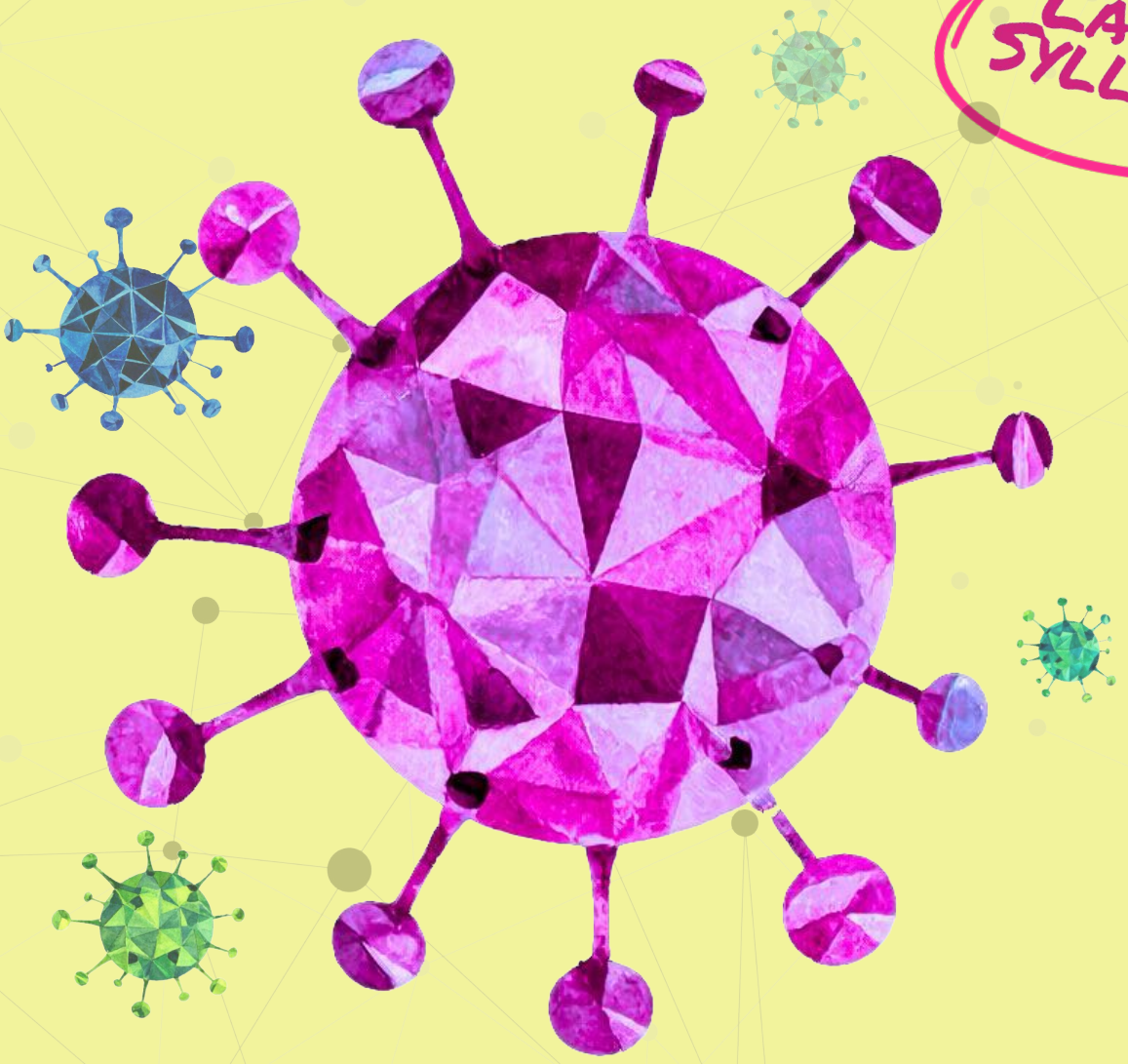
edexcel

A2 Biology

LATEST SYLLABUS



Unit 4: 2019 – 2025 Classified Past PAPERS

SCAN ME

UNIT 4

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PHOTOSYNTHESIS 1

1 The photograph below shows part of a leaf, as seen using a hand lens.

Magnification ×20

(a) Suggest why each of the following is important for the production of carbohydrates in the photosynthetic cells.

