Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

8499061471 5

BIOLOGY **9700/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2018**

1 hour 15 minutes

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.

Answer **all** questions.

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.

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CAMBRIDGE International Examinations

1 During the light dependent stage of photosynthesis, hydrogen ions and electrons are released by the photoactivation of chlorophyll and the photolysis of water. These are added to the carrier molecule, NADP, changing it from an oxidised state to a reduced state, as shown in Fig. 1.1.

$$2H^+ + 2e^- + \text{oxidised NADP} \longrightarrow \text{reduced NADP}$$

Fig. 1.1

DCPIP is a blue dye which becomes colourless when reduced by hydrogen ions and electrons, as shown in Fig. 1.2.

oxidised DCPIP (blue) ⟶ reduced DCPIP (colourless)

Fig. 1.2

A student used DCPIP to determine if the reactions in the light dependent stage had occurred in a suspension of chloroplasts.

- The suspension of chloroplasts was prepared by grinding, filtering and centrifuging a sample of leaves with ice-cold extraction medium.
- Four tubes covered in foil were set up containing the mixtures shown in Table 1.1.

Table 1.1

tube	contents
1	chloroplast suspension and DCPIP
2	chloroplast suspension and distilled water
3	DCPIP and extraction medium
4	chloroplast suspension and DCPIP

- The tubes were illuminated through a thin glass tank filled with water as shown in Fig. 1.3.

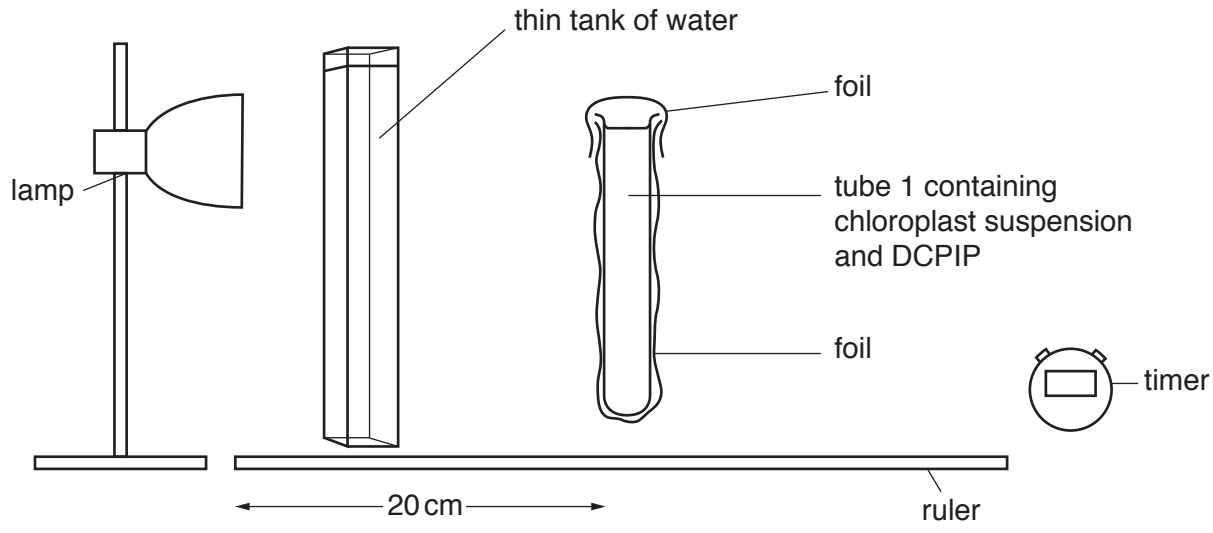


Fig. 1.3

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- The foil was removed from tubes 1, 2 and 3, but left on tube 4.
- A timer was started immediately.
- After 10 minutes the colour in each tube was observed and recorded.

Table 1.2 shows the student's results.

Table 1.2

tube	contents	foil	colour after 10 minutes
1	chloroplast suspension and DCPIP	removed	green
2	chloroplast suspension and distilled water	removed	green
3	DCPIP and extraction medium	removed	blue
4	chloroplast suspension and DCPIP	left in place	blue

(a) State why the results in Table 1.2 are qualitative.

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..... [1]

(b) Explain why tubes 2, 3 and 4 were included.

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..... [2]

(c) State the function of the thin tank of water.

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..... [1]

The student then modified the investigation to test the hypothesis:

As light intensity increases the rate of the light dependent stage of photosynthesis will increase.

(d) (i) Identify the independent variable **and** the dependent variable in this investigation.

independent .....

dependent .....

[2]

(ii) Using the apparatus shown in Fig. 1.3, describe a method the student could use to collect the data needed to test their hypothesis.

