

Examiners' report

A LEVEL

BIOLOGY B

(ADVANCING BIOLOGY)

**OCR Level 3 Advanced GCE in Biology B
(Advancing Biology)**

H422

For first teaching in 2015

H422/02 Summer 2025 series

Contents

Introduction	4
Paper 2 series overview	5
Question 1 (a) (i)	6
Question 1 (a) (ii)	7
Question 1 (a) (iii)	7
Question 1 (b) (i)	8
Question 1 (b) (ii)	9
Question 1 (b) (iii)	10
Question 1 (c) (i)	10
Question 1 (c) (ii)	11
Question 1 (d) (i)	12
Question 1 (d) (ii)	13
Question 1 (d) (iii)	14
Question 2 (a) (i)*	15
Question 2 (a) (ii)	17
Question 2 (b) (i)	17
Question 2 (b) (ii)	18
Question 3 (a)	19
Question 3 (b) (i) and (ii)	20
Question 3 (c)*	21
Question 4 (a) (i) and (ii)	23
Question 4 (a) (iii)	25
Question 4 (b)	25
Question 4 (c)	26
Question 5 (a) (i)	26
Question 5 (a) (ii)	27
Question 5 (b) (i)	28
Question 5 (b) (ii)	29
Question 5 (c) (i)	29
Question 5 (c) (ii)	30
Question 5 (d) (i)	30
Question 5 (d) (ii) and (iii)	31
Question 6 (a) (i)	32
Question 6 (a) (ii)	32

Question 6 (b)	33
Question 6 (c)	34
Question 7 (a)	35
Question 7 (b)	35
Question 7 (c)	36
Question 7 (d) (i)	36
Question 7 (d) (ii)	37
Question 7 (e)	37
Question 7 (f) (i)	38
Question 7 (f) (ii)	38
Copyright information	39

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate responses is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from [Teach Cambridge](#).

Would you prefer a Word version?

Did you know that you can save this PDF as a Word file using Acrobat Professional?

Simply click on **File > Export to** and select **Microsoft Word**

(If you have opened this PDF in your browser you will need to save it first. Simply right click anywhere on the page and select **Save as . . .** to save the PDF. Then open the PDF in Acrobat Professional.)

If you do not have access to Acrobat Professional there are a number of **free** applications available that will also convert PDF to Word (search for PDF to Word converter).

Paper 2 series overview

H422/02 is one of three components of the GCE A Level Biology B specification assessed during this examination session. For H422/02, candidates needed to demonstrate knowledge and scientific literacy skills across all modules (1 to 5). There is an Advance Notice Article (ANA) for candidates to study and use in responding to items in Question 1. Two Level of Response questions are included in the 100 marks.

There are no changes to the format of the exam paper and mathematical and practical skills continue to be embedded within the questions throughout. There was no evidence to suggest that candidates were under any time constraints towards the end of the paper and most questions were attempted, with few 'no responses'.

Overall, candidates demonstrated a wide range of ability with more successful candidates giving succinct responses and appearing more adept at coping with the demands of the paper's mathematical and practical content to get higher-level marking points. There is evidence that candidates are continuing to make good use of the ANA and credit is given for responses that show use of the ANA in Q1.

Candidates across the ability range continue to gain confidence in tackling Level of Response questions, with many providing detailed, well-communicated answers. Most candidates were able to demonstrate their ability to learn and recall facts from the specification.

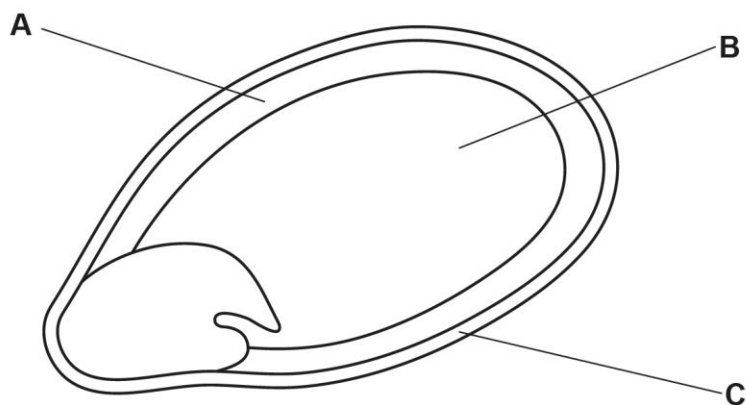
Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• used information in the ANA to apply knowledge and formulate good responses to Question 1 • could apply knowledge to the new contexts in the exam paper • demonstrated the ability to use mathematical skills in complex calculations • could explain, conclude and evaluate effectively to provide detailed, succinct responses • offered detailed responses to LoR questions in Question 2 (a) (i)* and 3 (c)*.	• used knowledge to recall facts and attempt definitions • could complete stages of a calculation and use formulae • could name and describe using knowledge from the specification • performed less well when asked to explain or evaluate.

Question 1 (a) (i)

- 1 This question is based on the Advance Notice Article '**Dormancy in cereals: not too much, not too little**'.

The article describes dormancy in cereal seeds, such as barley.

The diagram shows a drawing of a cross section through a barley seed.



(a)

- (i) State the name of the structure labelled **A** in the diagram and state its function.

Name

Function

.....

.....

.....

[2]

Most candidates got 1 mark for identifying the aleurone layer in the diagram and many could also state its function. The most common error was in mistaking the aleurone layer for the endosperm of the seed.

Question 1 (a) (ii)

(ii) Outline how the structure labelled **B** is formed and state its function.

Formation

.....

Function

.....

.....

[2]

This question required candidates to recognise that the structure labelled B in the diagram was the endosperm and apply this to outlining how it is formed. Many candidates remembered that polar nuclei were involved but, to get marks, responses needed to refer to fusion with the pollen 'nucleus' rather than just the pollen 'grain' or male gamete. Candidates that knew that structure B was the endosperm generally got credit for its function.

Question 1 (a) (iii)

(iii) The article describes how the hormones ABA and GA regulate seed dormancy.

Suggest how removal of the structure labelled **C** can reduce seed dormancy.

.....

.....

.....

.....

..... [2]

Candidates that recognised that structure C was the testa (seed coat) and correctly applied their knowledge of the plant hormones involved in seed dormancy provided successful responses. Research around the ABA was often seen in responses to this question that were worthy of marks, e.g. the fact that more water entering would 'flush out' ABA.