(i) The thin lamina

(2)

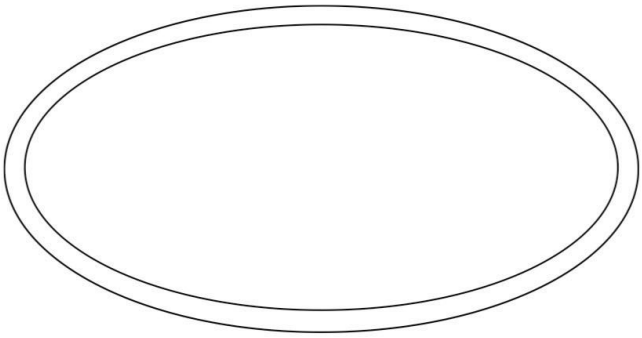
(ii) Vessels in the midrib

(2)

PHOTOSYNTHESIS 1

2 In seaweeds that are found on shores around Britain, photosynthesis occurs during the time that they are submerged at high tide. Seaweeds found near the top of the shore are submerged for short periods in shallow water. Seaweeds found lower down the shore are submerged for longer periods in deeper water.

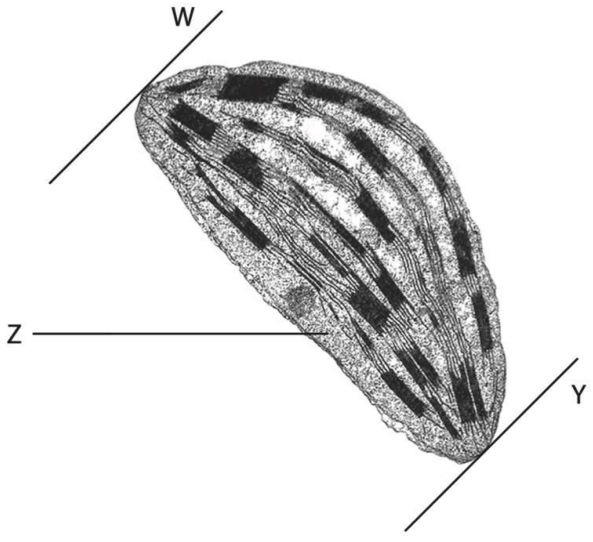
(a) The diagram below shows the double-membrane envelope of a chloroplast.



(i) Complete the diagram to show the structures involved in the light-dependent reactions of photosynthesis. Label these structures.

(2)

(b) The electronmicrograph below shows a chloroplast.



Magnification ×7500

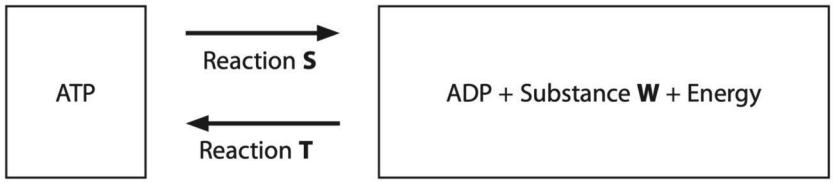
(i) Place a cross ☒ in the box next to the name of the part labelled **Z**.

(1)

- ☒ **A** cytoplasm
- ☒ **B** matrix
- ☒ **C** stroma
- ☒ **D** thylakoid

PHOTOSYNTHESIS 1

3 The diagram below summarises the interconversion of ATP and ADP.



(a) Place a cross ☒ in the box that identifies each of the following.

(3)

(i) Substance **W**

☒ **A** carbon dioxide

☒ **B** an electron

☒ **C** inorganic phosphate

☒ **D** a proton

(ii) Reaction **S**

☒ **A** carboxylation

☒ **B** hydrolysis

☒ **C** phosphorylation

☒ **D** photolysis

(iii) Reaction **T**

☒ **A** carboxylation

☒ **B** hydrolysis

☒ **C** phosphorylation

☒ **D** photolysis

(b) Reaction **T** occurs in a chloroplast.
Describe the structures in a chloroplast that are involved in this reaction.