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

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(e) Light intensity (I) can be calculated using the formula shown in Fig. 1.4.

$$I = \frac{1}{\text{distance}^2}$$

Fig. 1.4

Use the formula shown in Fig. 1.4 to calculate the light intensity for the investigation shown in Fig. 1.3.

I = ... [1]

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[Turn over

(f) The student prepared two tubes with the same contents as tube 1 (Table 1.1) from their original investigation. One tube was exposed to high light intensity and the other tube was exposed to low light intensity.

A colorimeter was used to measure the absorption values of samples taken from these tubes, at one minute intervals, over a period of 12 minutes.

Fig. 1.5 shows the absorption results at high light intensity.

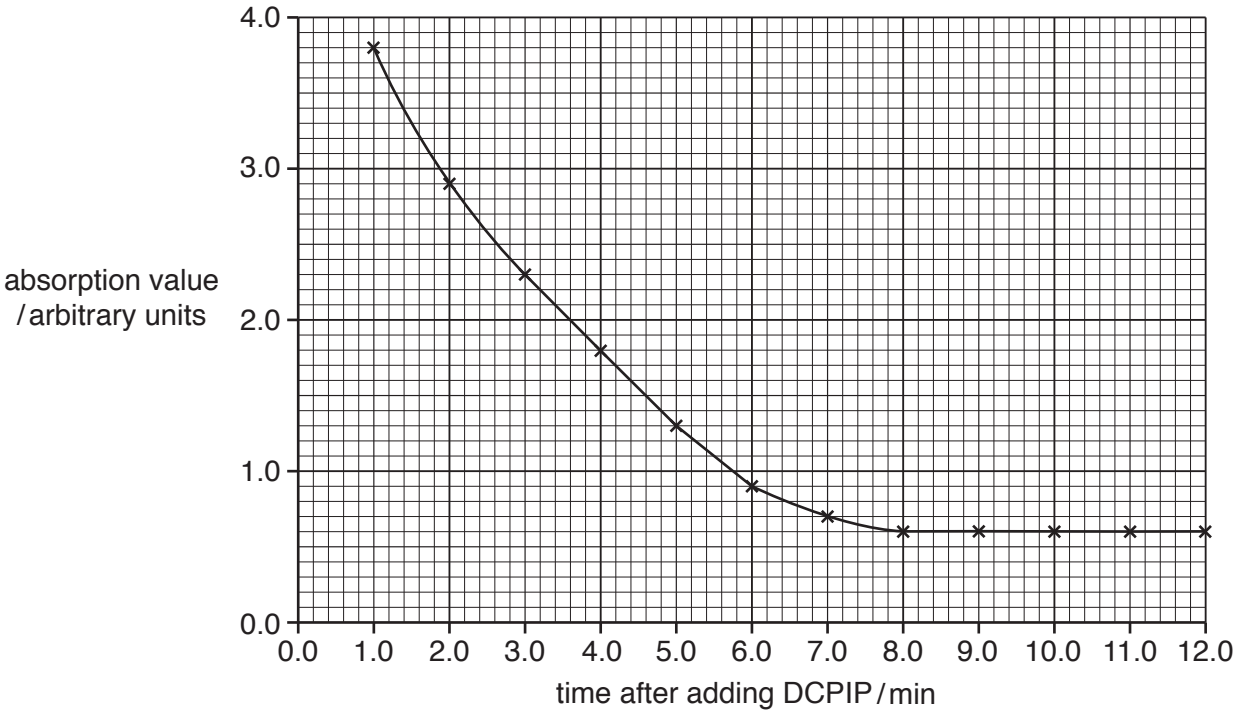


Fig. 1.5

(i) The student concluded that the reaction reached completion at 8 minutes.
State why the data in the graph do **not** support this conclusion.

.....

..... [1]

(ii) Draw a tangent on Fig. 1.5 **and** use it to calculate the rate of change at 6 minutes.

rate of change at 6 minutes = ... arbitrary units
[2]

(iii) On Fig. 1.5, sketch the curve that you would expect for the tube at low light intensity. [1]

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(g) The student then investigated the effect that three different weed killers had on the light dependent reaction.

- Four tubes covered in foil were set up containing the mixtures shown in Table 1.3.
- The volume of each component in the mixtures was standardised.

Table 1.3

tube	contents
1	chloroplast suspension, DCPIP and distilled water
2	chloroplast suspension, DCPIP and weed killer **X**
3	chloroplast suspension, DCPIP and weed killer **Y**
4	chloroplast suspension, DCPIP and weed killer **Z**

- The foil was removed and the tubes were illuminated as in the original investigation shown in Fig. 1.3.
- After 10 minutes the student used a colorimeter to measure the absorption value of the contents of each tube.
- The investigation was repeated a number of times and means were calculated.
- *t*-tests were used to compare the results for the tubes.

