Plant Nutrition

Mark Scheme 6

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Plant Nutrition
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 6

Time Allowed: **60 minutes**

Score: **/50**

Percentage: **/100**

1 **(** ref. to size/age/species of plant;
light; Ⓡ sun unqual.
carbon dioxide; Ⓡ air unqual. Ⓡ oxygen
temperature/heat/warmth;
soil type AW;
pH (of soil);
spacing of plants AW; Ⓐ 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); Ⓡ 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; Ⓐ washed away **max. [2]**

(ii)

- addition of + manure/compost/sewage sludge;
- addition of fertiliser/named nitrogen-based fertiliser; Ⓡ nitrates unqual
- ref. to growth of + leguminous AW plants/suitable named plants e.g. clover, peas, beans; Ⓡ crop rotation unqual.
- leave fallow and plough in/plough in dead plants ;
- improve soil drainage/aerate soil AW; **max. [2]**

1 **(d)**

(leguminous plants)

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

(insectivorous plants)

- 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]**

Total: 16

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

3	**(a)**	lock and key 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) cell wall;	**1**	

Question	Answer	Marks	Additional Guidance
3 (c) (i)	protease activity, similar / AW, on both sites; all enzyme activity is, greater / better / faster, in site **A**; cellulase activity on site **A** greater than protease activity on site **A**; cellulase activity, higher on site **A**, than site **B** / ORA; cellulase and protease activity on site **B** similar; use of data with units to support any of these marking points;	**max 3**	do not award data quote unqualified
(ii)	pH / water content, no effect on protease activity; cellulase more active, at higher pH / less acidic environment; cellulase more active, at lower soil moisture; ref to <u>optimum</u> pH of, protease / cellulase / enzymes; low pH may denature cellulase; idea of different leaf composition; size of leaves / surface area / species of leaf; different stage of decomposition;	**max 3**	
(d)	**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**	protease is linked to **MP2** ammonia to nitrate = 1 **A** nitrites **A** nitrates ammonia to nitrite and then to nitrate = 2 **A** nitrates
(e) (i)	<u>nitrogen</u> <u>fix</u>ation**;**	**1**	

Question	Answer	Marks	Additional Guidance
3 (ii)	root nodules (on legumes); free living bacteria; nitrogen-fixing bacteria; nitrogen, converted to, ammonium / ammonia / amino acids;	max 2	**I** lightning **I** nitrate(s) **I** nitrification / nitrifying bacteria
		[Total: 17]	