(3)

(Total for Question 1 = 6 marks)

PHOTOSYNTHESIS 1

4 (i) The table below shows two statements taken from a student's essay about the light-dependent reactions of photosynthesis.
Complete the following table by placing a tick (✓) in the correct column next to each statement to show whether it is true or false.

(2)

Statement	True	False
Electrons in chlorophyll are excited as light energy is absorbed		
The energy absorbed by chlorophyll is used to generate ADP and NADP		

(iii) Explain how oxygen is produced during the light-dependent reactions of photosynthesis.

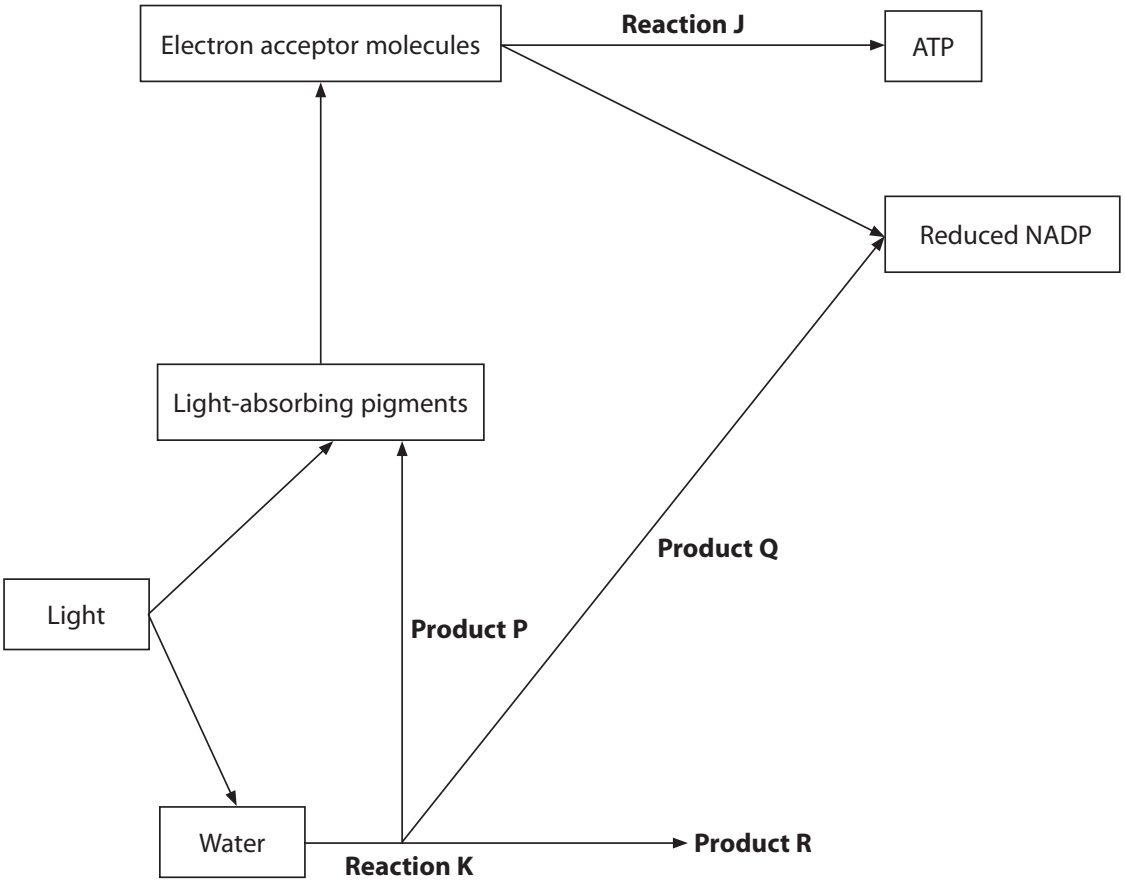
(2)

PHOTOSYNTHESIS 1

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

5 Photosynthesis involves light-dependent and light-independent reactions.

The diagram below shows some of the stages in the light-dependent reaction of photosynthesis.



