Mark scheme

Plant nutrition

Biology 0610 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

92

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
6	8	10	11	9	11	11	14	6	6	**92**

Question 1 [6]

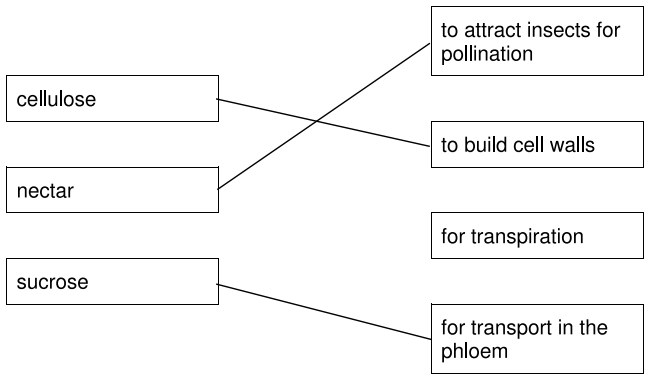
1	chlorophyll; glucose / starch; palisade; stomata; epidermis; chlorophyll;	6	
		Total: 6	

Question 2 [8]

2(a)	(**R**) epidermis ; (**S**) palisade ; (**T**) guard cell / cytoplasm ; (**V**) stoma / stomata ;	4	
2(b)	1 photosynthesis ; 2 carbon dioxide and water (substrate) / AW ; 3 glucose and oxygen (produced) ; 4 energy needed comes from light / light energy converted to chemical energy ; 5 chlorophyll / chloroplasts, traps / absorb, the light (energy) ; 6 carbon dioxide from the air / water from the soil ;	4	**A** mp2 and mp3 in a correct, word / symbol equation **A** sun / sunlight mp5 must be stated (not inferred by being placed on an arrow in an equation) **I** from the roots

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Question 3 [10]

3(a)	chloroplast **;**	**1**	
3(b)	*any three from:* it / the white part of the leaf, cannot photosynthesise **;** no glucose is produced **;** glucose is stored as starch **;** iodine solution remains yellow-brown in the absence of starch / the white part does not contain starch / negative result for starch / AW **;**	**3**	
3(c)	yellow-brown **;** yellow-brown **;**	**2**	
3(d)(i)		**3**	**R** each additional line
3(d)(ii)	carbon, hydrogen, oxygen **;**	**1**	any order **R** each additional element

Question 4 [11]

4(a)	*any two from:* large surface area **;** thin **;** AVP **;**	**2**	e.g. *idea of* not overlapping to maximise light capture / leaves are spreading / AW
4(b)(i)	*any four from:* **A**: spongy mesophyll, (orientation of cells) allow gases to move, easily / to palisade (mesophyll) **;** **B**: stomata, hole / AW that lets (named) gases to, enter / leave, leaf **;** **C**: guard cells, open **and** close stomata OR control stomatal size AW **;** **D**: air space, allow gases, to move (easily) / to get to the palisade (mesophyll) **;** by diffusion **;** AVP **;**	**4**	
4(b)(ii)	magnesium **;**	**1**	
4(c)	vascular **;** minerals / mineral ions **;** roots **;** sucrose **;**	**4**	

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Question 5 [9]

5	**(a)**	**1** **2** **3** **4** **5** **6**	carbon dioxide is required for photosynthesis ; (more carbon dioxide) more, glucose is produced ; carbon dioxide <u>concentration</u> is a <u>limiting</u> factor ; more carbon dioxide = faster rate of photosynthesis ; prevents concentration falling below that of atmosphere / AW ; ref to more, growth / yield ;	[max 2]	
	(b)		carbon dioxide will diffuse out of the glasshouse ; carbon dioxide is wasted ; *idea that* extra, growth / yield, does not cover the cost of the carbon dioxide ;	[max 2]	

	(c) (i)		plants respire at night and do not photosynthesise ;	[1]	*both ideas are needed for the mark*
	(ii)	**1** **2** **3** **4** **5** **6** **7** **8**	decrease temperature on hot days / AW / avoid plants overheating ; denaturing of enzymes ; avoids plants wilting ; *idea that* open to allow carbon dioxide to enter <u>during the day</u> / ref to **F** ; *idea that* open to allow oxygen to enter <u>at night</u> ; to allow plants to respire ; allow water vapour to escape / avoids air becoming too humid ; reduces chances of (fungal) disease ;	[max 4]	
				[Total: 9]	

Question 6 [11]

6(a)	*any six from:* LIGHT (B and C as light intensity increases) the rate (of photosynthesis) increases and remains constant / AW **;** rates (of photosynthesis) are the same at low(est) light intensities **;** light provides <u>energy</u> (for photosynthesis) **;** where the line rises / initially, light intensity is, limiting / the limiting factor **;** line(s) / rate, levels off where light intensity is **not** limiting **;** in **B** light intensity becomes limiting at higher light intensity than **C** / **ora ;** CARBON DIOXIDE *Idea that* line C levels off, at a lower rate (of photosynthesis) / lower light intensity **;** carbon dioxide (concentration) is, lower for **C** / 0.04% vs 0.4% **;** carbon dioxide is, reactant / substrate / raw material / needed, for photosynthesis **;** in **C** carbon dioxide is a limiting factor at a lower light intensity / in **B** carbon dioxide is a limiting factor at a higher light intensity **;** TEMPERATURE *idea that* temperature is limiting for **B** at high light intensities **;**	**6**	**I** if C given as well (as no evidence for C)
6(b)	O_2 **;**	**1**	
6(c)	*any four from:* (glucose) used, in respiration / to provide energy / to release energy / as an energy store **;** (glucose) converted to / stored as, starch **;** (glucose) converted to sucrose **;** sucrose for, translocation / transport (in the phloem) / sent to sink(s) **;** (glucose / fructose / sucrose) in nectar **;** (nectar) to attract, insects / pollinators **;** (glucose / fructose / sucrose) in fruits (to attract animals) **;** (glucose) converted to cellulose **;** cellulose to build cell walls **;** lignin for cell walls **;** used to make, amino acids / fatty acids **;** AVP **;**	**4**	e.g., used to make chlorophyll / (DNA/RNA) bases

