A Level OCR Biology

19 Photosynthesis – answers

Question	Answers	Extra information	Mark	AO Spec reference
1(a)	**E** Photosystem II ✓ **F** Photosystem I ✓ **G** ATP synthase ✓		3	AO1 AO2 5.2.1(b) 5.2.1(c)(i) 5.2.1(d)
1(b)	(different pigments) absorb different wavelengths of light ✓ more light energy can be absorbed (from the spectrum) ✓		2	
1(c)(i)	Photolysis ✓		1	
1(c)(ii)	Any two from: excited electrons move down an energy level (when going from carrier to carrier) ✓ the energy released is used to pump, protons / H^+ ions, into the thylakoid space ✓ against the concentration gradient / by active transport ✓ **AND** Any one from: generate a, proton / H^+ ion concentration / electrochemical gradient for chemiosmosis / photophosphorylation to occur ✓ for ATP production ✓	Award max 2 marks for explaining the process. Award max 1 mark for the importance.	3 max	
1(d)(i)	Any one from: Little oxygen (in the early atmosphere) ✓ Atmosphere mostly consisted of sulphuric gases ✓		1 max	
1(d)(ii)	Any one for similarity: Both have photosynthetic pigments to absorb light / energy ✓ Both reduce NADP (to reduced NADP) ✓ Both use CO_2 as a reactant ✓ Both make ATP from ADP and P_i ✓	Award max 1 mark for a similarity. Award max 2 marks for a difference.	3 max	

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	AND Any one pair for difference: (Normal/oxygenic) photosynthesis produces oxygen ✓ Anoxygenic photosynthesis produces sulphur ✓ **OR** (Normal / oxygenic) photosynthesis has H_2O to provide electrons and protons (for the electron transport chain and reducing NADP) ✓ Anoxygenic photosynthesis has H_2S instead ✓			
2(a)	**A** thylakoid membrane/ lamella ✓ **B** granum / grana ✓ **C** inner membrane (**DO NOT ACCEPT** cell membrane) ✓ **D** stroma ✓ **E** starch grain ✓		5	AO1 AO3 Synoptic: 2.1.1(g) 2.1.1(k) 5.2.2(b) 5.2.1(b) 5.2.1(d) 5.2.1(e)
2(b)	**E** ✓ **C** / **B** ✓ **B** ✓ **E** ✓		4	
2(c)	Any two from: have a double membrane (compared to prokaryotes having cell wall) ✓ have free/naked DNA **OR** DNA not in nucleus ✓ have smaller / 70S ribosomes ✓ have circular DNA ✓		2 max	
3(a)	increasing light intensity increases rate ✓ more light for more photolysis / photophosphorylation / Calvin cycle / Light-independent stage ✓		2	AO1 AO2 Synoptic 3.1.3(c)(i)

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3(b)(i)	RuBisCo / Ribulose bisphosphate carboxylase ✓ ATP synthase AVP (e.g., NADP reductase)		2	2.1.4(f) 5.2.1(g)(i)
3(b)(ii)	Any four from: stomatal closure ✓ due to high temperature / low humidity ✓ too much water loss ✓ by transpiration / high transpiration rate ✓ leading to stress response of plants ✓		4	
3(b)(iii)	Any three from: Oxygen is a competitive inhibitor for RuBisCo ✓ Oxygen can also fit into the active site of RuBisCo (to produce 2-phosphoglycolate) ✓ Less glycerate-3-phosphate / GP made ✓ Less light-independent stage can occur ✓ Less (named) photosynthetic products can be made ✓ **AND** One named disadvantage for farmers ✓ e.g., Slower growth rate / lower crop yield ✓		4	
4(a)	**A** Carbon dioxide ✓ **B** and **C** ATP **and** reduced NADP ✓	Ignore the order of answers for **B** and **C**	3	AO1 AO2 5.2.1(e) 5.2.1(f)
4(b)(i)	Triose phosphate / TP ✓		1	
4(b)(ii)	produced in light-dependent stage ✓ in thylakoid membrane ✓		2	