Misconception



It was a common misconception that the testa **prevents** oxygen and water from entering. It was important for candidates to understand that removing the testa would allow 'more' oxygen or water to enter thereby encouraging germination and reducing dormancy.

Question 1 (b) (i)

(b)

- (i) Outline an experimental plan to investigate the effect of temperature on the germination of barley seeds.

You do **not** need to include a risk assessment or details of apparatus in your answer.

.....

.....

.....

.....

.....

..... [4]

For an outline plan that did not require details of apparatus or a risk assessment, candidates were expected to include details of the main variables. For the independent variable (IV), a minimum of four temperatures would be required for gathering meaningful data; for the dependent variable (DV), a method of **measuring** when germination occurred was required. Some candidates confused or made unsuitable statements about variables, e.g. placing petri-dishes in thermostatically controlled water baths or only using five seeds per petri-dish.

OCR support



Support and practical guidance with regards to planning investigations and deciding appropriate variables can be found in the [Biology Practical Skills Handbook](#).

Exemplar 1

Place 20 barley seeds on a Petri dish in a solution suitable for germination. Make sure they are ^{all} of the same age and variety. Control oxygen levels, water concentration, ~~humidity~~ ^{pH}, and use same solution each time. ~~Make~~ Leave in a room with a specific temperature, for example 10°C for the first investigation, using a thermostat, leaving the seeds to germinate for 3 days. After 3 days, count how many seeds have germinated and measure the lengths of any shoots/roots. Repeat the experiment for 20 barley seeds of the same variety in the same solution with the same conditions, but leaving them in rooms with different temps (15°C, 20°C, 25°C, 30°C etc) for 3 days each and compare results.

This exemplar shows a successful response. The candidate demonstrates an understanding of appropriate temperatures, i.e. only using temperatures below 45 °C, as higher temperatures could damage germinating seeds or denature enzymes. The candidate also includes a suitable DV, i.e. measuring the length of roots, which is an acceptable standardised method. Two appropriate controlled variables were also stated to gain maximum marks.

Question 1 (b) (ii)

- (ii) State **two** environmental factors, other than temperature and oxygen concentration, that affect germination in barley seeds.

1

2

[2]

This question was generally well-answered, and most candidates knew two environmental factors that affected germination.

Question 1 (b) (iii)

(iii) Seed dormancy is usually the result of seeds being exposed to a period of cold.

State the name of another process in plants that requires exposure to a period of cold.

..... [1]

This was generally well-answered. Although 'flowering' also got the mark, the scientific term 'vernalisation' was correctly used by most candidates.

Question 1 (c) (i)

(c) Dormancy in cereal seeds is important in agriculture.

(i) Explain **one** advantage for farmers of dormancy in cereal seeds.

.....
.....
.....
.....
..... [2]

Candidates providing successful responses understood that the question required an explanation of one advantage rather than a list of advantages. Common correct responses referred to the ability of farmers to manage their crops or increase yield by being able to avoid their seeds germinating in poor environmental conditions.

Question 1 (c) (ii)

- (ii) Flooding of fields can lead to barley seeds failing to germinate, whereas rice seeds do germinate in flooded fields. Farmers often sow rice seeds in flooded fields.

Use the information in the article to explain why rice seeds do germinate in flooded fields but barley seeds do not.

.....

.....

.....

.....

.....

..... [4]

Research around the ANA was often seen in responses to this question that were worthy of marks. Successful responses understood that flooded fields would have low oxygen levels, linked this to the information in the ANA, noting that rice seeds could still germinate as they contain subfamily three of starch-digesting enzymes activated in low oxygen conditions.

Assessment for learning



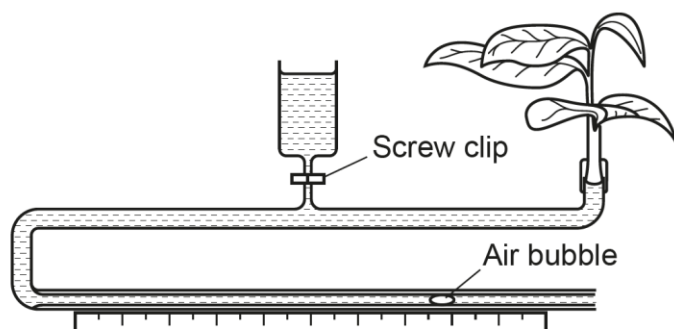
As stated in previous reports, candidates should be encouraged to research the topics included in the Advanced Notice Article (ANA) thoroughly in preparation for the examination.

Question 1 (d) (i)

(d) Some plant species have adaptations that allow them to grow in very dry conditions.

A student uses a potometer to calculate the rate of transpiration of different species of plant.

The potometer used by the student is shown in the diagram.



The movement of the air bubble was measured using a ruler with a mm scale.

(i) In an initial experiment, the student obtains these results for one species of plant:

Position of bubble at start = 2 mm

Position of bubble after 10 minutes = 117 mm

Distance moved by the bubble = 115 mm

Calculate the percentage error in the results.

Percentage error = % **[2]**

Percentage error can be a difficult concept for candidates, but many gave correct responses for this calculation demonstrating that this mathematical concept had been well-taught by centres.

Calculation:

uncertainty = $1\text{ mm} \times \frac{1}{2} = 0.5\text{ mm}$

Percentage error = $((2 \times \text{absolute uncertainty}) / \text{quantity measured}) \times 100$

Percentage error = $((2 \times 0.5) / 115) \times 100 = 0.87\%$

OCR support

As stated in the [Biology Practical Skills Handbook](#) page 36, credit was given for using either half the smallest division or the smallest division itself as the absolute uncertainty.

