

Cambridge
International
AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

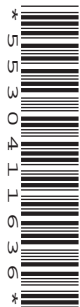
CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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BIOLOGY

9700/42

Paper 4 A Level Structured Questions

October/November 2017

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Section A

Answer **all** questions.

Section B

Answer **one** question.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

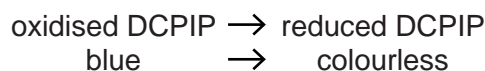
At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **19** printed pages, **1** blank page and **4** lined pages.

- 2 The light dependent stage of photosynthesis in a suspension of isolated chloroplasts can be investigated using the Hill reaction.

Dichlorophenolindophenol (DCPIP) can be used to follow the process. DCPIP is a blue dye which turns colourless when it is reduced by accepting hydrogen and electrons.



- (a) (i) DCPIP is an artificial hydrogen acceptor that can be used in the Hill reaction.

Name the natural hydrogen acceptor found in chloroplasts that is replaced by DCPIP in the Hill reaction.

.....[1]

- (ii) Outline the way in which hydrogen is made available to reduce the hydrogen acceptor in the light dependent stage of photosynthesis.

.....

[2]

- (b) A suspension of isolated chloroplasts for measuring the rate of the Hill reaction can be prepared by carrying out the following steps:

- prepare buffer solution with the same water potential as the stroma of chloroplasts
- liquidise (homogenise) spinach leaves in ice cold buffer solution
- filter the liquid and obtain the filtrate
- centrifuge the filtrate to obtain a pellet of chloroplasts
- add the chloroplast pellet to fresh buffer solution in a beaker and mix to obtain a suspension.

Explain the reason for:

- (i) keeping the temperature very low

.....

[2]

(ii) using a buffer solution

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.....[2]

(iii) using a solution of the same water potential as the stroma of chloroplasts.

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.....[2]

(c) An experiment was carried out to measure the time taken for decolourisation of DCPIP mixed with a suspension of chloroplasts.

The results are shown in Table 2.1.

Table 2.1

replicate	time taken for DCPIP to decolourise/s	rate/s ⁻¹
1	38	
2	43	
3	48	
mean

Complete Table 2.1 by calculating:

(i) for the three replicates, the mean time taken for the DCPIP to decolourise [1]

(ii) the mean rate using the formula:

$$\text{rate} = \frac{1000}{t} \quad \text{where } t = \text{time in seconds.} \quad [1]$$

(iii) The time taken to decolourise DCPIP was measured at a range of light intensities.

State **and** explain the expected relationship between light intensity and time taken to decolourise DCPIP.

expected relationship

.....

.....

explanation

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.....

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.....

.....

..... [4]

[Total: 15]

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- 4 (a) The body temperature of a human is maintained at its set point of approximately 37°C. If it rises above this temperature, physiological responses begin to return the temperature to its set point. Two of these responses are vasodilation and sweating.

Explain how vasodilation and sweating help to return the body temperature to its set point.

vasodilation

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sweating

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..... [4]

- (b) Diabetes mellitus is a disease where the pancreas is not able to secrete sufficient insulin.

The symptoms of diabetes mellitus include a tendency to drink a lot of water and a loss of body mass.

Suggest why these symptoms occur.

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..... [4]

(c) A person with diabetes mellitus can use a biosensor to measure the concentration of glucose in their blood.

(i) Outline how a glucose biosensor works.

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.....
.....
.....[3]

(ii) Suggest **one** advantage of using a biosensor rather than a dip stick.

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

[Total: 12]

(b) Young people who have a parent with Huntington's disease can choose to be screened for the presence of the Huntington allele.

(i) State the probability that a young person who has **one** parent with Huntington's disease will inherit the Huntington allele.

.....[1]

(ii) Suggest **one** advantage and **one** disadvantage of screening for Huntington's disease before any symptoms occur.

advantage

.....

.....

disadvantage

.....

.....[2]

(c) A couple, in which one partner has the Huntington allele, may choose to use IVF (*in vitro* fertilisation) to have a child.

Any embryos obtained from the IVF procedure can be screened in the following way:

- carry out an embryo biopsy
- use PCR
- test for the presence of the Huntington allele
- only implant embryos that do not contain the Huntington allele.

(i) State what is meant by the term *embryo biopsy*.

.....

.....[1]

(ii) Explain why PCR is used in this procedure.

.....

.....[1]

(iii) Outline **two** social or ethical implications of screening embryos in this way.

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.....[2]

[Total: 13]

- 6 Cloves are the aromatic flower buds of the tree *Syzygium aromaticum*. Eugenol is a drug extracted from cloves.

Eugenol affects the movement of sodium ions through the cell surface membranes of sensory neurones.

- (a) Fig. 6.1 shows the effect of eugenol concentration on the percentage decrease in sodium ion movement.