PHOTOSYNTHESIS 1

(a) Put a cross (☒) in the box next to the row in the table that correctly identifies the products **P**, **Q** and **R** made from **one** molecule of water.

(1)

	Product P	Product Q	Product R
☒ **A**	electrons	hydrogen ions	oxygen atom
☒ **B**	electrons	hydrogen molecule	oxygen molecule
☒ **C**	oxygen atom	electrons	hydrogen ions
☒ **D**	oxygen molecule	hydrogen molecule	electrons

(b) Put a cross (☒) in the box next to the name of reaction **K**.

(1)

☒ **A** condensation

☒ **B** hydrolysis

☒ **C** photolysis

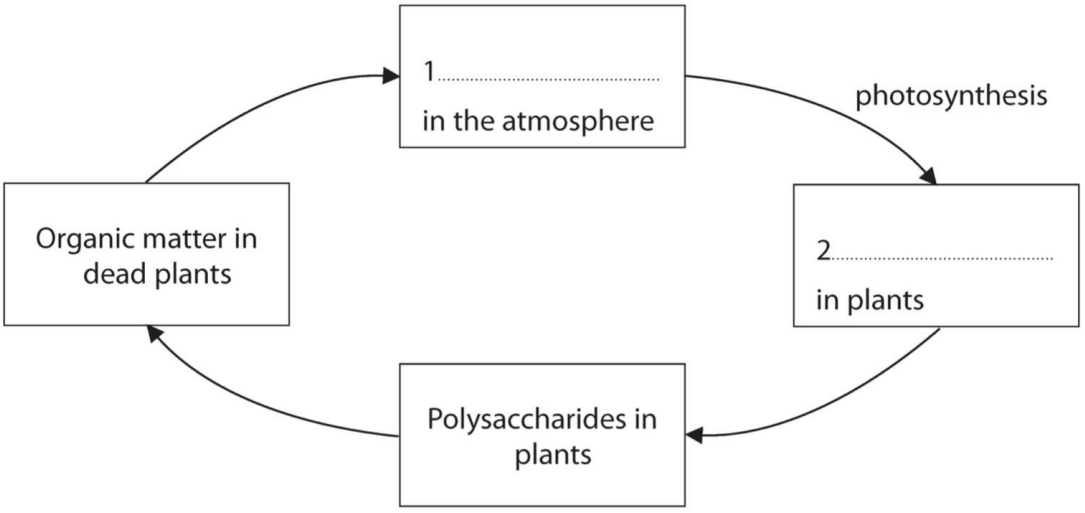
☒ **D** reduction

(c) Explain how reaction **J** is involved in the production of ATP in chloroplasts.

(3)

PHOTOSYNTHESIS 1

6 The diagram below shows part of the carbon cycle.



(a) Complete the diagram, by writing the appropriate word or words on the dotted lines.

