

- 1 (a) ref. to size/age/species of plant;
light; (R) sun unqual.
carbon dioxide; (R) air unqual. (R) oxygen
temperature/heat/warmth;
soil type AW;
pH (of soil);
spacing of plants AW; (A) other plausible answers **max. [3]**
- (b)(i) **(description)** **max. 2**
- ref. to reduced growth/stunted growth/plant shorter or smaller AW;
 - upper leaves pale green + bottom leaves yellow/dead or surface area smaller;
 - stem thin(ner); (R) feeble/weak unqual.
 - roots small(er) AW;
- (explanation)**
- to form + proteins/amino acids/other viable example of use of nitrate;
 - ref. to lack of chlorophyll/chlorophyll is a protein; **max. [4]**
- (ii) **(description)**
(lower) leaves pale green + yellow/(upper) leaves paler than normal;
- (explanation)**
magnesium needed to form + chlorophyll/chloroplasts/
photosynthesis (or description) will be reduced AW; **[2]**
- (c)(i)
- ref. to use of nitrate by (previous) crop AW/weeds or crop eaten by animals;
 - ref. to nitrate changed to protein in crop AW;
 - ref. to action of denitrifying bacteria/waterlogging of soil;
 - ref. to leaching; (A) washed away **max. [2]**
- (ii)
- addition of + manure/compost/sewage sludge;
 - addition of fertiliser/named nitrogen-based fertiliser;(R) nitrates unqual
 - ref. to growth of + leguminous AW plants/suitable named plants e.g. clover, peas, beans; (R) crop rotation unqual.
 - leave fallow and plough in/plough in dead plants ;
 - improve soil drainage/aerate soil AW; **max. [2]**

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(d)

(leguminous plants)

(insectivorous plants)

- ref. to leguminous plants AW/presence of nodules; (R) nodes
- ref. to nitrogen-fixing bacteria;
- ref. to conversion of nitrogen into ammonium salts/nitrates;
- made available to plant AW/to provide amino acids;

- ref. to insects/insectivorous plants;
- ref. to enzymes;
- ref. to digestion AW of proteins;
- to provide amino acids/amino acids absorbed;

- ref. to use of active transport/active uptake;
- presence of more/lots of + mitochondria/respiration;
- (absorption) against concentration gradient AW;

max. [3]

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Total: 16
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Question	Answer	Mark	Guidance
2 (a) (i)	iodine solution diffused, into the bag / through the (Visking) tubing ; iodine molecules <u>small</u> (enough to pass through the membrane) ; iodine solution stains starch ora ; no starch diffused, out of the bag / through the (Visking) tubing ; starch molecules too <u>large</u> (to pass through the membrane) ; ref to pore / AW, size ;	[max 4]	I osmosis
(ii)	temperature ; (surface) area ; concentration (gradient) / water <u>potential</u> ; size / type, of molecule ; thickness / distance, across membrane / permeability (of membrane) ; pressure ; (number of) protein, channels / pumps / AW ; energy / number of mitochondria ;	[max 3]	I distance / thickness unqualified
(b) (i)	<i>from muscle cell</i> (produced in) mitochondrion ; diffused ; (diffused) in cytoplasm / tissue fluid / (blood) plasma ; through membrane ; through capillary wall ; <i>from blood:</i> vein / vena cava / pulmonary artery / heart ; travels to lungs ; into alveoli ; exhaled / breathed out / excreted ;	[3]	A red blood cell I exit the body unqualified

Question	Answer	Mark	Guidance
2 (ii)	<p>thin, wall/epithelium ; for efficient, diffusion/gas exchange ;</p> <p>small, diameter/lumen ; idea that many capillaries can fit into tissues/capillaries reach (every cell) throughout the body/relative size to red blood cell ;</p> <p>extensive network ; large surface for diffusion ;</p> <p>capillary cells have pores ; to allow substances to pass in and out of the blood easily ;</p>	[max 3]	<p>adaptations must be linked to correct feature max 2 for features only</p> <p>A one cell thick R 'thin cell wall'</p>
(c)	<p>diffusion ; down concentration gradient ;</p> <p>(diffuses) through stoma/stomata ; (through) (intercellular) air space/(between) spongy mesophyll ; into/reached, palisade, mesophyll/cell ; chloroplast ;</p> <p>AVP ; e.g. dissolve/diffuse, through cell wall/cell membrane/cytoplasm</p>	[max 4]	<p>A lower concentration of carbon dioxide inside leaf / ora ;</p> <p>A into guard cell/spongy, mesophyll/cell I chlorophyll</p>
		[Total: 17]	

3 (a)	<u>lock and key</u> mechanism; substrate fits into enzyme; (shape of) substrate is complementary to, enzyme/active site; ref to active site; substrate breaks/product(s) forms/product(s) leaves enzyme; enzyme, free for next reaction/not used up/remains unchanged; AVP;	max 3	e.g. lowers activation ener
(b)	(cellulose) <u>cell wall</u> ;	1	

Question	Answer	Marks	Additional Guidance
3 (c) (i)	<p>protease activity, similar /AW, on both sites;</p> <p>all enzyme activity is, greater /better /faster, in site A;</p> <p>cellulase activity on site A greater than protease activity on site A;</p> <p>cellulase activity, higher on site A, than site B /ORA;</p> <p>cellulase and protease activity on site B similar;</p> <p>use of data with units to support any of these marking points;</p>	max 3	do not award data quote unqualified
(ii)	<p>pH /water content, no effect on protease activity;</p> <p>cellulase more active, at higher pH /less acidic environment;</p> <p>cellulase more active, at lower soil moisture;</p> <p>ref to <u>optimum</u> pH of, protease /cellulase /enzymes;</p> <p>low pH may denature cellulase;</p> <p>idea of different leaf composition;</p> <p>size of leaves /surface area / species of leaf;</p> <p>different stage of decomposition;</p>	max 3	
(d)	<ol style="list-style-type: none"> 1 ref to, decomposers /bacteria /fungi; 2 proteins are broken down to amino acids; 3 by proteases; 4 amino acids converted to, ammonia /ammonium (ions); 5 deamination; 6 ammonia /ammonium ions, converted to nitrite ions; 7 nitrites converted to nitrate ions; 8 nitrification /oxidation /nitrifying bacteria; 9 nitrate ions absorbed by plants; 	max 3	<p>protease is linked to MP2</p> <p>ammonia to nitrate = 1 A nitrites A nitrates ammonia to nitrite and then to nitrate = 2 A nitrates</p>
(e) (i)	<u>nitrogen fixation</u> ;	1	

Question	Answer	Marks	Additional Guidance
3 (ii)	root nodules (on legumes); free living bacteria; <u>nitrogen-fixing bacteria</u> ; nitrogen, converted to, ammonium/ammonia/amino acids;	max 2	<ul style="list-style-type: none"> I lightning I nitrate(s) I nitrification/nitrifying bacteria
		[Total: 17]	