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<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO
Spec reference</th></tr>
<tr><td>4(b)(iii)</td><td>ATP needed for energy for the reaction ✓
reduced NADP provides hydrogen atom for reduction of GP to TP ✓</td><td></td><td>2</td><td></td></tr>
<tr><td>4(b)(iv)</td><td>Any two <u>pairs</u> from:
nucleic acids made AND using nitrates from soil ✓ ✓
fatty acids made AND combine with glycerol made from TP to make lipids ✓ ✓
sucrose made AND by reacting glucose and fructose ✓ ✓
maltose AND by reacting two glucose molecules together ✓ ✓
cellulose AND by polymerisation of beta glucose ✓ ✓</td><td></td><td>4 max</td><td></td></tr>
<tr><td>5(a)(i)</td><td>
<table>
<tr><th>Description</th><th>Photophosphorylation</th><th>Oxidative phosphorylation</th><th>Substrate-level phosphorylation</th></tr>
<tr><td>photosystem I is involved</td><td>✓</td><td></td><td></td></tr>
<tr><td>electron transport chain is involved</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>occurs in the cytoplasm</td><td></td><td></td><td>✓</td></tr>
<tr><td>occurs in plant cells</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td><td>1 mark per correct row</td><td>4</td><td>AO2
AO3
Synoptic:
5.2.2(c)
5.2.2(d)
5.2.2(e)
5.2.2(f)
5.2.2(g)

5.2.1(d)
5.2.1(e)</td></tr>
<tr><td>5(a)(ii)</td><td>Any two <u>pairs</u> from:
cyclic involves photosystem I only AND non-cyclic involves both photosystems ✓
in cyclic, electrons end up in the same photosystem after excitation AND in non-cyclic, electrons travel to reduce NADP ✓
cyclic produces only ATP AND non-cyclic produces ATP and reduced NADP ✓</td><td></td><td>2 max</td><td></td></tr>
</table>

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Question	Answers	Extra information	Mark	AO Spec reference
5(b)	**Level 3** Describe multiple differences between the coenzymes, including details of **where** in the cell they are found and the **processes** they are involved in. Details of how they are made and used are included. All the content is relevant and accurate. **Level 2** Describe at least two differences between the coenzymes, with some details of their locations and processes in the cell. Most of the content is relevant, with some error. **Level 1** Describe at least one difference between the coenzymes, not a lot of details are included. Little content is relevant and contains more errors. **Level 0** No relevant content.	**Indicative content** • NAD and FAD, involved in respiration • Found in cytoplasm and in mitochondria • Associated with, dehydrogenase enzymes / dehydrogenation / reduction / redox • 2 reduced NAD made in glycolysis per glucose molecule • 1 reduced NAD made in link reaction per pyruvate (or 2 per glucose) • 3 reduced NAD made in one Krebs cycle (or 6 per glucose) • 1 reduced FAD made in one Krebs cycle (or 2 per glucose) • *Details* of how reduced NAD is made in any reactions above (e.g., NAD reduced from triose phosphate to pyruvate) • Carriers / transfers, hydrogen to, inner mitochondrial membrane / cristae • Releases hydrogen and electrons for oxidative phosphorylation • NADP involved in photosynthesis	6	

Question	Answers	Extra information	Mark	AO Spec reference
		• Found in chloroplasts • Produced in non-cyclic photophosphorylation • Hydrogen comes from, water / photolysis • Releases hydrogen in calvin cycle / light independent stage to reduce glycerate phosphate (GP) to triose phosphate (TP)		
6(a)	$d = \frac{1}{24^2}$ ✓ = 0.0017 ✓	If the answer is correct with no marking shown, award 2 marks. If the answer is incorrect but with correct marking, award 1 mark. If the answer is correct but not presented in 4 decimal places, award 1 mark. e.g., 0.00174 or 0.002	2	AO2 AO3 5.2.1(g)
6(b)	radius / diameter of the capillary tube ✓		1	
6(c)(i)	Any one <u>pair</u> from: carbon dioxide **AND** produced in respiration ✓ ✓ nitrogen **AND** some left in air spaces in the leaves ✓ ✓	1 mark for correctly named gas, 1 mark for correct explanation	2 max	
6(c)(ii)	Any one of: some used in aerobic respiration ✓ some dissolved in the water in the test tube ✓ some might have escaped ✓		1 max	

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6(d)(i)	increasing light intensity increases rate ✓ more light energy to break down more water / excite more electrons / more photophosphorylation / more light-independent stage ✓		2	
6(d)(ii)	*Temperature:* Set up thermostatically controlled water bath to place test tube of plant in ✓ *Carbon dioxide concentration:* Fill test tube with sodium/potassium hydrogencarbonate solution (HCO_3^-) ✓		2	

Skills box answers

Question	Answer
1(a)	1.74%
1(b)	0.159%
1(c)	2.45%
2	0.1
3	0.5