WORKBOOK

AQA A-LEVEL

Biology 2

YEAR 2 TOPICS

- Energy transfers in and between organisms
- Organisms respond to changes in their internal and external environments
- Genetics, populations, evolution and ecosystems
- The control of gene expression

- ✔ *Build confidence with practice questions*
- ✔ *Practise key maths and practical skills*
- ✔ *Prepare for assessment with exam-style questions*

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Contents

SAMPLE

About this book

1 **This workbook** will help you to prepare for AQA A-level Biology Topics 5–8.

2 **Topics 5–8** could be assessed in:

- A-level Paper 2, which lasts for 2 hours and covers Topics 5–8. Paper 2 is worth 35% of the A-level. There is a mixture of short- and long-answer questions, worth 76 marks. There are also some questions requiring extended-response answers, worth 15 marks.
- A-level Paper 3, which lasts for 2 hours and covers Topics 1–8. Paper 3 is worth 30% of the A-level. Section A has structured questions, including practical techniques, worth 38 marks. Some questions require critical analysis of experimental data, worth 15 marks. Section B requires one essay from a choice of two titles and is worth 25 marks.

3 **For each topic** in this workbook there are:

- stimulus materials, including key terms and concepts
- short-answer questions that build up to exam-style questions
- spaces for you to write or plan your answers
- questions that test your mathematical skills

4 **Answering the questions** will help you to build your skills and meet the assessment objectives AO1 (knowledge and understanding), AO2 (application), AO3 (analysis) and AO4 (evaluation). Quantitative skills will make up a minimum of 20% of the total marks across the A-level.

5 **Worked answers** are included throughout the practice questions to help you understand how to gain the most marks.

6 Icons next to the question will help you to identify:

 where the practical elements of the course are covered

 where your calculations skills are tested

 where questions draw on synoptic knowledge, i.e. content from more than one topic

how long this question should take you

7 **You still need** to read your textbook and refer to your revision guides and lesson notes.

8 **Marks available** are indicated for all questions so that you can gauge the level of detail required in your answers.

9 **Timings** are given for the exam-style questions to make your practice as realistic as possible.

10 **Answers** are available at: **www.hoddereducation.co.uk/workbookanswers.**

SAMPLE

Topic 5 Energy transfers in and between organisms

Photosynthesis

Photosynthesis uses light energy to produce useful organic substances. The overall equation for photosynthesis is:

carbon dioxide + water → glucose + oxygen

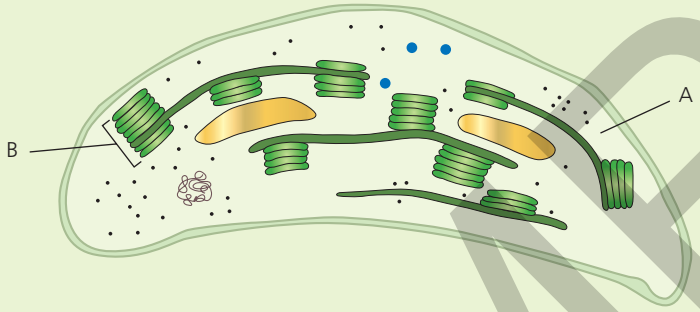
$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

In eukaryotic cells, chloroplasts are the sites of photosynthesis. Chloroplasts contain the green pigment **chlorophyll**, which absorbs light energy.

Photosynthesis produces ATP from the condensation of ADP and Pi (an inorganic phosphate group) in a reaction catalysed by ATP synthase.

Practice questions

1 The diagram shows a chloroplast.



a Name the parts of the chloroplast labelled A and B. **1 mark**

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b Where do the **light-dependent** reactions take place and where do the **light-independent** reactions take place? **1 mark**

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2 The light-dependent reaction involves:

- photoionisation of chlorophyll
- ATP synthesis
- photolysis of water

a What happens in the photoionisation of chlorophyll? **2 marks**

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b How is ATP synthesised? **4 marks**

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c Describe what happens in the photolysis of water. **3 marks**

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d The **light-dependent** reactions produce ATP and reduced NADP. How are these products used in the **light-independent** reactions? **2 marks**