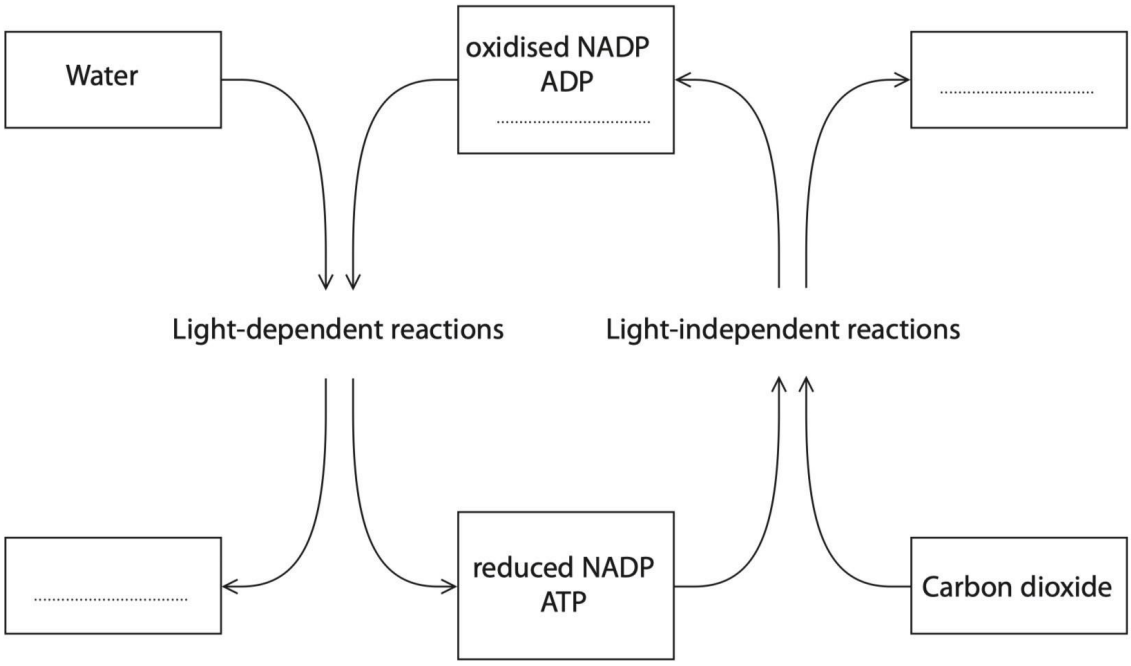
(2)

(b) Explain the role of light in the photosynthesis stage of this cycle.

(5)

PHOTOSYNTHESIS 1

7 The diagram below shows some of the steps involved in photosynthesis.



(a) Complete the diagram by writing the correct word or words on the dotted lines.

(3)

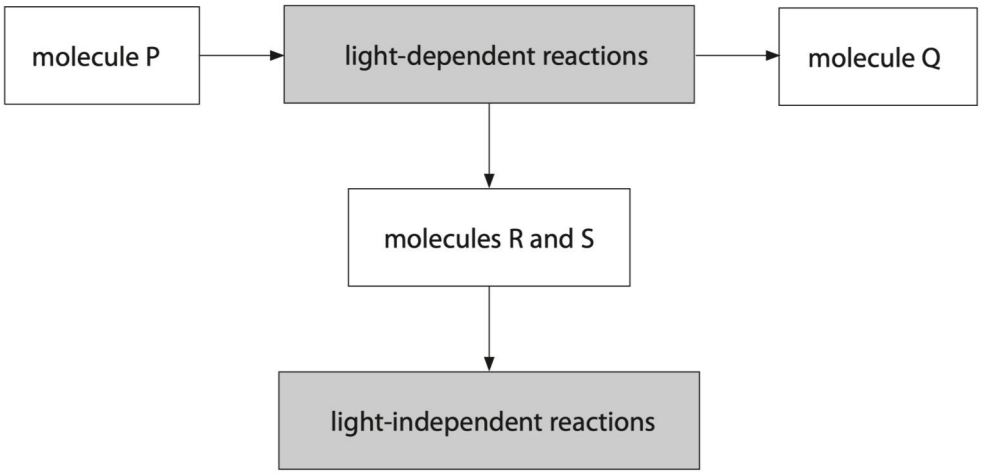
*(b) Describe the roles of the thylakoid membranes in the production of ATP in the light-dependent reaction.

(6)

(Total for Question = 9 marks)

PHOTOSYNTHESIS 1

8 (a) The diagram below shows some of the steps in the process of photosynthesis.



(i) Name molecules **P** and **Q** in the diagram.

(1)

molecule P .....

molecule Q .....

(ii) Place a cross ☒ in the box next to the names of molecules **R** and **S** in the diagram.

