

5.1 Energy transfers in and between organisms (A-Level Only)

Photosynthesis 2 – Mark schemes

Q1.

- (a) (i) pigment reflects / does not absorb green or yellow or orange;
pigment absorbs blue or violet;
pigment absorbs red;
(accept correct wavelengths instead of colours)
(any 2 for 1 mark) 1
- (ii) light (energy) absorbed by chlorophyll;
raises energy level of electrons / electrons are excited / emitted;
ATP formed; 3
- (b) more wavelengths / colours absorbed;
more (efficient) photosynthesis can occur at these depths / low light intensities
or
more (efficient) photosynthesis can occur when some wavelengths are not present; 2

[6]

Q2.

- (a)

✓	✓	x;
x	x	✓;
✓	✓	✓
✓	x	x

4
- (b) (i) pyruvate / succinate / any suitable Krebs cycle substrate; 1
- (ii) ADP and phosphate forms ATP;
oxygen used to form water / as the terminal acceptor; 2
- (iii) Y X W Z;
order of carriers linked to sequence of reduction / reduced carriers cannot pass on electrons when inhibited; 2

[9]

Q3.

- (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]**

Q4.

- (a) (i) RuBP – 5; GP – 3; TP – 3; Glucose – 6;
(all correct = 2 marks; 3 or 2 correct = 1 mark) 2
- (ii) stroma; 1
- (iii) light-dependent reaction / (photo)phosphorylation;
(accept photolysis) 1
- (iv) 5 out of 6 / 83% / equivalent; 1
- (b) enzymes involved / not a photochemical reaction;
slow rate of enzyme / chemical reaction at low temperature /
less kinetic energy / fewer collisions; 2
- [7]**

Q5.

- (a) adding CO₂ decreases pH / makes more acid
OR removing CO₂ increases pH / makes more alkaline;
*(credit anywhere but do not credit this mark if
stated that oxygen is an alkaline gas)*
- rate of photosynthesis > rate of respiration in **A**;
respiration only in **B**;
rate of photosynthesis = rate of respiration in **C**; 4
- (b) (i) shows that indicator alone does not change colour in light; 1
- (ii) so that all tubes receive same amount of heat 1
- [6]**

Q6.

- (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]

Q7.

(a) (i) Reduced NADP;
Accept NADPH/ NADPH⁺/NADPH₂ 1

ATP;
Accept oxygen/O₂ 1

(ii) (To incorporate carbon dioxide) to make sugars/glucose/fructose;
Accept 'to fix carbon dioxide'
Accept correct biochemical answers
Accept provide energy to make sugars 1

(b) Change (in CO₂ exchange) due to photosynthesis; 1

Plants carry out photosynthesis and respiration; 1

At **X** (rates of) respiration and photosynthesis same; 1
2 max

[5]

Q8.

(a) rate of photosynthesis increased;
normal atmospheric concentration a limiting factor / more / faster production of biomass or sugars / more products of photosynthesis transported to fruits; 2

(b) (increased temperature) increases rate of respiration;
rate of photosynthesis too low to replace respiratory loss

2

(c) lower water potential of nutrient solution;
less water absorbed into roots (by osmosis);
(not: water lost from roots)

2

[6]

