Photosynthesis as an energy transfer process

Mark Scheme 8

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Photosynthesis
Sub Topic	Photosynthesis as an energy transfer process
Booklet	Theory
Paper Type	Mark Scheme 8

Time Allowed : **54 minutes**

Score : **/ 45**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** 1 high rate of photosynthesis at 430–435 nm **and** 655 nm wavelengths ;

2 idea of (high) absorption of light at these wavelengths ;

3 highest rate, at 430–435 nm ;

4 shorter wavelengths have more energy ;

5 low(er rate) in, middle range / 500–600, of wavelengths ;

6 low light absorption here ;

7 absorbed light used for photosynthesis ;

8 in light-dependent stage ; [4 max]

(b) **(i)** ATP ;

reduced NADP ; [2]

(ii) 1 ATP provides energy ;

2 reduced NADP, is reducing agent / provides hydrogen ;

3 for converting GP to TP ;

4 (ATP used to) regenerate RuBP ; [3 max]

(c) process / photosynthesis, affected by more than one factor ;

rate is limited by the factor nearest its minimum value / AW ; [2]

(d) 1 enters leaf through (open) stomata ;

2 by diffusion ;

3 substomatal air space ;

4 many air spaces in spongy mesophyll ;

5 spaces between palisade cells ;

6 dissolves in moisture on cell (walls) ;

7 enters through cell walls ; [4 max]

[Total: 15]

2	**(a)**	**(i)**	1. yield for sorghum is great than yield for wheat (in any soil type) ; 2. yield for wheat is bett in HWC soil / little difference in yield for sorgham ; 3. paired figs *only award if linked correctly to mp 1 or mp2* 4. sorghum is adapted to live in arid environment / AW 5. and 6. *any two of the following* ;; feature / f extensive / deep, root system / maximises water absorption curled leaves / leaves small surface area / wazy leaves / bulliform leaf cells / hinged leaf cells / reduced stomata numbers / stomata in pits / reduces water loss high silica content / more sclerenchyma / more strengthening tissue / reduces wilting	[4 max]

		(ii)	number of seeds sown ; density of seeds sown / area of plot ; minerals / fertilisers ; wind / shelter ; soil pH;	[2 max]
	(b)		1. ref. bundle sheath cell 2. light independent stage occurs / RuBP found (in bundle shea cells) ; 3. RuBP / rubisco, kept away from, air / oxygen 4. ~~~ mesophyll cells ; 5. limits uptake of $_2$ / maintains high CO_2 concentration (in bundle sheath cells) ; 6. enzymes / PEP carboxylase, have high optimum temperature 7. approx ^{0}C ; 8. not denatured	[4 max]
				[Total: 10]

3	**(a)**	1 2 3 4 5 6 7	stomata ; air spaces (between cells) ; thin cell walls ; moist internal walls ; <u>thin</u> leaf ; cylindrical palisade cells ; large surface area of, palisade / mesophyll, cells ;	[4 max]
	(b)		0.0025 / 2.5 x 10^{-3}; **A** 0.003 only if 0.0025 in answer	[1]
	©	1 2 3 4	photosynthesis takes place ; oxygen is produced ; collects, inside disc / on surface of disc ; disc, less dense / more buoyant ;	[3 max]
	(d)		<u>rate</u> of photosynthesis increases as light intensity increases ; paired data quotes from columns 2 and 4 ;	[2]
	(e)	1 2 3	light intensity no longer limiting ; <u>carbon dioxide</u>, concentration / rate of diffusion, now limiting ; temperature, too high / denatures enzymes ;	[2 max]
				[Total: 12]

4 **(a)** **(i)** ribulose ; [1]

(ii) ribulose bisphosphate carboxylase / rubisco ; [1]

(iii) stroma ; stoma [1]

(iv) ATP / reduced NADP ; **R** reduced NAD [1]

(b) 1 light independent reaction / Calvin cycle, continues ;

2 RuBP (still) converted to GP ;

3 until used up ; *link to 2*

4 light dependent reaction stops ;

5 no, ATP / reduced NADP, produced ;

6 RuBP not regenerated ;

7 GP, coverted to TP / used to make hexose ; [4 max]

[Total: 8]