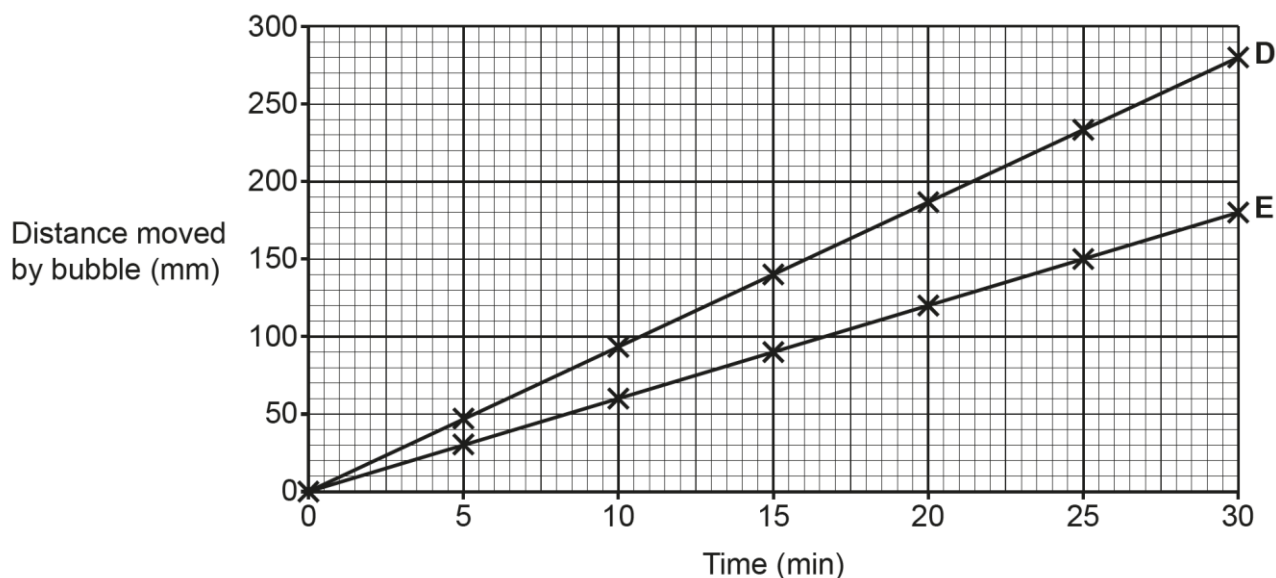
Further guidance on uncertainty can be found in the [Language of measurement resource](#).

Question 1 (d) (ii)

(ii) The student then calculates the rate of transpiration in two other species of plant, **D** and **E**.

The student takes readings every 5 minutes using the potometer.

The results are shown in the graph.



Calculate the rate of movement of the air bubble in mm min^{-1} for species **E**.

Rate = mm min^{-1} [1]

Straightforward application of extracting data from a graph was required in this question part, and most candidates correctly calculated the rate by dividing total distance moved by 30 minutes.

Calculation:

Distance moved at 30 minutes = 180 mm

Rate = $180 / 30 = 6 \text{ mm min}^{-1}$

Question 1 (d) (iii)

(iii) The student calculates the rate of movement of the air bubble in species **D** as 9.33 mm min^{-1} .

The internal diameter of the potometer tube is 1.5 mm.

Calculate the rate of transpiration for species **D** in $\text{mm}^3 \text{ min}^{-1}$.

Use the formula: volume of a cylinder = $\pi r^2 l$

Rate = $\text{mm}^3 \text{ min}^{-1}$ [2]

As distance moved per minute was given in the question stem as 9.33 mm min^{-1} , many candidates had no problem in calculating the rate as volume (of water) moved per minute.

Calculation:

Diameter = $1.5 / 2 = 0.75$

rate = $\pi \times 0.75^2 \times 9.33$

rate = $16 \text{ (mm}^3 \text{ min}^{-1}\text{)}$

Assessment for learning

The most common error when calculating rate of transpiration from potometer experiments is that candidates often forget to divide the diameter provided by two to obtain the radius required in the volume calculation.

It would be helpful to continually remind candidates to check whether diameter or radius has been provided in such questions.

Question 2 (a) (i)*

2

(a)

- (i)* Blood clotting is an essential process that protects against excessive bleeding when a blood vessel is damaged.

Describe the mechanism of blood clotting **and** suggest why a small amount of initial damage can lead to a relatively large and rapid response.

.....

.....

.....

.....

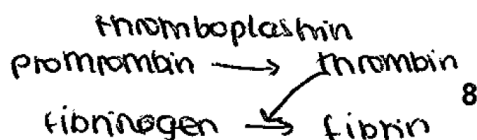
.....

.....

..... [6]

Knowledge of the blood clotting process was applied well in this Level of Response question, and many candidates provided detailed descriptions of the clotting cascade and the role of enzymes. It proved more challenging for candidates to suggest reasons for why large and/or rapid responses occurred with only a small amount of tissue damage. Common reasons why the communication mark could not be given were misidentification of substrate, product or enzyme at a particular stage, e.g. thrombin catalysing the conversion of fibrin to fibrinogen.

Exemplar 2



Blood clotting is an essential process that protects against excessive bleeding when a blood vessel is damaged.

Describe the mechanism of blood clotting and suggest why a small amount of initial damage can lead to a relatively large and rapid response.

- collagen fibres are exposed when cut or damage to the skin & release Ca^{2+}
- this triggers the release of platelets to the wound to form a sticky plug of platelets (temporary)
- these platelets trigger the release of the enzyme thromboplastin, thromboplastin catalyses the conversion of prothrombin into thrombin
- thrombin further catalyses fibrinogen to fibrin
- fibrin forms a mesh over the wound trapping erythrocytes to form a blood clot.
- small amount of damage triggers a large and rapid response as platelets act as a positive feedback mechanism which intensifies the original stimulus.
- the body produces an immediate response. [6]

This exemplar shows a good, succinct Level 3 response with a detailed description of the clotting process that includes the role of platelets, Ca^{2+} ions and the various enzyme reactions involved. There are no errors in scientific terminology, and the candidate suggests how a positive feedback mechanism would be responsible for the large and rapid response.

Question 2 (a) (ii)

- (ii) Styptic pencils can be used to stop bleeding from minor cuts, such as cuts from shaving.

A styptic pencil is a stick of hydrated salt, which acts as a vasoconstrictor and also stimulates clumping of blood proteins.

Suggest how a styptic pencil stops bleeding at the site of a cut.

.....

.....

.....

.....

..... [2]

This question proved challenging for candidates. Some candidates got 1 mark for describing how narrowing of blood vessels could reduce blood flow to the site, but few could suggest that clumping of proteins would mimic the action of blood proteins, such as fibrin. Many candidates repeated information in the question stem which was not given credit.

Question 2 (b) (i)

- (b) The intracellular enzyme lactate dehydrogenase (LDH) can be used to diagnose tissue damage caused by injury or disease.
- (i) Explain how analysis of LDH in a blood sample can be used to assess the severity of tissue damage.

.....

.....

.....

.....

..... [2]

Successful responses that gained both marks for this question gave a clear explanation of how LDH was released from damaged tissue and that the higher the concentration of LDH in the blood the more severe the damage. Few candidates mentioned how it enabled the location of damaged tissue could be identified.