(1)

☒ **A** ADP and oxidised NADP

☒ **B** ADP and reduced NADP

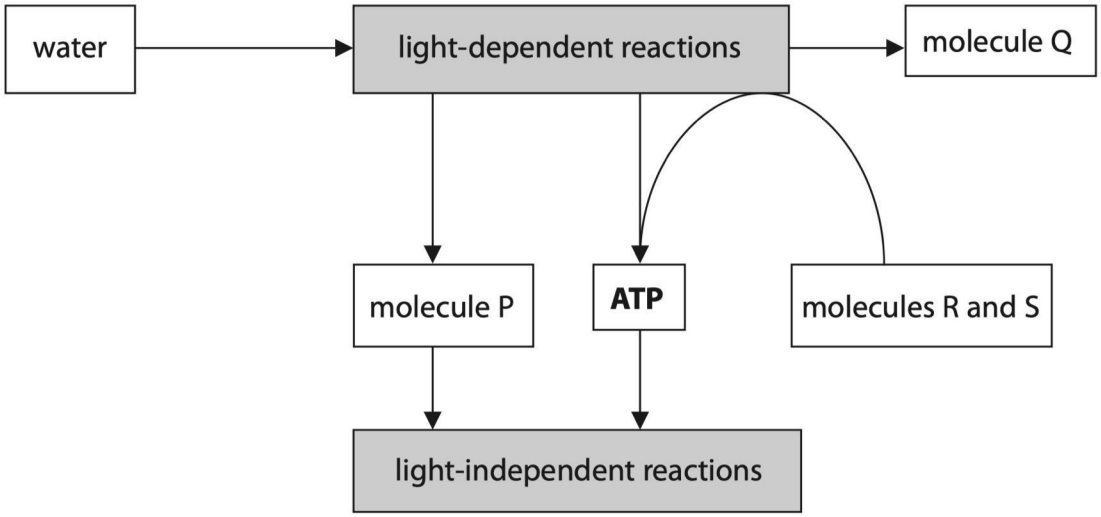
☒ **C** ATP and oxidised NADP

☒ **D** ATP and reduced NADP

(iii) Describe how the membranes inside the chloroplast are involved in photosynthesis. **(3)**

PHOTOSYNTHESIS 1

9 (a) The diagram below shows some of the steps in the process of photosynthesis.



(i) Place a cross ☒ in the box next to the name of molecule **P** in the diagram.

(1)

☒ **A** carbon dioxide

☒ **B** oxidised NADP

☒ **C** reduced NADP

☒ **D** RUBISCO

(ii) Name the molecules **R** and **S** in the diagram.

(1)

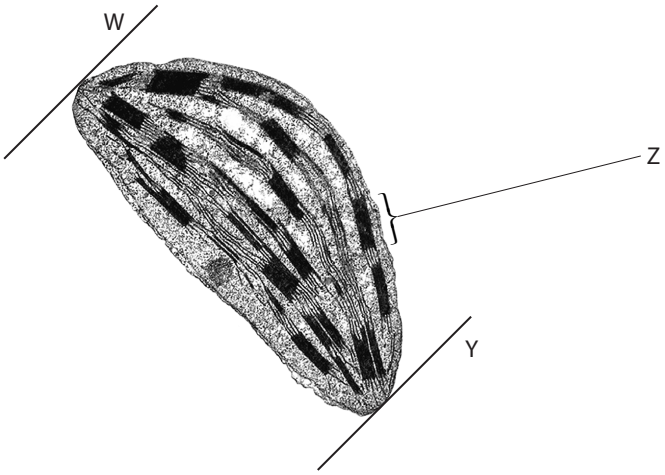
molecule **R** .....

molecule **S** .....

(iii) Describe how molecule **Q** is produced.

(4)

(b) The electronmicrograph below shows an image of a chloroplast.



(i) Place a cross ☒ in the box next to the name of the part labelled **Z**.

(1)

- ☒ **A** granum
- ☒ **B** ribosome
- ☒ **C** starch grain
- ☒ **D** stroma

(ii) The equation below can be used to calculate the magnification of this chloroplast.

image length = actual length × magnification

The actual length of this chloroplast is 0.007 mm.

Measure the image length between lines **W** and **Y**. Use this equation to calculate the magnification of the image.

(3)

magnification = ...

(iii) Describe the structure of chloroplasts in relation to their roles in photosynthesis.

(3)

.....

.....

.....

.....

.....

.....

.....

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.....

(Total for Question 2 = 13 marks)

(b) As light penetrates deeper water, red, orange and yellow wavelengths are absorbed by the seawater, whereas in shallow water most wavelengths penetrate.