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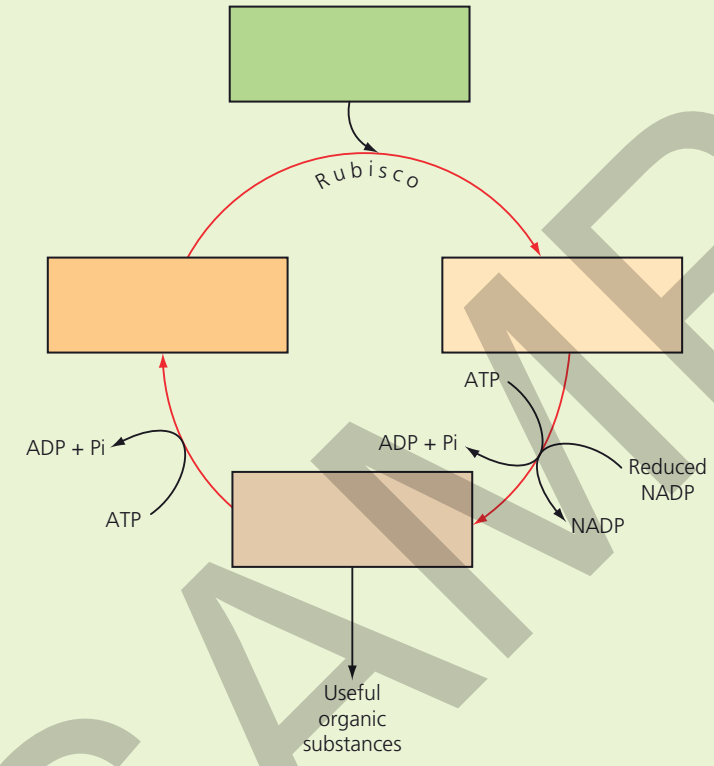
3 The diagram shows a simplified **light-independent** reaction.



a Complete the diagram by adding these labels: **2 marks**

- CO_2
- GP (glycerate-3-phosphate)
- RuBP (ribulose bisphosphate)
- TP (triose phosphate)

b How many carbon atoms are found in GP, RuBP and TP? **1 mark**

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c How many molecules of GP are formed from RuBP? **1 mark**

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d What percentage of TP is used in the regeneration of RuBP? **1 mark**

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e Explain why increasing temperature increases the rate of TP production in the **light-independent** reaction, but has little effect on the **light-dependent** reaction. **2 marks**

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4 Required practical 7 requires you to use chromatography to investigate the pigments isolated from the leaves of different plants.

The table describes some of the steps used in the chromatography of leaf pigments.

Step used in chromatography	Reason for the step
Step 1: The line marking the origin is drawn using **pencil.**	
Step 2: The chromatography paper is positioned in the tube so that the solvent is **not** above the origin.	
Step 3: A pencil line marking the solvent front is drawn **immediately** after removing the chromatography paper from the tube.	

a Complete the table to give the reason for each step. **3 marks**

b State **one** risk associated with this practical and what control measure would you take to minimise this risk? **2 marks**

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c The chromatogram produced after separating leaf pigments by chromatography can be used to calculate Rf values for each pigment.

How are Rf values calculated? **2 marks**

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The diagram shows a chromatogram from the chromatography of leaf pigments.

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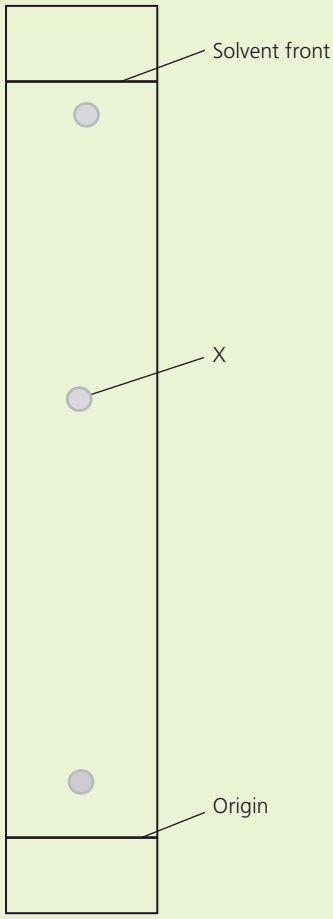

d Calculate the Rf value of the pigment labelled X. **2 marks**

The table gives the Rf values of some leaf pigments.

Leaf pigment	Rf value
Carotene	0.96
Chlorophyll a	0.58
Chlorophyll b	0.48
Xanthophyll	0.46

e Identify pigment X using the table. **1 mark**

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f A student calculates the Rf of a leaf pigment as 0.47. Suggest what the student could do to identify this pigment. **1 mark**

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5 Required practical 8 requires you to investigate the rate of dehydrogenase activity in extracts of chloroplasts.

Chloroplast extract can be made by blending spinach leaves with an isotonic buffer solution.

a Why is it important to use an **isotonic** solution? **2 marks**

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DCPIP is a blue dye that can be used to measure dehydrogenase activity because it decolourises when it is reduced.