Assessment for learning



Candidates should be encouraged to use the correct terminology for concentration rather than ambiguous terms such as amount/level or abbreviated terms such as 'conc'.

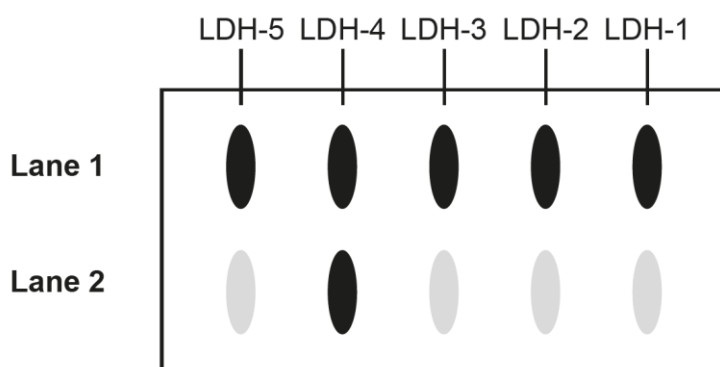
Question 2 (b) (ii)

(ii) Screening for tissue damage uses gel electrophoresis to separate different forms of LDH.

The table shows the five different forms of LDH and their main locations in tissues.

Enzyme form	Main locations
LDH-1	Heart muscle and erythrocytes
LDH-2	White blood cells
LDH-3	Lung
LDH-4	Kidney, placenta and pancreas
LDH-5	Liver and skeletal muscle

The diagram shows the results of an analysis of a blood sample from a **male** patient.



Lane 1 is a mixture of pure samples of the five forms of LDH. Lane 2 is the patient sample.

Explain why it is **not** possible to be certain about the site of tissue damage in this patient.

.....

.....

.....

.....

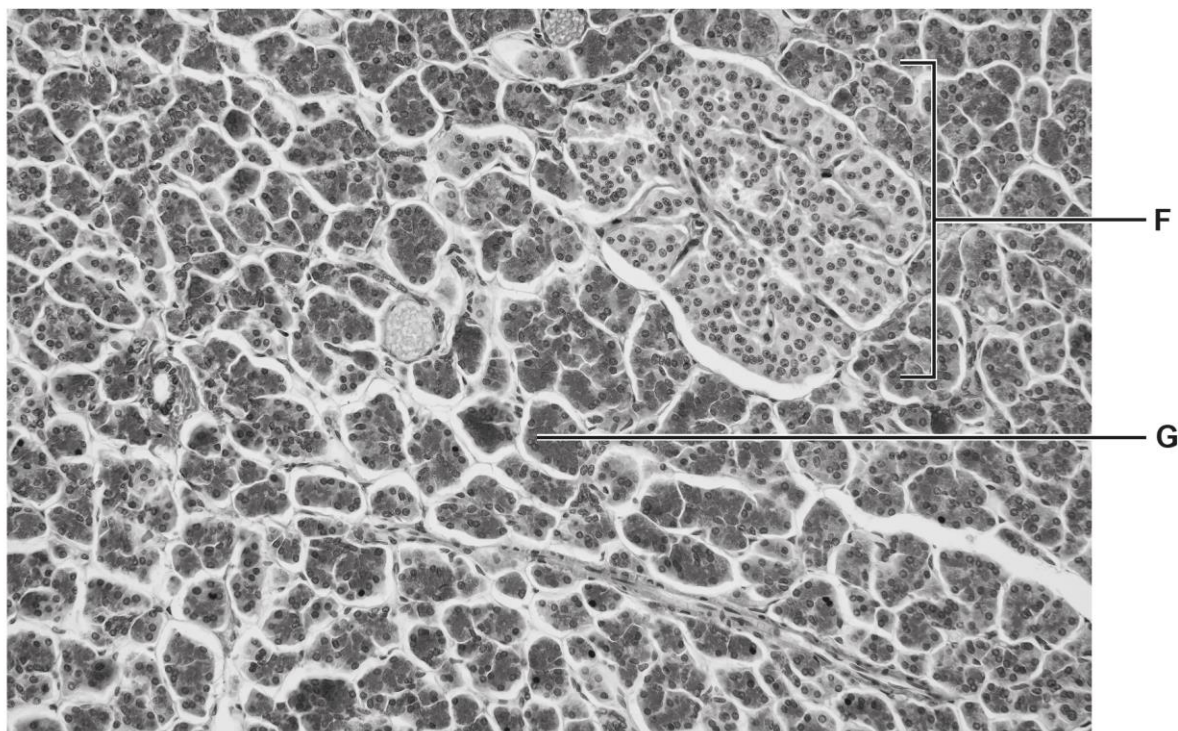
..... [2]

Candidates that interpreted the information in the diagrams and noted that the patient referred to in the question was 'male' performed well in this question part.

Question 3 (a)

3

(a) This is a photomicrograph of a section of mouse pancreas.



Identify the structures labelled **F** and **G**.

F

G

[2]

Most candidates correctly identified **F** as islets of Langerhans, but only more generally successful candidates recognised **G** as exocrine tissue or acinar cells.

Question 3 (b) (i) and (ii)

(b) Glycosylated haemoglobin (HbA1c) is used to monitor how well a patient's diabetes is controlled.

HbA1c was traditionally measured as a percentage, but it is now measured in mmol mol^{-1} , which is the amount of glucose (in mmol) per mole of haemoglobin.

A patient was told that their HbA1c was 42 mmol mol^{-1} .

They found a table of HbA1c values used in diagnosis.

HbA1c (%)	Status
<5.7	normal
5.7–6.4	prediabetes (high probability of developing Type 2 diabetes)
>6.4	diabetes

(i) The equation can be used to convert values in % to mmol mol^{-1} .

$$\text{HbA1c (mmol mol}^{-1}\text{)} = (\text{HbA1c (\%)} - 2.14) \times 10.929$$

Calculate the patient's HbA1c concentration in %.

Give your answer to **2** significant figures.

HbA1c concentration = % **[2]**

(ii) Use your answer to part **(i)** to determine the status of the patient, based on the values in the table.

..... **[1]**

In **Question 3 (b) (i)**, most candidates were able to manipulate the equation and input the correct data to complete this calculation. The most common error was where candidates forgot to provide their answer to two significant figures as required by the question. As ECF (i.e., error carried forward) was applied to **Question 3 (b) (ii)**, all candidates got 1 mark for correctly determining the status of the patient using the information in the table and their calculation.

