GradeMax

* 0000800000001 * DFD

CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 9 4 9 8 7 2 5 8 2 3 *

BIOLOGY **9700/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2026**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen. Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 30.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

DC (EV/TC) 360498/2
© Cambridge University Press & Assessment 2026

[Turn over

GradeMax

1 The avocado tree, *Persea americana*, is a cultivated food crop. The fruits of the tree are called avocados.

Figure 1.1 shows a whole avocado and an avocado that has been cut to show the inside.

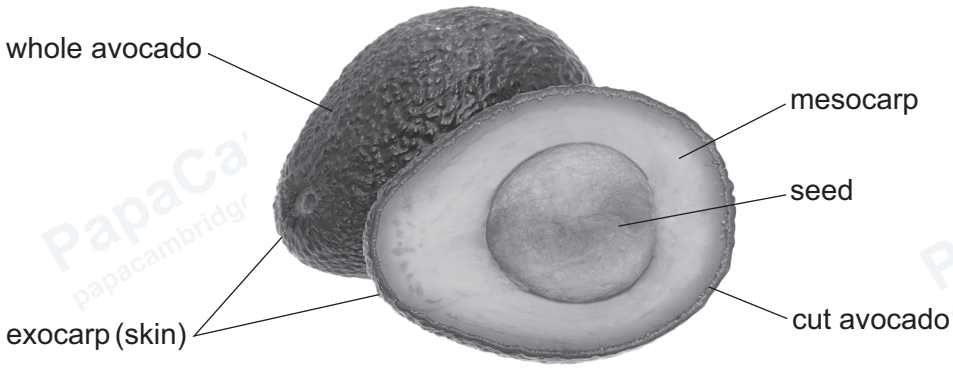


Figure 1.1

Avocados are removed from the tree (harvested) when they are mature (maximum size). Avocados ripen only after harvesting. As avocados ripen, the colour of the skin changes from bright green to dark purple and the mesocarp changes from hard to soft.

Mesocarp cells in the avocado are a source of the enzyme catalase. The quantity of catalase in the mesocarp changes as the avocado ripens.

Catalase catalyses the breakdown of hydrogen peroxide, as shown in Figure 1.2.

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

Figure 1.2

(a) A student decided to see the effect of catalase activity in avocados.

The student removed the skin from an avocado and cut up some pieces of the mesocarp. The student placed some of the pieces of mesocarp into a beaker containing hydrogen peroxide solution. Tiny bubbles of oxygen were immediately released from the surface of the mesocarp, as shown in Figure 1.3.

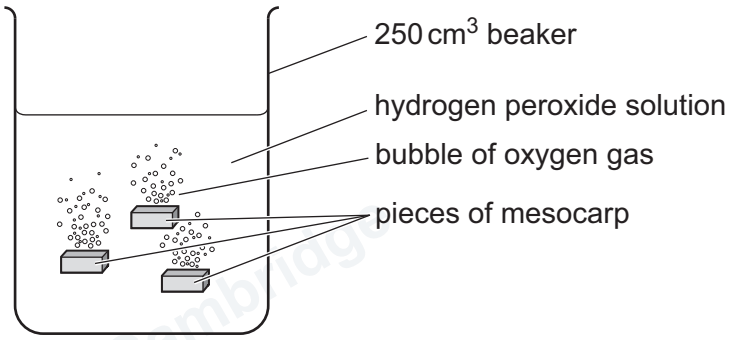


Figure 1.3

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

Suggest **one** hazard of this method **and** the risk associated with the hazard **and** the precaution that should be taken.

hazard .....

.....

risk .....

.....

precaution .....

.....

[1]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

(b) The student planned to investigate the changes in catalase activity in avocados as they ripen.

(i) Identify the independent variable in the investigation.

..... [1]

(ii) Describe a method the student could use to measure changes in catalase activity in avocados as they ripen, using hydrogen peroxide solution.

Do **not** include a risk assessment.

Your method should be set out in a logical order and be detailed enough to allow another person to follow it.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [7]

DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

(c) After food crops such as avocados are harvested, they may be stored in cold conditions (cold storage) to delay ripening.

Some scientists investigated the effect of cold storage for different lengths of time on catalase activity in avocados.