The table below shows the relative rates of photosynthesis in a green seaweed, *Ulva lactuca*, and a red seaweed, *Schizymenia dubyi*, at different wavelengths of light.
The relative rates of photosynthesis are compared with the rate in light with a wavelength of 660 nm (red).

Seaweed	**Relative rate of photosynthesis / arbitrary units**		
	430 nm (blue)	**540 nm (green)**	**660 nm (red)**
Ulva lactuca	0.94	0.17	1.0
Schizymenia dubyi	0.38	3.40	1.0

(i) Using the data in the table, suggest where each of these two seaweeds is most likely to be found on a seashore. Place a tick (✓) in the most appropriate box in each column.

(2)

Position on shore	***Ulva lactuca***	***Schizymenia dubyi***
Top of the shore		
Middle of the shore		
Lower down the shore		
All regions		

(ii) Give reasons for your answers.

(4)

.....

.....

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.....

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.....

(Total for Question 2 = 12 marks)

PHOTOSYNTHESIS 1

9 The process of photosynthesis has two main stages. The first of these involves the light-dependent reactions.

(a) The statements below describe important parts of the light-dependent reactions of photosynthesis. Place a cross ☒ in the box next to the term that completes each statement correctly.

(i) When light is absorbed by chlorophyll, it excites

(1)

☒ **A** electrons

☒ **B** neutrons

☒ **C** photons

☒ **D** protons

(ii) Oxygen is produced when water molecules are split in the process of

(1)

☒ **A** analysis

☒ **B** autolysis

☒ **C** hydrolysis

☒ **D** photolysis

(iii) The products of the light-dependent reactions that are used in the light-independent reactions are reduced NADP and

(1)

☒ **A** ATP

☒ **B** GALP

☒ **C** DNA

☒ **D** RuBP

(b) Describe the structures in a chloroplast that are involved in the light-dependent reactions of photosynthesis.

(3)

(c) In an investigation, wheat plants were grown using artificial lighting. Three different types of lighting were used. When the wheat plants were mature, the total biomass of the plants and the mass of the grain (seeds) they produced were measured for each type of lighting.

The table below shows the results of this investigation.

Type of lighting	**Total biomass / kg**	**Mass of grain / kg**	**Grain yield as a percentage of total biomass (%)**
Low pressure sodium lamps	171	61.7	36.1
High pressure sodium lamps	159	58.8	37.0
Metal halide lamps	162	62.4	

(i) Calculate the grain yield, as a percentage of total biomass, for the wheat grown under metal halide lamps. Show your working.

(2)

Answer ..... %

(ii) With reference to the data in the table, suggest the conclusions the investigators may have made about the effect of using different types of lighting on grain yield.

(3)

(iii) Suggest **two** advantages of growing crops of wheat in glasshouses with artificial lighting rather than growing them in open fields.

(2)

(Total for Question 2 = 13 marks)

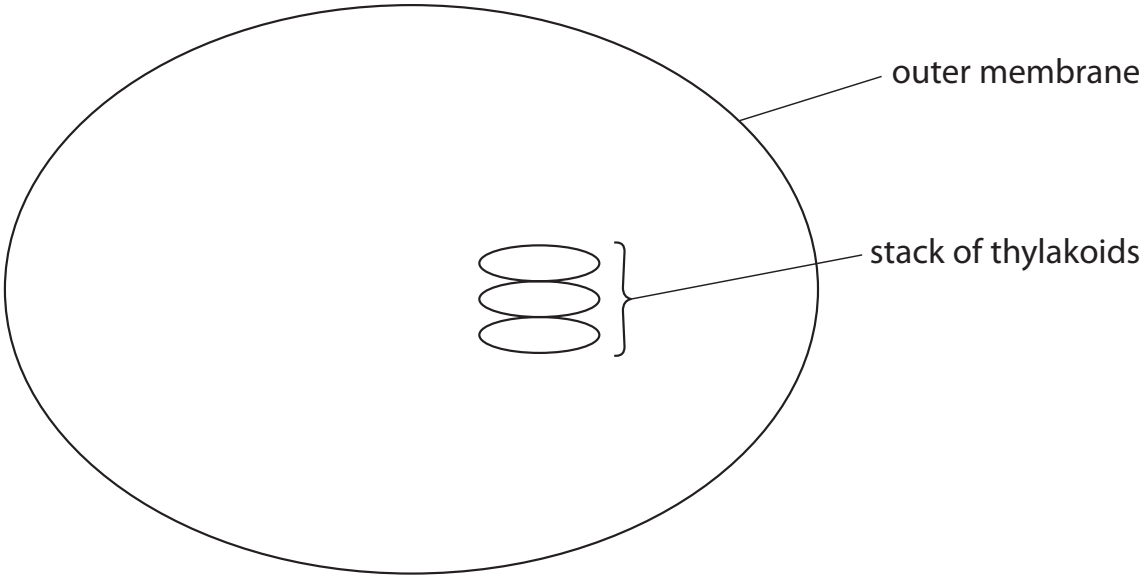
10 Chloroplasts are involved in both the light-dependent reactions and the light-independent reactions of photosynthesis.