Calculation:

Rearrangement of equation:

$$\text{HbA1c (\%)} = \frac{\text{HbA1c (mmol mol}^{-1}\text{)}}{10.929} + 2.14$$

Substitution and evaluation:

$$\frac{42}{10.929} + 2.14 = 5.98 = 6.0 \text{ (2 sig figs)}$$

Question 3 (c)*

(c)* Semaglutide is a new form of anti-diabetes medication that is prescribed as a once-weekly injection for treatment of Type 2 diabetes.

Clinical trials have shown that semaglutide causes a significant reduction in HbA1c and body mass compared with existing treatments, such as daily insulin injections and other anti-diabetic drug treatments.

Other clinical trials have shown that semaglutide causes a significant reduction in kidney damage but a significant increase in retina damage compared with placebos.

Evaluate the potential advantages and disadvantages of semaglutide for treatment of Type 2 diabetes.

.....

.....

.....

.....

.....

..... [6]

Successful higher-level responses gave a balanced evaluation of semaglutide as a treatment for type II diabetes. Commonly noted advantages included the fact that weekly injections would be more convenient for patients than daily injections so would likely have less impact on daily activities and that a reduction in obesity could enable patients to have a more active lifestyle with less burden on NHS resources. Unknown side effects and loss of vision were often stated as possible disadvantages of the medication. It was common for candidates to repeat information in the question stem, for example stating that there would be an increase in retina damage without stating the potential disadvantage of causing loss of vision, which were not credit worthy.

OCR support



Support and guidance can be found on how to answer and understand marking for Level of Response questions [here](#).

Exemplar 3

- (c)* Semaglutide is a new form of anti-diabetes medication that is prescribed as a once-weekly injection for treatment of Type 2 diabetes. *insulin resistance*

Clinical trials have shown that semaglutide causes a significant reduction in HbA1c and body mass compared with existing treatments, such as daily insulin injections and other anti-diabetic drug treatments. *metformin*

Other clinical trials have shown that semaglutide causes a significant reduction in kidney damage but a significant increase in retina damage compared with placebos. *phase 2*

(+)
(-)

Evaluate the potential advantages and disadvantages of semaglutide for treatment of Type 2 diabetes.

- Advantages:
- clinical trials show that this treatment is effective in patients with diabetes.
 - Injections only have to be taken once a week compared to everyday 30 minutes before meals. Semaglutide may be less disruptive to daily routine and lifestyle.
 - It significantly reduces the concentration of glucose in the blood.
 - It reduces ^(body mass) obesity, which is one of the main risk factors for Type 2 diabetes, and is a factor that needs to be controlled normally with regular exercise and healthy balanced diets with decreased intake of glucose.
 - Once a week injections reduces the risk of forgetting to take daily medicinal drugs such as metformin or insulin injections.
 - Reduces risk of kidney damage so has fewer side effects compared to other treatments.
- Disadvantages:
- It causes significant retina damage which is not beneficial as retina damage is already something that diabetics suffer from.
 - This may increase risk of macular degeneration and loss of visual acuity. [6]

Extra answer space if required.

- Semaglutide must be tested in phase 3 and 4 in clinical trials to ensure it has been tested on a large sample size which will improve validity.
- Don't know what the long term effects are.

This exemplar shows a detailed Level 3 response. There are no errors in scientific terminology and the candidate has clearly separated their response into potential advantages and disadvantages of semaglutide.

Question 4 (a) (i) and (ii)

- 4** Solar farms use solar panels to generate electricity from sunlight. In the UK, solar farms range in size from 0.3 to 1 km² and are usually located on agricultural land.

Some people are concerned about the environmental impact of solar farms, particularly when agricultural land is converted into a solar farm.

- (a)** A study in the USA examined the biodiversity of a solar farm over a period of five years.

Construction of the solar farm was completed in 2017.

Scientists monitored the biodiversity of the plant species in the solar farm each year from 2018 to 2022 and used Simpson's Index of Diversity (D) to compare biodiversity over the study period.

The table shows the results for 2018 and 2022.

Plant species	Mean number of each species	
	2018	2022
Black-eyed Susan	15	45
Clover	18	50
Blue vervain	3	40
Common yarrow	2	28
Ironweed	0	35
Canadian milkvetch	0	30
Totals	38	228
$D =$	0.61	

- (i) Use the data in the table to calculate D for 2022.

Use the formula: $D = 1 - \left(\sum \left(\frac{n}{N} \right)^2 \right)$

$D =$ [3]

- (ii) The scientists concluded that the biodiversity had increased from 2018 to 2022.

Explain whether your value for D supports this conclusion.

.....
..... [1]

Question 4 (a) (i) was generally well-answered, with most candidates getting marks for a correct calculation of Simpson's Index of Diversity. It was expected that the response given to two significant figures was required for full marks to be given to align with the values in the table, although candidates that did not round their answer were given 2 marks for a correct calculation. As ECF was applied, candidates that had attempted the calculation were able to explain whether their value supported the conclusion in **Question 4 (a) (ii)**.

OCR support



Guidance on how data in the tables should be recorded can be found in the [Practical skills Handbook](#).

Question 4 (a) (iii)

- (iii) Suggest what additional information would be needed to increase the confidence in this conclusion.

.....

.....

.....

.....

..... [2]

Few candidates got both marks for this question. The most common correct responses suggested collecting data at the same time each year, e.g. same season, or that data from intervening years should also be collected.

Question 4 (b)

- (b) In the same study, the scientists compared the biodiversity of insect species in the solar farm and in two parts of an adjacent field that was growing soybean crops throughout the study period.

Their results are shown in the table.

Study area	Insect biodiversity
Solar farm	high
Soybean field (adjacent to solar farm)	medium
Soybean field (middle of field)	low

Explain the results shown in the table.

.....

.....

.....

.....

..... [2]

Successful responses gave detailed explanations of how lower biodiversity of plants in the field growing soybean crops would lead to a reduction in suitable habitats or food for insects. Many candidates got 1 mark for noting that there could be a higher usage of insecticides or pesticides in the soybean field.

Question 4 (c)

(c) A student stated:

'The main challenge for agriculture in the future is that climate change will have a worse effect on crop plants than it will on weed species.'

Suggest and explain whether the student's statement is likely to be correct.

.....

.....

.....

.....