- The scientists selected 100 avocado trees at random from the same field.
- The scientists harvested **one** mature avocado from each tree.
- Each of the 100 avocados had a mass of approximately 210 g.
- The catalase activity in 10 of the avocados was measured immediately after harvest.
- The remaining 90 avocados were divided into three groups and stored at 7 °C and 85% humidity for different lengths of time, as shown in Table 1.1.

Table 1.1

group	number of avocados	storage time / days
10d	30	10
20d	30	20
30d	30	30

(i) Suggest a suitable method the scientists could use to select avocado trees at random.

.....

..... [1]

(ii) Humidity is the concentration of water vapour in the air. The higher the humidity, the higher the concentration of water vapour in the air.

Suggest a reason why the avocados were stored at 85% humidity.

.....

..... [1]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

After each storage time, 5 avocados from each group were tested for catalase activity.

The remaining 25 avocados in each group were kept at 20 °C and 80% relative humidity until they were ripe (soft enough to eat).

When they were ripe, 5 avocados from each group were tested for catalase activity.

The results are shown in Table 1.2.

Table 1.2

group	when catalase activity was tested	mean catalase activity / arbitrary units	standard error (SE)	95% confidence interval (95% CI)
0d	immediately after harvesting	571	162	571 ± 324
10d	after 10 days cold storage	615	169	615 ± 338
20d	after 20 days cold storage	455	49	455 ± 98
30d	after 30 days cold storage	550	112	550 ± 224
10dR	after 10 days cold storage plus time to ripen	642	198	642 ± 396
20dR	after 20 days cold storage plus time to ripen	822	206	.....
30dR	after 30 days cold storage plus time to ripen	736	179	.....

(iii) Complete Table 1.2 by calculating the 95% confidence intervals (95% CI) for groups 20dR and 30dR. Use the formula:

$$95\%\ \text{CI} = \bar{x} \pm (2 \times \text{SE})$$

Key to symbols:

$\bar{x}$ = mean

SE = standard error

[1]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

Figure 1.4 shows a graph of the results, with error bars showing the 95% CI.

