Plant Nutrition

Mark Scheme 3

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Plant Nutrition
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 3

Time Allowed: **69 minutes**

Score: **/57**

Percentage: **/100**

1 **(a)**			
1	(CO_2) is a greenhouse gas / causes (increase in) (enhanced) greenhouse effect **;**		**Ignore** *descriptions* of greenhouse effect
2	global warming **;**		
3, 4	any two qualified examples of environment effects of global warming e.g. flooding, extreme weather conditions, qualified habitat change, reduced biodiversity **;;**		**Ignore** *descriptions* of global warming
5	increase in rate of photosynthesis **;**		
6	causes increase in, plant growth / crop yield / vegetation **;**	[max 4]	**Ignore** ref to deforestation
(b)	*nitrate ions (max 3)*		
1	needed to make amino acids **;**		**Mpt 1 A** proteins or nucleic acids
2	amino acids to proteins **;**		
3	protein needed for growth **;**		
4	suitable use of protein ; e.g. membranes / enzymes		
	magnesium ions (max 2)		
5	needed for making chlorophyll **;**		
6	to absorb (much) light **;**		
7	for (energy for) photosynthesis **;**		
8	for producing sugars / organic compounds produced / energy available **;**	[max 4]	
(c) (i)	eutrophication **;**	[1]	
(ii)			
1	dead plant material **;**		
2	decomposed by, bacteria / microorganisms / decomposers **;**		
3	use oxygen in (aerobic) respiration **;**	[max 2]	
(d)			
1	sedimentation / filtration / screening **;**		
2	digestion by, bacteria / fungi / decomposers / microorganisms **;**		
3	with aeration (tank) / trickle filter **;**		
4	second settling tank (to remove / collect microorganisms) **;**		
5	treated with, chlorine / ozone / UV **;**		
6	collection of water from evaporator **;**	[max 3]	
		[Total 14]	

2 (a) (i)	light <u>intensity</u> **;** constant **;** **A** control(led) variable ref to limiting factor **;** intensity / amount of light, will affect (rate of) photosynthesis	max [2]	***ignore*** refs to temperature change
(ii)	raw material for / 'is needed for' / AW, photosynthesis **;** maintain suitable concentration **;** carbon dioxide, concentration / AW, is / could be / wasn't a limiting factor **;**	max [2]	**A** 'amount' for concentration, **A** fixed quantity
(b)	*rate of photosynthesis ('it')* general description – increases and decreases **;** peak / maximum rate, at 30 °C **;** optimum temperature is 30 °C **;** use of two figures from the table to illustrate, including units **;**	max [3]	***ignore*** droplet movement unqualified
(c)	if no enzymes then rate should increase as temperature increases **;** but rate decreases, above 30 °C / at high temperatures **;** enzymes are denatured **;** ref to active site destroyed **;** substrate no longer fits into active site **;** reaction not catalysed / AW **;**	max [4]	**A** (30 °C) optimum temperature / described
(d)	ref to fewer limiting factors **;** higher temperatures / hot temperatures**;** higher rates of photosynthesis **;** more food for, growth / reproduction **;** no, grazers / animals to feed on it **;** more suitable habitats / more fertile soils / more nutrients **;** no disease **;** fewer / no, competitors **;** AVP **;**	max [2]	This MP is dependent on making point 3. **A** no predators **R** space
	[Total:13]		

