1** sodium moves into the cell down the electrochemical gradient the pump created and glucose is carried in with it, against its own concentration gradient, with no ATP hydrolysed at this membrane. **B1** glucose then leaves the far side of the cell into the blood by facilitated diffusion through a different carrier protein, down the gradient its accumulation has created. [4]
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B4 **B1** much of the surface area for absorption has gone, with fewer villi and microvilli, so fewer products of digestion are absorbed before the contents pass on to the large intestine. **B1** less glucose and fewer amino acids are absorbed, so less substrate is available for respiration and stored lipid and body protein are respired instead, and mass falls. **B1** monoglycerides and fatty acids are also absorbed across the ileum epithelium, so with less epithelium available a greater proportion of the products of lipid digestion is left in the lumen and leaves in the faeces. [3]