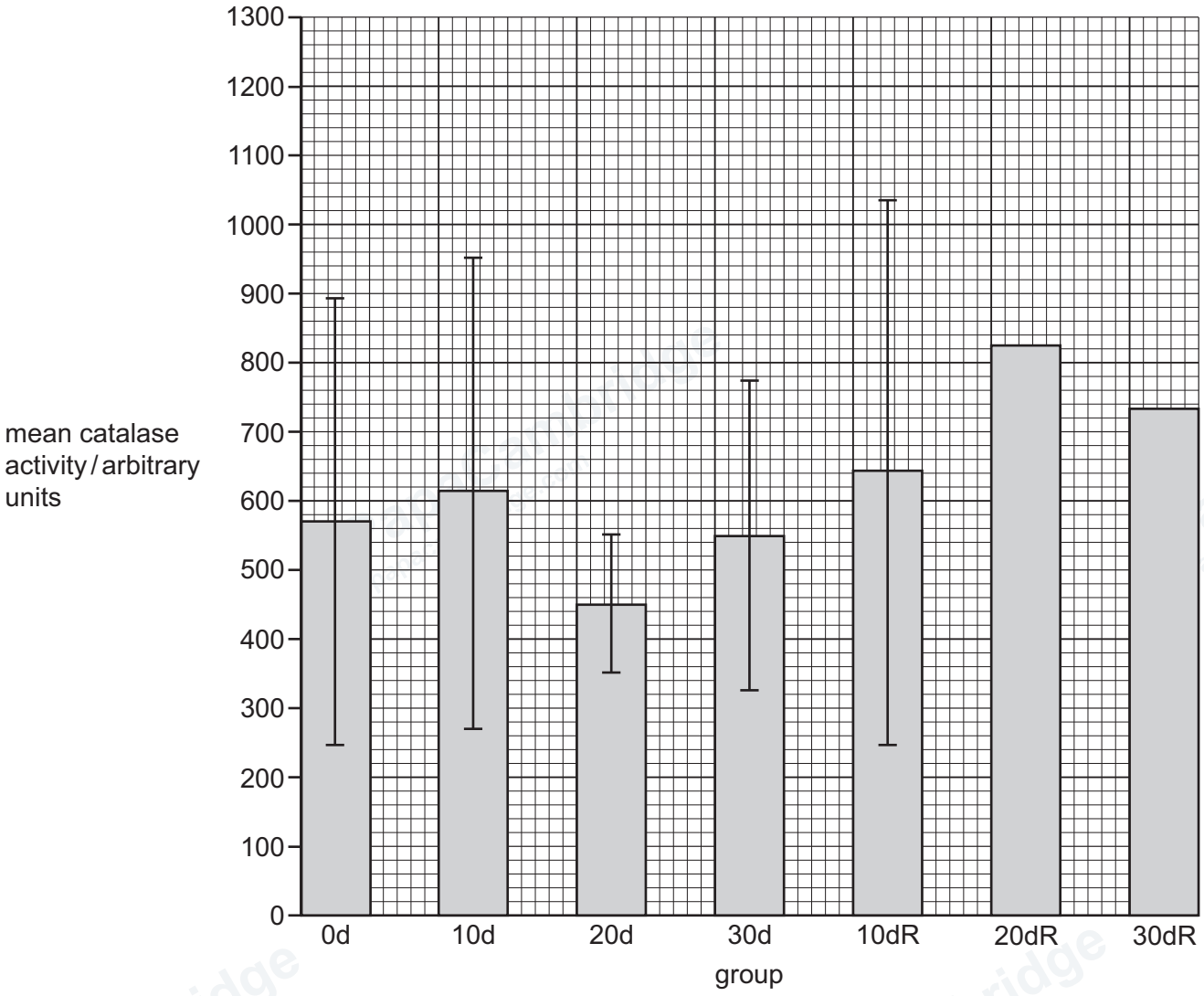


Figure 1.4

(iv) On Figure 1.4, draw error bars showing the 95% CI for groups 20dR and 30dR that you calculated in **1(c)(iii)**. [2]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

(v) Outline the conclusions that can be made about the effect of cold storage on the mean catalase activity in avocados.

State the evidence from Table 1.2 and Figure 1.4 that supports your conclusions.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(vi) The scientists decided that the *t*-test was **not** an appropriate choice of statistical test for this investigation.

Suggest **two** reasons why the *t*-test is **not** an appropriate choice of statistical test for this investigation.

.....

.....

.....

.....

.....

..... [2]

[Total: 20]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

Turn over

© Cambridge University Press & Assessment 2026

GradeMax

2 A butterfly is a flying insect. One species of butterfly, the cabbage white butterfly, *Pieris brassicae*, is shown in Figure 2.1.



Figure 2.1

Some scientists are carrying out a long-term project to estimate the population size of all butterfly species in the UK. The scientists have asked people living in the UK to help them to collect the data.

A modified belt transect is one of the methods used to collect the data.

The recommended method for the modified belt transect is to:

- walk at a slow pace along a transect line
- identify all the butterfly species within 2.5 m on each side of the transect line
- count the number of individuals of each species within 2.5 m on each side of the transect line.

(a) (i) Suggest how each species of butterfly could be identified.

.....

.....

..... [1]

(ii) The scientists standardised the width of the belt transect.

State **two other** variables that should be standardised when carrying out this belt transect.

.....

.....

.....

..... [2]

DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

(iii) Discuss the limitations of the method used to collect data.

.....

.....

.....

.....

.....

..... [3]

(b) The scientists plan to compare the diversity of butterfly species found in urban areas (towns and cities) and rural areas (e.g. farmland and woodland).

Predict whether a greater diversity of butterfly species is found in urban areas **or** rural areas. Explain your answer.

prediction .....

explanation .....

.....

.....

.....

.....

[2]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

(c) In another study, the number of individuals of the cabbage white butterfly, *Pieris brassicae* (shown in Figure 2.1), was counted each day over a four-year period and recorded. For each year, the highest number of butterflies counted in one day was identified.

The results are shown in Figure 2.2.