Question			E Answers	Marks	Additional Guidance
3	(a)		$CO_2 + H_2O$; → $C_6H_{12}O_6 + O_2$; $6O_2$, $6CO_2$, $6H_2O$;	3	marks for: correct formulae for carbon dioxide and water correct formulae for glucose and oxygen balancing the equation **ignore** word equation
	(b)		4.98 ;	1	
	(c)	(i)	constant light <u>intensity</u> / ora; *idea that* light intensity is not the factor that is varied / not the independent variable / only carbon dioxide is varied / it is a control(led) variable ;	2	**accept**: if changed, would change rate of photosynthesis itself / AW **R** simply 'makes results invalid'
		(ii)	gas / oxygen / air, collects at top of syringe / from plant or photosynthesis ; creates pressure to **force** water down the tube ;	2	**R** CO_2 **A** push
	(d)		concentration of (sodium) hydrogen carbonate / mol per dm^3 + rate of photosynthesis (1000 / t) ; point plotted correctly ; line of best fit ;	3	**A** ecf from **(b)**
	(e)		rate of photosynthesis increases as concentration of carbon dioxide increases (up to 0.07 mol per dm^3); data quote ; carbon dioxide (concentration) is limiting factor ; <u>after 0.07 mol per dm^3</u> :- rate of photosynthesis remains (near) constant ; data quote ; carbon dioxide (concentration) is **not** the limiting factor ; light intensity / temperature, is limiting factor ;	max 5	**A** increases very little
				[Total: 16]	

<table>
<tr><th>Question</th><th colspan="2">E answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>4 (a)</td><td colspan="2">$6CO_2 + 6H_2O$; → $C_6H_{12}O_6 + 6O_2$;

correctly balanced ;

if no marks for the balanced equation allow one mark for correct word equation if given</td><td>[3]</td><td>correct equation = 3 marks

if formulae of molecules are correct but equation is not correctly balanced = 2 marks
with one mark for each side of the equation</td></tr>
<tr><td>(b)</td><td colspan="2"><table>
<tr><th>features</th><th>functions</th></tr>
<tr><td>A</td><td>transparent to allow light to penetrate into the leaf</td></tr>
<tr><td>B</td><td>max one
open / close, stoma(ta) ;
allow movement of, gas(es) / oxygen / carbon dioxide / <u>water vapour</u> ;
allows / controls rate of, transpiration ;
ignore gas exchange / movement of air</td></tr>
<tr><td>C</td><td>absorbs light / photosynthesis / starch or sugar production ;</td></tr>
<tr><td>D</td><td>buoyancy / floating / diffusion or movement of gas or named gas ;</td></tr>
</table></td><td>[3]</td><td>if more than one function given in a box, take the first answer. If this is contradicted by the second answer then award 0.

A controls size of stoma(ta)
A for (named) gas to, enter / leave

ignore gas exchange
R gas(es) in and / or out</td></tr>
</table>

Question	E answers	Mark	Additional Guidance
4 (c) 1 2 3 4 5 6 7 8	large air spaces / large spongy mesophyll ; **A** alternatives for large for, buoyancy / floating ; leaves float ; efficient at absorbing light / 'gets more light' / AW ; stomata in upper, surface / epidermis ; **A** ora diffusion / movement, of gas / gases (from the air) ; **R** 'stops entry of water' thin cuticle ; no need to reduce water loss by transpiration ;	[2 max]	*mark **first** 'way' only* *marking points are in pairs – only one pair is needed to gain the two marks* ***ignore*** gas exchange in this question **A** 'top of the leaf' / 'at top' **R** transpiration ref. ***ignore*** ref. to stomata on lower surface and uptake of water
(d) (i)	*effect of decreasing concentration of magnesium salt* fewer plants / smaller number of plants / reduction in number / less (asexual) reproduction ; **R** ref. to survival *data quote* number of plants from two stated concentrations with unit ; plants, were yellow / had yellow spots (at lower concentrations) / ora ; ref. to yellow spots at 0.15 *or* 0.10 / nearly all yellow at 0.05 mg dm^{-3} ;	[max 3]	must be a clear statement that this is about the number of plants, do not accept numbers alone for this point **A** 'highest' and 'lowest' concentrations without units
(ii) 1 2 3 4	magnesium required for making <u>chlorophyll</u> ; <u>chlorophyll</u> gives (leaves) green colour / without <u>chlorophyll</u> (leaves) are yellow ; less photosynthesis / cannot produce (much), food / glucose ; (so) less, food / glucose / AW, therefore less growth ;	[max 3]	**A** 'magnesium is needed for chlorophyll' **A** (less magnesium) less chlorophyll is made **A** 'no photosynthesis' **R** chlorophyll is needed for photosynthesis **A** 'no food, therefore no growth'
	[Total: 14]		