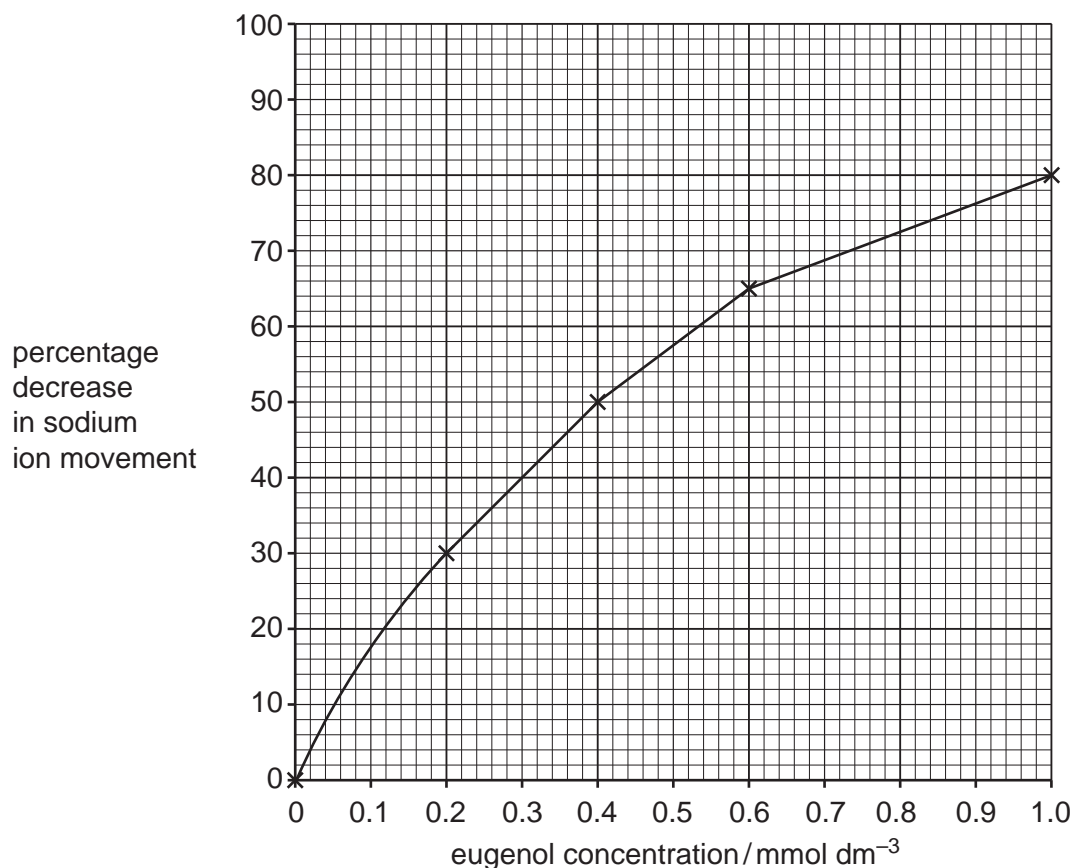


Fig. 6.1

- (i) Describe the effect of eugenol concentration on the percentage decrease in sodium ion movement.

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..... [2]

- (ii) Using Fig. 6.1, determine the percentage decrease in sodium ion movement at a eugenol concentration of 0.5 mmol dm⁻³.

percentage decrease % [1]

- 7 (a) In respiration, most ATP is synthesised during oxidative phosphorylation. Some ATP is made by substrate-linked reactions in glycolysis and Krebs cycle.

Describe how ATP is made by substrate-linked reactions.

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.....[2]

- (b) Lipids can be metabolised to provide ATP.

- The enzyme lipase hydrolyses lipids to glycerol and fatty acids.
- The hydrocarbon chain of the fatty acid breaks down into smaller, 2C compounds.
- Each 2C compound reacts with coenzyme A to form acetyl coenzyme A.

- (i) Name the covalent bond in lipids that is hydrolysed by lipase.

.....[1]

- (ii) State the role of acetyl coenzyme A in respiration.

.....[1]

- (iii) Explain why lipids have a higher energy value than carbohydrates.

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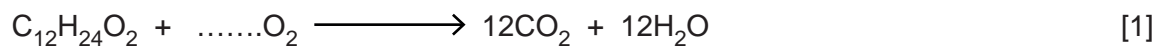
.....[2]

- (c) The respiratory quotient, RQ, is used to show which substrate is being metabolised by cells. It can be determined using the equation below.

$$\text{RQ} = \frac{\text{molecules of carbon dioxide released}}{\text{molecules of oxygen taken in}}$$

Lauric acid is a saturated fatty acid found in coconuts and has a chain of 12 carbon atoms.

- (i) Complete the equation below which outlines the aerobic respiration of lauric acid.



- (ii) Calculate the RQ value for lauric acid.

Show your working. Give your answer to 2 decimal places.

answer =[2]

[Total: 9]

