

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

2 (a) (i)	light <u>intensity</u> ; constant ; <b>A</b> control(led) variable ref to limiting factor ; intensity / amount of light, will affect (rate of) photosynthesis	max [2]	<b>ignore</b> 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]	<b>A</b> 'amount' for concentration, <b>A</b> fixed quantity
(b)	<i>rate of photosynthesis ('it')</i> 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]	<b>ignore</b> 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]	<b>A</b> (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. <b>A</b> no predators  <b>R</b> space
<b>[Total:13]</b>			

Question		E	Answers	Marks	Additional Guidance
3	(a)		$\text{CO}_2 + \text{H}_2\text{O};$ $\rightarrow$ $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 ;$ $6\text{O}_2, 6\text{CO}_2, 6\text{H}_2\text{O} ;$	3	marks for: correct formulae for carbon dioxide and water correct formulae for glucose and oxygen balancing the equation <b>ignore</b> word equation
	(b)		4.98 ;	1	
	(c)	(i)	constant light <u>intensity</u> / ora; <i>idea that</i> 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	<b>accept:</b> if changed, would change rate of photosynthesis itself / AW <b>R</b> simply 'makes results invalid'
		(ii)	gas / oxygen / air, collects at top of syringe / from plant or photosynthesis ; creates pressure to <b>force</b> water down the tube ;	2	<b>R</b> $\text{CO}_2$ <b>A</b> push
	(d)		concentration of (sodium) hydrogen carbonate / mol per $\text{dm}^3$ + rate of photosynthesis (1000 / t) ; point plotted correctly ; line of best fit ;	3	<b>A</b> ecf from (b)
	(e)		rate of photosynthesis increases as concentration of carbon dioxide increases (up to $0.07 \text{ mol per dm}^3$ ) ; data quote ; carbon dioxide (concentration) is limiting factor ;  <u>after <math>0.07 \text{ mol per dm}^3</math> :-</u> rate of photosynthesis remains (near) constant ; data quote ; carbon dioxide (concentration) is <b>not</b> the limiting factor ; light intensity / temperature, is limiting factor ;	max 5	<b>A</b> increases very little
				<b>[Total: 16]</b>	

Question	E answers		Mark	Additional Guidance
4 (a)	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ ; correctly balanced ; if no marks for the balanced equation allow one mark for correct word equation if given		[3]	<i>correct equation = 3 marks</i>  <i>if formulae of molecules are correct but equation is not correctly balanced = 2 marks</i> <i>with one mark for each side of the equation</i>
(b)	features	functions	[3]	<i>if more than one function given in a box, take the first answer. If this is contradicted by the second answer then award 0.</i>  <b>A</b> controls size of stoma(ta) <b>A</b> for (named) gas to, enter / leave  <b>ignore</b> gas exchange <b>R</b> gas(es) in and / or out
	<b>A</b>	transparent to allow light to penetrate into the leaf		
	<b>B</b>	<i>max one</i> open / close, stoma(ta) ; allow movement of, gas(es) / oxygen / carbon dioxide / <u>water vapour</u> ; allows / controls rate of, transpiration ; <b>ignore</b> gas exchange / movement of air		
	<b>C</b>	absorbs light / photosynthesis / starch <i>or</i> sugar production ;		
	<b>D</b>	buoyancy / floating / diffusion <i>or</i> movement of gas <i>or</i> named gas ;		

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