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Question 7 [11]

7(a)	**J –** (upper) epidermis (cell) ; (translucent / transparent / thin / flat / no chloroplasts) to allow passage of light, through / to palisade (cells) / leaf / AW ; **K –** xylem (vessel) ; continuous tube / no cytoplasm / no (named) cell contents / hollow / no end walls / no cross walls / pits, to allow transport of, water / mineral ions (to leaf) **OR** lignin, to prevent collapse of water column / support the leaf to maximise light absorption / AW ;	**4**	
7(b)	limiting factor ; 6 / six ; source ; (sun)light ; chemical ; water vapour ; chlorophyll ;	**7**	**A** reactant / substrate / raw material

Question 8 [14]

8(a)	it is made of (named) tissues (in a leaf) ; (tissues), working together / for a specific (named) function(s) ;	**2**	
8(b)	*ref* to photosynthesis ; **B** is the palisade (mesophyll / tissue / layer / cells) and **C** contains spongy (mesophyll / tissue / layer / cells) / vascular bundles / xylem / phloem ; *any three from:* ***layer B*** cells are, tightly / vertically, packed *or* columnar *or* few cross walls ; (cells / layer) positioned (immediately) below, layer **A** / the upper epidermis ; to (maximise) light (energy) reaching, cells / chloroplasts / layer ; *ref* to many chloroplasts / lots of chlorophyll ; (large) vacuole keeps the chloroplasts towards the sides of cells ; *any three from:* ***layer C*** cells are loosely packed / layer contains (interconnecting) air spaces (between cells) ; (mesophyll / air spaces) to allow, gas exchange / diffusion of (named) gases ; (mesophyll / air spaces) to allow evaporation (of water) from cell surfaces (into air spaces) ; (xylem) has, thick / lignified / waterproofed / pitted, cell wall ; (xylem) (long) continuous tube / no cytoplasm / hollow *or* no end / cross, walls ; (xylem) to allow transport of, water / mineral ions ; (phloem) to allow, translocation / transport of, sucrose / sugar / amino acids ;	**6**	**MP1 A** transpiration
8(c)(i)	guard (cell) ;	**1**	
8(c)(ii)	gas exchange (described) / (regulation of) transpiration / AW ;	**1**	
8(c)(iii)	reduce water loss (through transpiration) ; *ref* to preventing wilting ;	**1**	
8(d)	*any three from:* stomata will take longer to close / reduces (stomatal) closure / reduces (stomatal) response ; reduced, water vapour / concentration / diffusion, gradient (between the air spaces and the outside) ; so the (guard) cells do not lose water (as, quickly / much as the first experiment) ; the (guard) cells, stay / become, turgid *or* (guard) cells take longer to become flaccid ;	**3**	

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Question 9 [6]

9	*six from:* **1** *independent variable* at least two different temperatures **,** tested / stated **;** **2** *dependent variable* counting bubbles / measuring volume of gas given off **;** **3, 4, 5** *variables kept constant - max three from* **;;;** set time period (for measurement) species / type of, plant / plant tissue size / mass of plant or number of leaves age of plant carbon dioxide / HCO_3^- concentration light intensity / same lamp / same light bulb / AW pH of water nutrient content of water volume of water **6, 7** *method – max two from* **;;** use of gas syringe / upturned measuring cylinder or test-tube method of controlling the temperature fixed distance from light source use of heat shield equilibration time use of oxygen probe AVP **8** repeat investigation (at least) twice / at least two replicates **;**	**6**	**A** colour change of hydrogencarbonate indicator / measure**,** oxygen or carbon dioxide**,** concentration

Question 10 [6]

10	*independent variable* **1** at least three different light intensities **;** *dependent variable* **2** the colour of the indicator **;** **3 and 4** *details of the method* **;;** • method of changing light intensity e.g. different lamp distances / dimmer switch altered / different bulbs / different lamps / different power lamps / detail of how to make one in the dark ***and*** one in the light • method to avoid heating effect of light e.g. heat shield / beaker of water between lamp and plant / use LED bulbs to prevent heating • keeping the plant under the water / weighting the plant down • sample the water around the plant and test with indicator **5 and 6 and 7** *variables kept constant* **;;;** • colour / wavelength**,** of light • temperature • type / species / age**,** of plant • size / mass / length / height / surface area / number of leaves**,** of plant • volume of water (covering plant) • volume / number of drops**,** of (hydrogencarbonate) indicator • concentration of (hydrogencarbonate) indicator • set (stated) time for equilibration (to the new light intensity) • set (stated) time before noting colour **8** two or more repeats **;** **9** relevant safety **;**	**6**	

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