Photosynthesis as an energy transfer process

Mark Scheme 6

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 6

Time Allowed : **47 minutes**

Score : **/ 39**

Percentage : **/100**

Grade Boundaries:

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

1 (a) top half of leaf/just below (upper) epidermis;
packed (densely);
long axis in line with incident light/AW;

2 max

(b) contain large numbers of chloroplasts/large amount of chlorophyll;
large vacuole; *(only give if linked to next point)*
chloroplasts (in cytoplasm) close to cell wall/cell membrane;
short diffusion pathway;
(cell) elongated/arranged to intercept (maximum) light;
thin (cell) wall;
ref. movement of chloroplasts;

3 max

(c) contains photosystems/PS1 and PS2/chlorophyll and accessory pigments/ reaction centres;
maintain carriers/receptors in position;
site of photophosphorylation/light reaction;
site of ETC;
ref. proton pumping/proton gradient;
large surface area;
produce ATP/ref. ATP synthase;
produce reduced NADP;

4 max

(d) ref. to Rubisco;
carbon dioxide combines with RuBP;
driven/powered by ATP;
and reduced NADP;
forms PGA;

2 max

Total: 11

2 **(a) (i)** **A** – RuBP / ribulose bisphosphate **;**

B – fatty acid **;**

C – nitrates **;** **A** suitable nitrogenous substance e.g. ammonium ions
I nitrogen / ammonia

(ii) non-cyclic photophosphorylation **;** [1]

(iii) condensation / polymerisation **;** **A** anabolic

glycosidic **;** [2]

(iv) 1 enters via stoma(ta) **;**

2 by diffusion / down a concentration gradient **;**

3 passes through air spaces **;**

4 dissolves in film of water (on cell surface) **;**

5 (diffuses) through cell, wall / surface membrane (of palisade cells) **;** [max 3]

(b) 1 excited electrons leave, chlorophyll a / photosystem **;**

2 pass along ETC **;**

3 protons present from photolysis **;**

4 protons (pumped) into intermembrane space **;**

5 rubisco is in stroma **;**

6 *idea that* protons leaving stroma raises pH **;** [max 3]

[Total: 12]

3 **(a (i)** 1. (blue) light is absorbed and used for photosynthesis **;**

2. CO_2 , used / concentration decreased **;**

3. leads to, rise in pH / decrease in acidit **;** [max 2]

(ii) 1. respiration **but no** photosynthesis **;**

2. CO_2, produced / released **;**

3. leads to, decrease in pH / increase in acidit **;** [max 2]

(b) (i) absorb light (energy) **;**

pass (light) energy onto, primary pigment / chlorophyll a / reaction centre **;** [2]

(ii) $H_2O \longrightarrow 2H^+ + 2e^- + ½ O_2$ **;**

A $2H_2O \longrightarrow 4H^+ + 4e^- + O_2$ [1]

(iii) grana / thylakoid, membrane **;** [1]

[Total: 8]

4 **(a** **A** – photosystem II / P680 / PS II ;

B – photosystem I / P700 / PS I ; [2]
if photosystem given for both but wrong way round give one mark

(b) **(i)** 1. carbon dioxide fixation ;

2. production of GP

3. ref. to rubisco [max 2]

(ii) 1. reduction (of GP) / donates hydrogen ;

2. GP to ; [2]

(iii) 1. supplies, energy / phosphate ;

2. (to convert) GP to ;

3. (to) regenerate of Ru ; [max 2]

[Total: 8]