

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) | <p>1 (CO₂) is a greenhouse gas / causes (increase in) (enhanced) greenhouse effect ;</p> <p>2 global warming ;</p> <p>3, 4 any two qualified examples of environment effects of global warming e.g. flooding, extreme weather conditions, qualified habitat change, reduced biodiversity ;;</p> <p>5 increase in rate of photosynthesis ;</p> <p>6 causes increase in, plant growth / crop yield / vegetation ;</p> | [max 4] | <p>Ignore descriptions of greenhouse effect</p> <p>Ignore descriptions of global warming</p> <p>Ignore ref to deforestation</p> |
| | (b) | <p><i>nitrate ions (max 3)</i></p> <p>1 needed to make amino acids ;</p> <p>2 amino acids to proteins ;</p> <p>3 protein needed for growth ;</p> <p>4 suitable use of protein ; e.g. membranes / enzymes</p> <p><i>magnesium ions (max 2)</i></p> <p>5 needed for making chlorophyll ;</p> <p>6 to absorb (much) light ;</p> <p>7 for (energy for) photosynthesis ;</p> <p>8 for producing sugars / organic compounds produced / energy available ;</p> | [max 4] | Mpt 1 A proteins or nucleic acids |
| | (c) (i) | eutrophication ; | [1] | |
| | (ii) | <p>1 dead plant material ;</p> <p>2 decomposed by, bacteria / microorganisms / decomposers ;</p> <p>3 use oxygen in (aerobic) respiration ;</p> | [max 2] | |
| | (d) | <p>1 sedimentation / filtration / screening ;</p> <p>2 digestion by, bacteria / fungi / decomposers / microorganisms ;</p> <p>3 with aeration (tank) / trickle filter ;</p> <p>4 second settling tank (to remove / collect microorganisms) ;</p> <p>5 treated with, chlorine / ozone / UV ;</p> <p>6 collection of water from evaporator ;</p> | [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) | <i>rate of photosynthesis</i> ('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 | | 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 ignore 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 | 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] | | |

| 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] | 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 |
| (b) | features | functions | [3] | 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 |
| | A | transparent to allow light to penetrate into the leaf | | |
| | B | 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 | | |
| | C | absorbs light / photosynthesis / starch or sugar production ; | | |
| | D | buoyancy / floating / diffusion or movement of gas or 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 ; A 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 ; A ora diffusion / movement, of gas / gases (from the air) ; R 'stops entry of water'</p> <p>thin cuticle ;</p> <p>no need to reduce water loss by transpiration ;</p> | [2 max] | <p>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</p> <p>A 'top of the leaf' / 'at top' R transpiration ref.</p> <p>ignore ref. to stomata on lower surface and uptake of water</p> |
| (d) (i) | <p>effect of decreasing concentration of magnesium salt fewer plants / smaller number of plants / reduction in number / less (asexual) reproduction ; R 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⁻³ ;</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>A '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>A 'magnesium is needed for chlorophyll' A (less magnesium) less chlorophyll is made</p> <p>A 'no photosynthesis' R chlorophyll is needed for photosynthesis A 'no food, therefore no growth'</p> |
| [Total: 14] | | | |