The table shows how three test tubes were set up, and the observations made.

Test tube contents	Test tube conditions	Observations
Tube 1: 1 cm^3 isotonic buffer solution + 5 cm^3 DCPIP	Light	Remains blue
Tube 2: 1 cm^3 chloroplast suspension + 5 cm^3 DCPIP	Light	Decolourises
Tube 3: 1 cm^3 chloroplast suspension + 5 cm^3 DCPIP	Dark	Remains blue

b Tube 1 contains no chloroplasts. What is the purpose of Tube 1? **2 marks**

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c Why does Tube 2 decolourise? **2 marks**

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d Why does Tube 3 remain blue? **2 marks**

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e How could you use chloroplast suspension and DCPIP to investigate the effect of temperature on the rate of dehydrogenase activity? Include control variables in your description. **3 marks**

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Exam-style questions

1 Atrazine is a weedkiller that reduces the rate of photosynthesis. Atrazine binds to one of the proteins in the electron transfer chain and inhibits the movement of electrons. **12**

a Explain why atrazine inhibits the growth of weeds. **4 marks**

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Weeds treated with atrazine have a reduced uptake of carbon dioxide.

b Where in a chloroplast does carbon dioxide join with RuBP? **1 mark**

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c Name the enzyme that catalyses the reaction between carbon dioxide and RuBP. **1 mark**

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d Explain why atrazine reduces the uptake of carbon dioxide. **2 marks**

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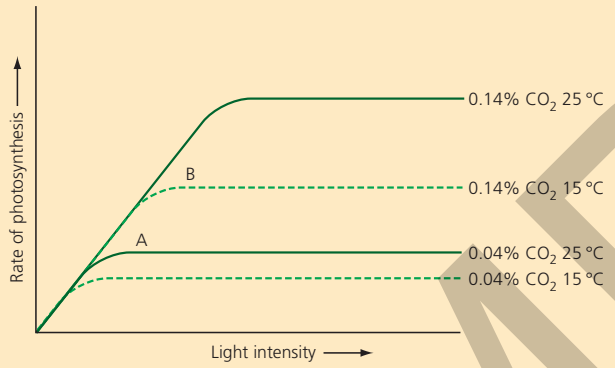
2 The rate of photosynthesis can be limited by environmental factors. 16

The graph shows the effect of environmental factors on the rate of photosynthesis.



a Name the limiting factors between points A and B on the graph. Explain your answer. **3 marks**

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b Explain the difference in the rates of photosynthesis for:

i 0.04% CO_2 at 15°C and 0.04% CO_2 at 25°C and high light intensity **2 marks**

ii 0.04% CO_2 at 25°C and 0.14% CO_2 at 25°C and high light intensity **2 marks**

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c Suggest a suitable unit for measuring the rate of photosynthesis. **2 marks**

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d A tomato grower uses the data from the graph to conclude that the optimum conditions for his glasshouse are a carbon dioxide concentration of 0.14% and a temperature of 25°C.

Evaluate this conclusion. **3 marks**

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3 The graphs show the percentage light absorbance at different wavelengths of light for three leaf pigments, and the rate of photosynthesis at different wavelengths of light.

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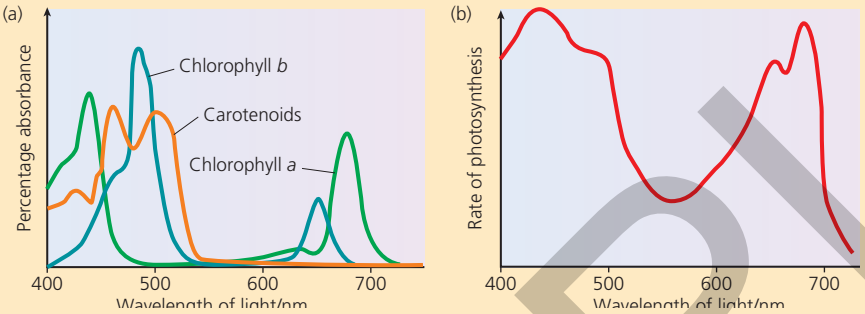

a Using evidence from the graph, what can you conclude about the involvement of the leaf pigments in photosynthesis? **1 mark**

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b Describe the role of chlorophyll in photosynthesis. **3 marks**

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c Using the evidence from the graph, what can you conclude about the properties of chlorophyll a? **2 marks**

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d Some photosynthetic organisms also have yellow pigments called xanthophylls.

Suggest the advantage of these additional pigments for a photosynthetic organism. **2 marks**

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