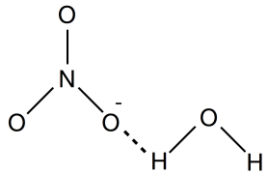
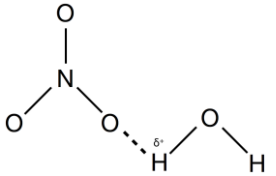
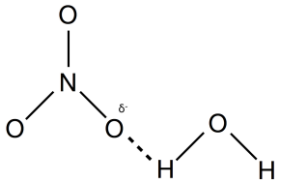
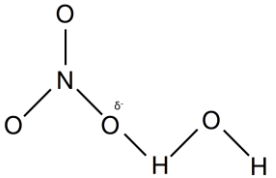
Question			Answer	Marks	Guidance
18	(a)		the factor that will , determine / limit / AW , the rate ✓ when at , low(er) / sub-optimal / AW , level ✓	2	**Both marks can be gained from a correctly described example** e.g. when CO_2 (concentration) is in short supply, it prevents the rate of photosynthesis increasing **DO NOT ALLOW** inhibits / reduces **ALLOW** prevents rate from increasing / slows down rate of increase / stops rate from increasing / causes rate to plateau **ALLOW** when in short (est) supply
18	(b)	(i)	increased volume of water added (to seedlings) , leads to lower survival (of seedlings) ✓ larger decrease in survival for added water , above / from , 30 (cm^3) ✓ volume of water has no effect on number (of seedlings) surviving up to the first 3 days / AW ✓ quote data points / calculation(s) used , to support any point ✓	3 max	**ALLOW** the more water the faster they die **ALLOW** ora e.g. less / little , decrease in survival for 30(cm^3) and below **DO NOT ALLOW** at 30cm^3 minimum one pair of readings quoted for two water volumes (no units needed)

18	(b)	(ii) *	Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme. Once the level is located, award the higher or lower mark. **The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met. **The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing. **In summary:** • **The science content determines the level.** • **The communication statement determines the mark within a level.** **Level 3 (5–6 marks)** A detailed scientific statement about aerobic respiration **AND a** detailed scientific statement about anaerobic respiration **AND** more than one scientific consequence for the plant of overwatering	6	**Indicative scientific points may include…** **Aerobic respiration (A)** *Statement* **(S)** *The scientific statement can be implied by giving good scientific detail* • (No oxygen so) no aerobic respiration occurs *Further detail* **(D)** • No , link reaction / Kreb's cycle / ETC / oxidative phosphorylation • No oxygen to act as the final , electron / hydrogen acceptor **Anaerobic respiration (An)**

			There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. **Level 2 (3–4 marks)** A detailed scientific statement about either aerobic or anaerobic respiration **AND** a scientific consequence for the plant of overwatering *There is a line of reasoning presented with some structure. The information presented in the most part relevant and supported by some evidence.* **Level 1 (1–2 marks)** A statement about either aerobic or anaerobic respiration **AND** a scientific consequence for the plant of overwatering *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant and correct.* **0 marks** No response or no response worthy of credit.		*Statement* **(S)** *The scientific statement can be implied by giving good scientific detail* • (Plant has to) switch to anaerobic respiration / only anaerobic respiration can occur *Further detail* **(D)** • Only glycolysis occurs • Alcoholic fermentation occurs • NAD regenerated (for glycolysis) • Pyruvate to ethanal to ethanol • Named enzyme e.g. pyruvate decarboxylase • (Only) 2 ATP **Scientific consequences for the plant (C)** • ethanol is toxic • (alcoholic fermentation) is irreversible • Less ATP produced / only 2 ATP from glycolysis • Less / no , active transport • (root hair cells) cannot take up mineral ions (by active transport) • so (plant) cannot make , proteins / amino acids / DNA / chlorophyll etc • cannot generate water potential gradient (into roots) / water potential (in root hair cells) is too high • water cannot be absorbed (so cells cannot remain turgid) • less / no , photosynthesis

Question			Answer	Marks	Guidance
18	(c)	(i)	water is (a) polar (molecule) ✓ nitrate (ion) / NO_3^- , is , charged / negative ✓ (hydrogen bonds form) between H on water and O on nitrate ✓	2 max	*Read answer first; if two marks from written response, **IGNORE** diagram. If two marks not awarded refer to diagram to find additional mark(s).* **DO NOT ALLOW** water is charged **ALLOW** water has slightly positive / δ^+ , H **IGNORE** 'δ^- O' if describing water **IGNORE** 'δ^- O' if describing nitrate or on diagram **DO NOT ALLOW** nitrate is polar **IGNORE** solid line for H bond on diagram **NOTE** 'delta plus of water is attracted to negative charge of nitrate' = 2 marks (MP1 and 2) **NOTE** the following examples  = 2 marks (MP 2 & 3)  = 2 marks (MP 1 & 3)  = 1 mark (MP3)  = 0 mark

Question			Answer	Marks	Guidance
18	(c)	(ii)	solutes / ions / named ion , enter , against concentration gradient / by active transport ✓ reduces water potential of (endodermal) cell(s) ✓ water , moves / diffuses , by osmosis / down water potential gradient ✓	2 max	**ALLOW** Ψ for water potential throughout **DO NOT ALLOW** ref to concentration of water in mps 2 or 3 **ALLOW** 'pumped' as AW for active transport **ALLOW** water potential of cell(s) becomes more negative **ALLOW** from high to low water potential
18	(d)		*organ is* collection / AW , of tissues ✓ perform / carry out / adapted to , function / role ✓ *leaves have* **two** from: epidermis / spongy mesophyll / palisade mesophyll / vascular / phloem / xylem , (tissues) ✓ (to carry out) photosynthesis / gaseous exchange ✓	4	**IGNORE** cells throughout **ALLOW** working together **IGNORE** mesophyll (unqualified) **IGNORE** stomata
			Total	19	