Exampro A-level Biology

3.4.3 Photosynthesis

Name:

Class:

Author:

Date:

Time: 91

Marks: 80

Comments:

M1. (a) Temperature affects photosynthesis; Affects enzyme activity;
So that any change in photosynthesis rate is result of
carbon dioxide/light intensity;

max 2

(b) Carbon dioxide increases rate of photosynthesis;
Up to max;
Something else/correct suggestion is a limiting factor;

3

[5]

M2. (a) the more light absorbed, the greater the rate of photosynthesis;
light provides the energy for light dependent reactions / photolysis /
light independent reactions / production of reduced NADP /
exciting electrons in chlorophyll;
(do not give credit if energy is used in photosynthesis)

2

(b) count the number of bubbles / measure the volume of gas / measure the change in pH / carbon dioxide / hydrogen carbonate ions;
(credit oxygen produced)

1

(c) 530 – 630 nm;
(any values within this range)

limited absorption of light / (green) plants reflect green light /
limited photosynthesis at these wavelengths of light;
(allow references to no light absorbed or no photosynthesis)

2

(d) (i) chlorophyll excited / reduced NADP formed;
electrons from chlorophyll / reduced NADP changes the dye colour;

2

(ii) ADP and phosphate needed to produce ATP / ATP is a product of the light dependent reactions;
ADP levels are a limiting factor;
(must explain the idea of limiting factors – do not credit answers like more ADP causes more photosynthesis)

2

[9]

M3. (a) Grana/thylakoids/ lamellae;

1

(b) **A** = oxygen/O_2

B = ADP and phosphate/P_i /phosphoric acid/correct formula;

C = reduced NADP; ALLOW NADPH/$NADPH_2$ /NADPH + H^+

3

(c) (i) Absorbs light/energy;
Loses electrons/becomes positively charged/is oxidised;
Accepts electrons from water/from OH^- ;
Causes more water to dissociate/pulls equilibrium to the right;

max 3

(ii) Electrons raised to higher energy level/electrons excited;
Use of electron carriers/cytochromes/acceptors;
For production of ACT

[REJECT 'energy production']

3

(d) (i) GP formed from RuBP + CO_2;

GP → TP/sugar-phosphate/sugar/to RuBP;
GP formed at same rate as it is used;

3

(ii) No CO_2 to combine with/not enough CO_2 to combine with;

RuBP not changed into GP/TP;
RuBP reformed from GP/TP;

max 2

[15]

M4. (a) (Absorption of) light;

1

(b) Inner membrane/cristae/stalked particles of mitochondria;

1

(c) Plantae (plants) / Protoctista / prokaryotes;
Processes are photosynthesis and respiration /
plants/algae/(some) protoctistans/prokaryotes photosynthesise/have chlorophyll;

2

[4]

M5. (a) Glycolysis;
Glucose and pyruvate/pyruvic acid;

2

(b) Light-independent reaction;
Ribulose bisphosphate/RuBP and carbon dioxide;

2

(c) Light-independent reaction;
Triose phosphate and glucose/hexose;

Q *Do not accept sugar or carbohydrate as alternative for glucose*

2

[6]

M6. (a) <u>On diagram, correctly labelled:</u>

Light-dependent: granum/thylakoid membranes – labelled 'X'
AND
Light-independent: stroma – labelled 'Y';

1

(b) <u>Any two from:</u>

(Water) forms H^+ /hydrogen ions <u>and</u> electrons/e^- ;

O_2/oxygen formed; [*NOT* 'O', *NOT* 'O^-']

(Light) excites electrons / raises energy level of electrons / electrons to chlorophyll / to photosystem;

max 2

(c) (ATP) Provides <u>energy</u> for GP → TP / provides <u>P</u> for RuP/TP → RuBP;

(Reduced NADP) Provides <u>H / electrons</u> for GP → TP / <u>reduces</u> GP to TP;

2

[5]

M7. (a) electrons;
from chlorophyll / photolysis;

2

(b) (i) RuBP combines with carbon dioxide to produce 2 x GP;

1

(ii) less used to combine with carbon dioxide /
less used to form glycerate 3-phosphate;

1

(c) (i) used in photosynthesis allows detection of products;

1

(ii) ATP and reduced NADP not formed;
GP is not being used to form RuBP / is being formed from RuBP;

2

(iii) used in respiration / formation of starch / cellulose;

1

[8]

M8. (a) (i) Temperature and light;

1

(ii) Increase in temperature causes increase in rate of photosynthesis/uptake of carbon dioxide;

Increase in light/more/medium/high light (intensity) causes increase in rate of photosynthesis/uptake of carbon dioxide;

2

(b) 2.75 – 2.81 (mg g^{-1} hr^{-1})

Accept answers in range 2.75 – 2.81

1

(c) 1. Growth will decrease (at higher temperature);

2. Rate of respiration will increase at higher temperature;

3. Photosynthesis decreases as limited by light/as there is less light;

Ignore references to effect of temperature on rate of photosynthesis

3

[7]

M9. (a) (i) temperature also affects photosynthesis/ rate of reaction; need to ensure the effect of only one variable is being observed;

1

(ii) CO_2 used/ O_2 produced/ sugar produced/increase in mass;
per unit of time;

accept any volume or mass unit; per time unit;)

(allow one mark for indicator of photosynthesis – second mark is for time element)

2

(b) (i) as carbon dioxide increases, rate of photosynthesis increases;

1

(ii) carbon dioxide not limiting photosynthesis;
another factor/named factor limiting;
explanation for named factor;

2 max

[6]

M10. (a) (i) Stroma (of chloroplasts);

Reject: stoma

1

(ii) 2;

1

(b) 1. As oxygen (concentration) increases less Rubisco / RuBP reacts / binds with carbon dioxide;

1. Accept - as oxygen (concentration) increases more Rubisco / RuBP reacts / binds with oxygen

1. Accept – less GP / more phosphoglycolate formed as oxygen (concentration) increases

2. Competitive inhibition / competition between oxygen and carbon dioxide for rubisco / enzyme / active site;

2. Accept oxygen and carbon dioxide are complementary to active site

3. Less RuBP formed / regenerated (to join with carbon dioxide);

2 max

(c) 1. Less glycerate 3-phosphate / GP produced;

1. Accept one GP formed rather than two GP

2. (Less) triose phosphate to form sugars / protein / organic (product) / any named photosynthetic product;

3. Less RuBP formed / regenerated;

3. Accept RuBP takes longer to form

3

[7]

M11. (a) Ribulose bisphosphate / RuBP;

Accept Ribulose biphosphate or Ribulose diphosphate

Accept phonetic spellings

Accept any variation in upper or lower case for RuBP

1

(b) ATP and reduced NADP are produced in grana / thylakoids / present in A / both tubes;

Must be reduced NADP but accept any alternative which show hydrogen attached to NADP

Must be reduced NADP not reduced NAD

1

(c) 1. 4 000;

Accept 'same as in (tube) C', but not 'same' on its own

2. Light-dependent reaction does not occur / ATP and reduced NADP are not produced;

Accept converse for mark point 2

2

(d) 1. (Less) GP converted to TP;

GP = glycerate 3-phosphate

TP = triose phosphate but abbreviations are sufficient

2. (Less) TP converted to RuBP;

Accept GALP as TP

2

(e) 1. No / less ATP / ATP produced (during electron transport);

Must be reduced NADP but accept any alternative which shows hydrogen attached to NADP

2. No / less reduced NADP / reduced NADP produced (during electron transport)

2

[8]