.....

..... [3]

This question proved challenging for candidates, and few got full marks. Successful responses referred to the likely differences in genetic diversity between crop plants and weeds which would affect their ability to adapt to climate change.

Question 5 (a) (i)

5

(a) The hormones that control gametogenesis have different roles in males and females.

(i) State the role of luteinising hormone (LH) in males and in females.

Males

.....

Females

..... [2]

Candidates generally answered this well, with most getting at least 1 mark for stating a role of LH in either males or females.

Question 5 (a) (ii)

(ii) Explain why follicle stimulating hormone (FSH) is often used to treat infertility in women.

.....

.....

.....

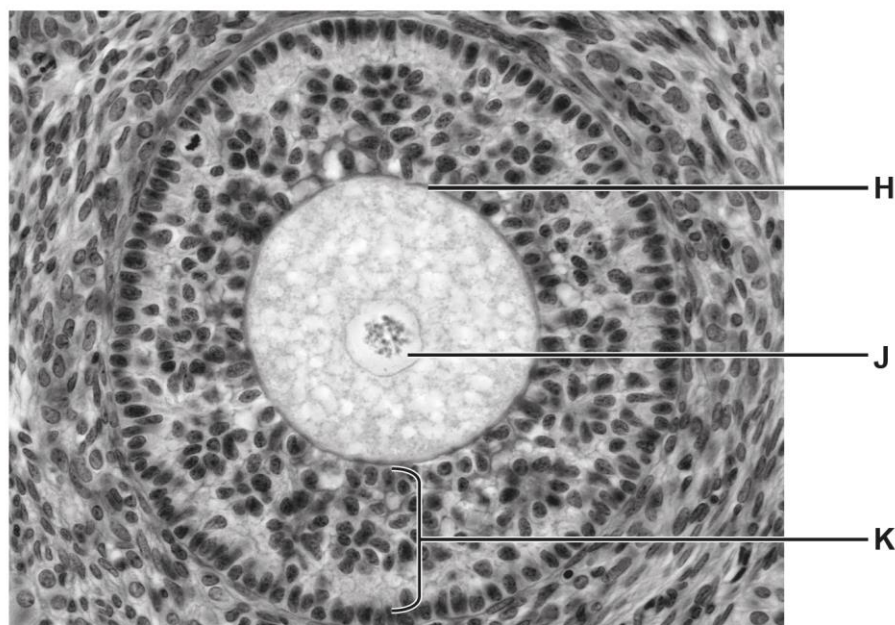
.....

..... [2]

This was generally well-answered, with most candidates getting at least 1 mark for explaining that FSH could stimulate follicle development and maturation.

Question 5 (b) (i)

(b) The light microscope image shows a section through part of a human ovary.



(i) Identify the structures labelled **H**, **J** and **K**.

H

J

K

[3]

Many candidates demonstrated knowledge of the structure of the ovary and could apply their knowledge to this photomicrograph. Most candidates used correct scientific terminology and identified **H** as the zona pellucida, although marks were also given where candidates stated that this was the plasma membrane (of the oocyte). Many candidates could also identify **K** as the corona radiata, but few identified **J** as the nucleus to gain all 3 marks.

Question 5 (b) (ii)

(ii) Outline the formation of secondary oocytes from oogonia.

.....

.....

.....

.....

..... [2]

There were quite a few relevant points that candidates could have stated to get 2 marks for an outline of how secondary oocytes could be formed from oogonia. Successful responses often provided more than two statements and gave detailed accounts of the stages occurring, including reference to the timeline of events before birth and after puberty. Most candidates got 1 mark for recalling that oogonia firstly develop into primary oocytes.

Misconception



There was confusion among candidates about whether mitosis or meiosis was occurring and it was a common misconception for candidates to think that secondary oocytes were the product of meiosis II.

Question 5 (c) (i)

(c) The most common cause of Down's syndrome is trisomy 21, which results in three copies of chromosome 21 being present in the cells of an affected individual.

(i) Describe how trisomy 21 occurs.

.....

.....

.....

.....

..... [2]

Candidates that could recall the events that occur during non-disjunction of chromosomes generally performed well on this question part. Some candidates described translocation here, which was the desired response to **Question 5 (c) (ii)**.

Question 5 (c) (ii)

(ii) Describe **one other** way in which Down's syndrome can be caused.

.....

.....

..... [1]

Successful responses either stated or described the term 'translocation' to get 1 mark. Many candidates could not recall the term or offered imprecise descriptions of chromosomes breaking and so were not given the mark.

Question 5 (d) (i)

(d) The risk of having a child with Down's syndrome increases with the mother's age.

(i) Suggest and explain a reason for this.

.....

.....

.....

.....

..... [2]

Many candidates got 1 mark for suggesting that there would be an increase in mutations due to age. Successful responses could explain that the length of time spent by oocytes in prophase I would likely lead to an increase in events such as non-disjunction or translocation.

Question 5 (d) (ii) and (iii)

(ii) Describe **two** ways in which an older couple can reduce the risk of having a child with Down's syndrome.

1

.....

2

.....

[2]

(iii) Identify **one** ethical issue associated with either of your answers to part **(ii)**.

.....

.....

.....

[1]

In **Question 5 (d) (ii)**, many candidates could state two ways of reducing risks, but descriptions were often too vague to get marks. Successful responses correctly described ways such as screening embryos for abnormalities during IVF procedures before implantation and also described the use of genetic counselling and pedigree analysis. Correct responses to **Question 5 (d) (iii)** generally referred to the destruction or abortion of foetuses, but there were many vague references to 'designer babies' or religious issues which could not be given the mark.

Question 6 (a) (i)

6

- (a) In 1952, Erwin Chargaff published a paper showing the composition of DNA bases in many species.

The paper formed the basis of what are now known as Chargaff's rules.

The table shows some of the data from Chargaff's original paper.

Source of DNA	Percentage of base within DNA (%)			
	Adenine (A)	Guanine (G)	Cytosine (C)	Thymine (T)
Human	29.3	20.7	20.0	30.0
Maize	26.8	22.8	23.2	27.2
<i>E. coli</i> bacteria	24.7	26.0	25.7	23.6
PhiX174	24.0	23.3	21.5	31.2

- (i) Use data from the table for human, maize and *E. coli* DNA to explain the basis of Chargaff's rules.

.....

.....

.....

.....

.....