(a) Which row of the table is correct for these two reactions?

(1)

	Light-dependent reactions	Light-independent reactions
☒ **A**	ADP is phosphorylated, releasing energy	ATP is hydrolysed, requiring energy
☒ **B**	ADP is phosphorylated, requiring energy	ATP is hydrolysed, releasing energy
☒ **C**	ATP is hydrolysed, releasing energy	ADP is phosphorylated, requiring energy
☒ **D**	ATP is hydrolysed, requiring energy	ADP is phosphorylated, releasing energy

(b) The diagram shows part of a chloroplast.



(i) Complete this diagram to show **three** other labelled structures found in a chloroplast.

(3)

(ii) Compare and contrast the structure of the outer membrane of a chloroplast with that of a thylakoid membrane.

(4)

(Total for Question 10 = 8 marks)

11 Photosynthesis consists of the light-dependent reactions and the light-independent reactions.

(a) In the light-dependent reactions, light energy is converted into energy stored in ATP.

(i) Explain why light energy is converted into energy stored in ATP.

(2)

.....

.....

.....

.....

.....

.....

(ii) An equation can summarise the production and breakdown of ATP.

Complete this equation, by writing the names of the substrates and the type of reaction on the three dotted lines provided.

(2)

..... + ... ⇌ ..... **ATP**

phosphorylation

(iii) Explain the role of light energy in the light-dependent reactions.

(3)

(b) The light-independent reactions use products of the light-dependent reactions to produce simple sugars.

(i) Which row of the table shows the products of the light-dependent reactions that are used in the light-independent reactions?

(1)

	ATP produced by	NADP
☒ **A**	cyclic photophosphorylation	oxidised
☒ **B**	cyclic photophosphorylation	reduced
☒ **C**	non-cyclic photophosphorylation	oxidised
☒ **D**	non-cyclic photophosphorylation	reduced

(ii) Simple sugars have the formula $C_nH_{2n}O_n$.

Name the inorganic molecule from which each element in a simple sugar originated.

(2)

C .....

H .....

O .....

(iii) Simple sugars are used in the synthesis of new biological molecules.

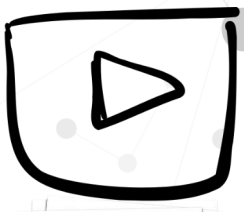
Which row of the table shows the inorganic ions that are needed to synthesise these new biological molecules?

(3)

New biological molecule	Nitrates	Phosphates	Both nitrates and phosphates	Neither nitrates nor phosphates
protein	☒	☒	☒	☒
RNA	☒	☒	☒	☒
triglyceride	☒	☒	☒	☒

(Total for Question 11 = 13 marks)

The Complete Course for IAL A2 Biology



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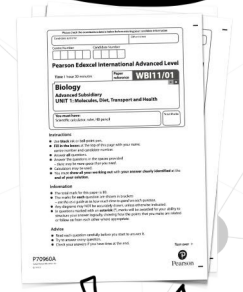

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