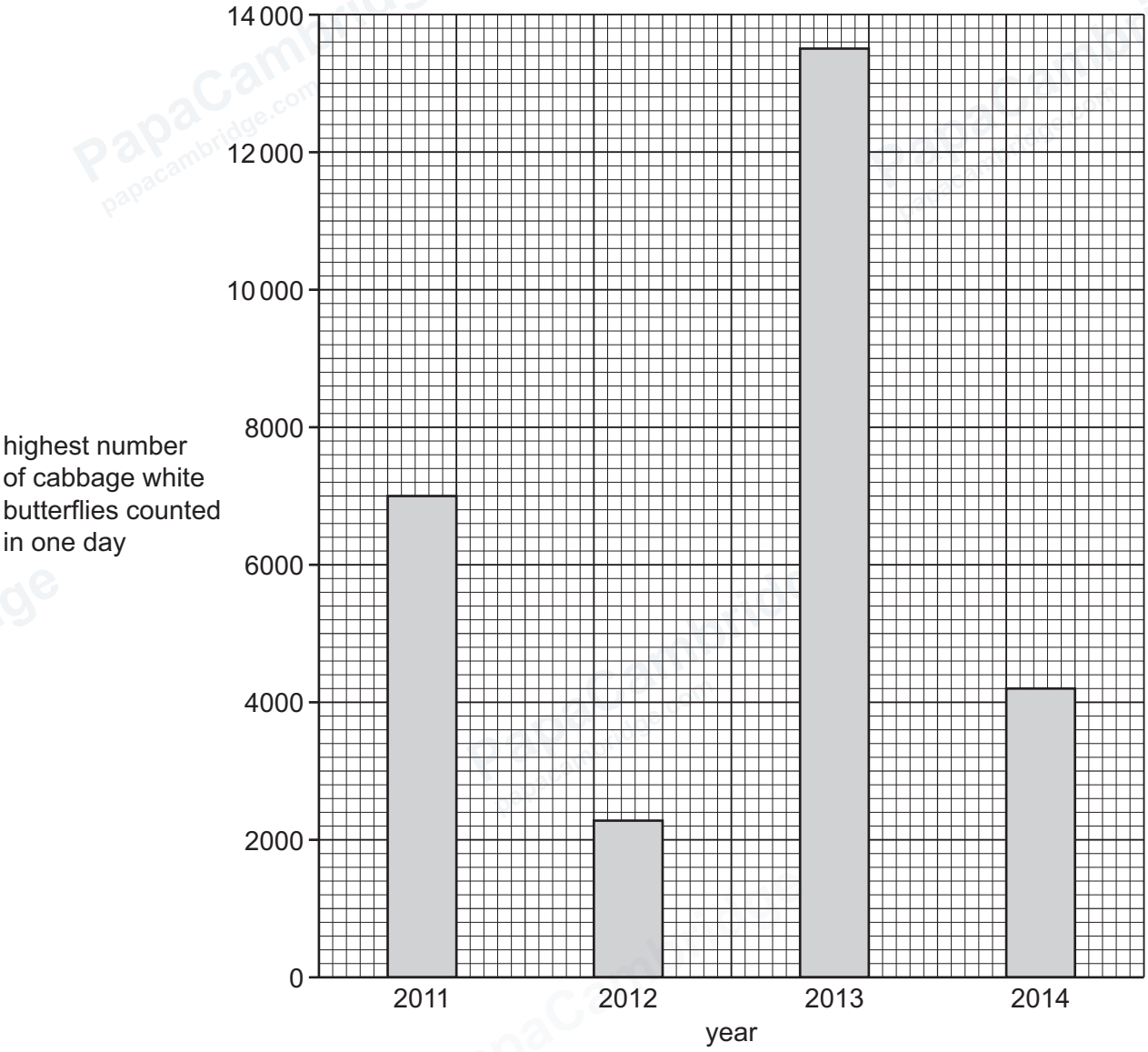


Figure 2.2

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

Figure 2.2 shows that there is an increase in the highest number of cabbage white butterflies counted in one day from 2012 to 2013.

Use Figure 2.2 to calculate the percentage increase from 2012 to 2013.

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

Show your working.

percentage increase = ...% [2]

[Total: 10]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

BLANK PAGE

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

PapaCambridge
papacambridge.com

© Cambridge University Press & Assessment 2026

GradeMax

BLANK PAGE

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

BLANK PAGE

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

The boundaries and names shown, the designations used and the presentation of material on any maps contained in this question paper/insert do not imply official endorsement or acceptance by Cambridge International Education concerning the legal status of any country, territory, or area or any of its authorities, or of the delimitation of its frontiers or boundaries.

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (Cambridge University Press & Assessment) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in our Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge International Education is the name of our awarding body and a part of Cambridge University Press & Assessment, which is a department of the University of Cambridge.

© Cambridge University Press & Assessment 2026