..... [3]

Candidates generally answered this well, with many getting marks for using the data in the table and recognising the complementary base pair ruling between adenine and thymine **and** guanine and cytosine.

Question 6 (a) (ii)

- (ii) PhiX174 is a virus that has single-stranded DNA and does not obey Chargaff's rules.

Suggest an explanation for PhiX174 not obeying Chargaff's rules.

.....

.....

..... [1]

Candidates that understood that single-stranded DNA would not have complementary base pairs got the mark for this question part.

Question 6 (b)

(b) A group of students extract DNA from peas.

This is the method they use:

1. Blend 100 cm³ peas with 2g table salt and 100 cm³ cold water.
2. Strain through a mesh and collect the liquid portion (the homogenate) in a beaker.
3. Allow to settle for 10 minutes.
4. Transfer to several test tubes.
5. Slowly pour ethanol into each tube to form a layer on top of the homogenate.
6. Use a glass rod to collect the DNA that clumps where the layers meet.

Suggest modifications to the procedure that would:

- reduce damage to the DNA by enzymes
- increase the release of DNA from cells after step 2
- remove histones from DNA after step 4.

Reduce damage to DNA by enzymes

.....

.....

Increase release of DNA from cells

.....

.....

Remove histones from DNA

.....

.....

[3]

Few candidates could suggest three modifications to this procedure for extracting DNA. Most stated that the use of detergent would increase the release of DNA from cells. Many also recalled that histones were proteins so using proteases would remove them from DNA. However, very few candidates understood that it would be necessary to work at low temperatures to reduce damage by enzymes. Many candidates incorrectly stated that it would be necessary to increase the temperature to denature the enzymes, forgetting that high temperatures could also damage DNA.

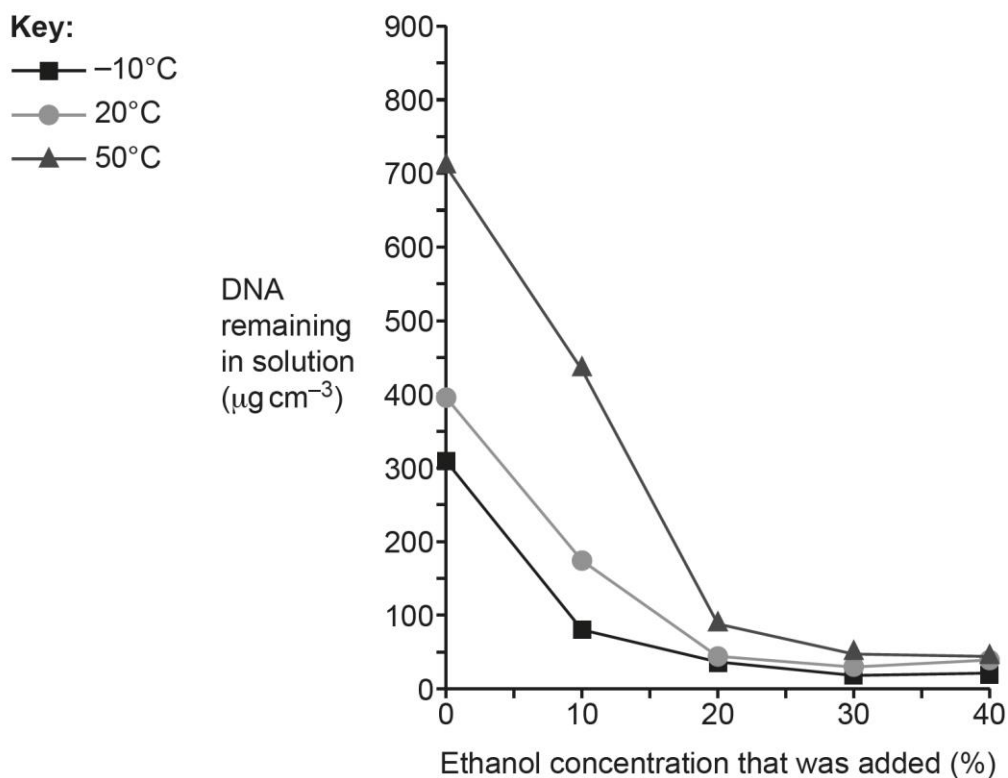
Question 6 (c)

(c) One student places the ethanol in a water bath at 50 °C before using it in step 5.

The student is unable to collect any DNA.

The student carries out some research online. They find a publication that investigated the effect of temperature on the concentration of DNA remaining in solution when ethanol was added.

The results are shown in the graph.



Use the data in the graph to explain why the student was unable to collect any DNA.

.....

.....

.....

.....

..... [2]

This question proved challenging for candidates. Successful responses demonstrated the ability to interpret the graph correctly. Some candidates were confused by the context and incorrectly stated that more DNA would be precipitated at low ethanol concentrations.

Question 7 (a)

7

(a) The table compares the structure of DNA and RNA nucleotides.

Complete the table by writing the names of the structural features present in DNA and RNA.

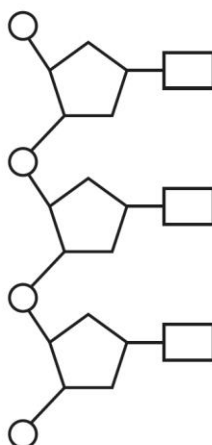
Structural feature	DNA	RNA
Pentose sugar		
Purine bases		
Pyrimidine bases		

[3]

Many candidates demonstrated good knowledge of differences in the structures of DNA and RNA nucleotides to complete the table. Most candidates correctly identified the pentose sugar in each type of nucleotide, but some confused purine and pyrimidine bases which restricted them to 1 mark. Some candidates also incorrectly replaced cytosine rather than thymine with uracil in RNA.

Question 7 (b)

(b) A section of RNA is represented in the diagram.



Draw a circle around a phosphodiester bond.

Answer on the diagram.

[1]

This question was not well-answered, and many candidates drew a circle around the bonds either side of the phosphate group.

Misconception

It was common for candidates to circle the bond between ribose and phosphate **within** the nucleotide rather than the bond between two different nucleotides, a common misconception.

Question 7 (c)

(c) Complete the following passage using the most appropriate words or phrases.

Semi-conservative replication of DNA involves the enzyme,

which breaks the bonds between the two strands.

DNA nucleotides bind to each of the separated strands and the enzyme

..... joins the nucleotides in a

..... reaction to form two new strands.

[4]

This gap fill style question was generally well-answered, with many candidates getting all 4 marks. The most common errors included DNA ligase rather than DNA polymerase as the enzyme joining nucleotides together and hydrolysis rather than condensation as the reaction involved in forming two new strands.

Question 7 (d) (i)

(d)

(i) Describe the role of cell cycle checkpoints in ensuring the accuracy of DNA replication.

.....
.....
.....
.....
..... [2]

Many candidates got at least 1 mark for this question with correct naming of a cell cycle checkpoint. Successful responses demonstrated knowledge of the role of G2 or S checkpoints in checking for damaged DNA and halting the cell cycle if DNA is damaged.

Question 7 (d) (ii)

- (ii) Suggest why mutations that affect cell cycle checkpoints can increase the general rate of mutation.

.....

.....

.....

.....

..... [2]

This question required that candidates apply their knowledge of the cell cycle to the concept of checkpoint mutations. Many candidates were able to make one suggestion, but it proved more challenging to make further suggestions, limiting them to 1 mark.

Assessment for learning



There was ambiguous terminology when referring to cell cycles and cell division in this question.

Candidates need to be clear when using these terms as increase in cell division is not the same as 'uncontrolled' cell division which could also mean a decrease. It is the cell cycle that is described as uncontrolled.

Question 7 (e)

- (e) Radiotherapy causes damage to the DNA of cancer cells.

Suggest how this process can reduce the size of a tumour.

.....

.....

.....

.....

..... [2]

Successful responses used knowledge of cancer treatments to describe how ionising radiation targets cancer cells to damage them, resulting in apoptosis and fewer cells.

Question 7 (f) (i)

- (f) Umbilical cord blood can be collected from the placenta after birth.

Umbilical cord blood transplantation can be used as an alternative to bone marrow transplantation.

- (i) Suggest the type of potency for the stem cells present in umbilical cord blood.

..... [1]

Candidates that could recall types of stem cells and apply their knowledge to the context of umbilical cord blood being used as an alternative to bone marrow provided a correct response to this question.

Question 7 (f) (ii)

- (ii) Suggest **one** advantage of umbilical cord blood transplantation over bone marrow transplantation.

.....
..... [1]

The most common correct response suggested how the use of umbilical cord blood would not require surgery or would be less invasive. Incorrect responses were either too vague, such as stating that it would be faster, or gave irrelevant detail of differentiation into different types of blood cell.

Copyright information

Question 1 (a), Pre-release article written by author based on review article, Seed Science Research vol. 25, 99-119, Rodriguez, et al., 2015

Question 3 (a), Photomicrograph of section of mouse pancreas, © EYE OF SCIENCE / SCIENCE PHOTO LIBRARY

Question 5 (b), Photomicrograph of ovarian secondary follicle, © JOSE CALVO / SCIENCE PHOTO LIBRARY

Supporting you

Teach Cambridge

Make sure you visit our secure website [Teach Cambridge](#) to find the full range of resources and support for the subjects you teach. This includes secure materials such as set assignments and exemplars, online and on-demand training.

Don't have access? If your school or college teaches any OCR qualifications, please contact your exams officer. You can [forward them this link](#) to help get you started.

Reviews of marking

If any of your students' results are not as expected, you may wish to consider one of our post-results services. For full information about the options available visit the [OCR website](#).

Access to Scripts

We've made it easier for Exams Officers to download copies of your candidates' completed papers or 'scripts'. Your centre can use these scripts to decide whether to request a review of marking and to support teaching and learning.

Our free, on-demand service, Access to Scripts is available via our single sign-on service, My Cambridge. Step-by-step instructions are on our [website](#).

Keep up-to-date

We send a monthly bulletin to tell you about important updates. You can also sign up for your subject specific updates. If you haven't already, [sign up here](#).

OCR Professional Development

Attend one of our popular professional development courses to hear directly from a senior assessor or drop in to a Q&A session. Most of our courses are delivered live via an online platform, so you can attend from any location.

Please find details for all our courses for your subject on **Teach Cambridge**. You'll also find links to our online courses on NEA marking and support.

Signed up for ExamBuilder?

ExamBuilder is the exam paper builder platform for a range of our qualifications. [Find out more](#).

Free for all OCR centres with an Interchange account, it allows unlimited users per centre. We require an [Interchange](#) username to verify your centre's users for ExamBuilder.

If you do not have an Interchange account, please contact your centre administrator (usually the Exams Officer) to request a username.

Once you have an Interchange username, use the form on [this page](#) to sign up for ExamBuilder, or ask an existing user at your centre to create an ExamBuilder account for you.

Active Results

Review students' exam performance with our free online results analysis tool. It is available for all GCSEs, AS and A Levels and Cambridge Nationals (examined units only).

[Find out more](#).

Tell us what you think

Your feedback plays an important role in how we develop, market, support and resource qualifications now and into the future. We want you and your students to enjoy and get the best out of our qualifications and resources, but to do that we need your honest opinions to tell us whether we're on the right track or not.

You can email your thoughts to resources.feedback@ocr.org.uk or visit our [feedback page](#) to learn more about how you can help us improve our resources.



Designing and testing in [collaboration with you](#) and your students



Helping young people develop an [ethical view of the world](#)



Equality, diversity, inclusion and belonging (EDIB) are [part of everything we do](#)

Contact the team at:

☎ 01223 553998

📧 ocr.org.uk

To stay up to date with all the relevant news about our qualifications, register for email updates at ocr.org.uk/updates

Visit our Online Support Centre at support.ocr.org.uk



OCR is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

OCR is a Company Limited by Guarantee and an exempt charity. Registered in England. Registered office: The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA. Registered company number: 3484466.

We operate academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers.

We are committed to providing a fully accessible experience across all our products, platforms, and websites. Find out more about our [accessibility standards](#).

© OCR 2025. All rights reserved. We retain the copyright on all our publications. However, our registered centres are permitted to copy and distribute our material for their own internal use, in line with any specific restrictions detailed in the publication. Find out more about our [copyright policies](#).

We update our publications regularly so please check you have the most up-to-date version.

We cannot be held responsible for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication and do not guarantee that any content on such websites is, or will remain, accurate or appropriate.

When we update our specifications, you'll see a new version number and a summary of the changes. While we do our best to reflect these changes in all associated resources on [Teach Cambridge](#), if you notice any discrepancies, please refer to the latest specification on our website and [let us know](#).

Our resources do not represent any teaching method we expect you to use. We cannot be held responsible for any errors or omissions in our resources.