The results of all the *t*-tests are shown in Table 1.4.

Table 1.4

	$p < 0.05$		
contents of tube	**no weed killer added**	**weed killer X**	**weed killer Y**
no weed killer added			
weed killer **X**	not significant		
weed killer **Y**	significant	significant	
weed killer **Z**	significant	not significant	not significant

(i) Suggest a null hypothesis for the *t*-test used for tubes 1 and 2.

.....

..... [1]

(ii) The *t*-tests were used to compare the means.
State **one** feature of data that allows use of the *t*-test.

.....

..... [1]

(iii) The student calculated that there were 22 degrees of freedom in each of these *t*-tests. An equal number of replicates for each tube was carried out.

State the number of replicates of **each** tube that were carried out.

.....

..... [1]

(iv) The critical value for t at $p < 0.05$ in this investigation was 2.07.

State what the results in Table 1.4 tell you about the student's **calculated value** of t when comparing the effect between weed killers **X** and **Y**.

..... [1]

[Total: 22]

2 Red deer are herbivores common in the highlands of Scotland. They have no natural predators and in some areas culling of the deer is carried out in order to manage their numbers and maintain the species diversity of the ecosystem.

A group of scientists read a report which suggested that allowing sheep to graze alongside deer significantly reduces the need to cull the deer. They decided to carry out a survey to investigate the number of deer found grazing at 16 different sites.

- 8 sites contained deer **and** sheep.
- 8 sites contained deer but **no** sheep.
- Each site was visited during the first week of April and the first week of July in 2007 and again in 2009.
- Each site was 0.25 × 0.25 km.
- Within each site, three 10 × 10 m study plots were selected at random.
- The scientists used dung counts along a 1 × 10 m strip around each study plot to provide an estimate of the number of deer and sheep present. Dung is a pile of animal faeces.

Fig. 2.1 shows one study plot.

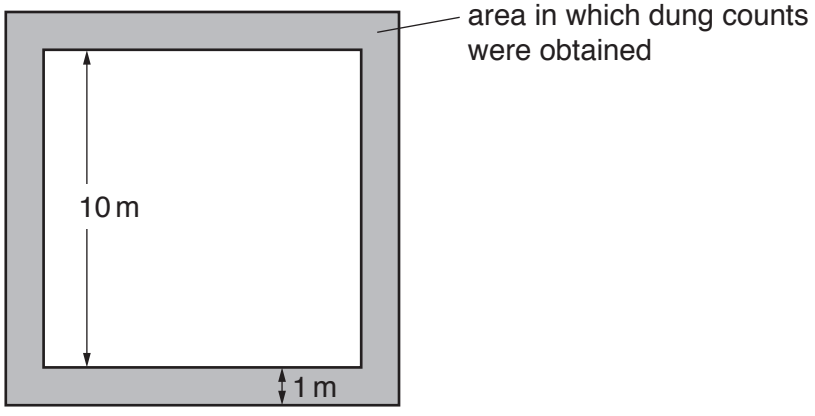


Fig. 2.1

(a) Describe a method that the scientists could have used to select the study plots randomly.

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..... [2]

(b) Suggest why counting the dung may **not** provide an accurate estimate of deer or sheep numbers.

.....

..... [1]

(c) State two variables that were standardised by the scientists.

1 .....

.....

2 .....

..... [2]

(d) The scientists also counted the number of plant species present within each of the 16 sites.

Fig. 2.2 shows the mean deer dung count for each site and the number of plant species present within each site.

Fig. 2.3 shows the mean deer dung count for the sites containing deer **and** sheep and for the sites containing deer but **no** sheep. Range bars are also included.

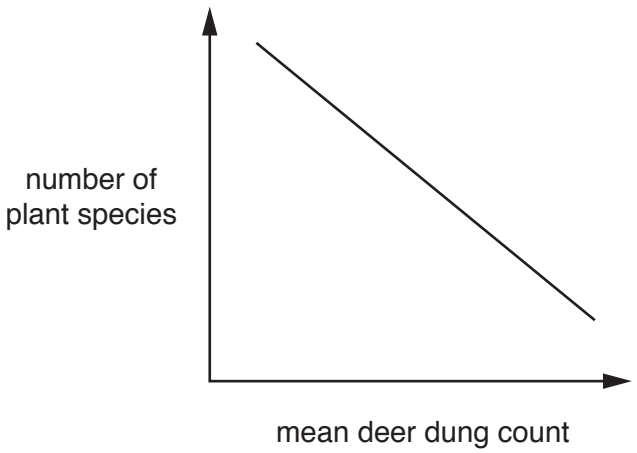


Fig. 2.2

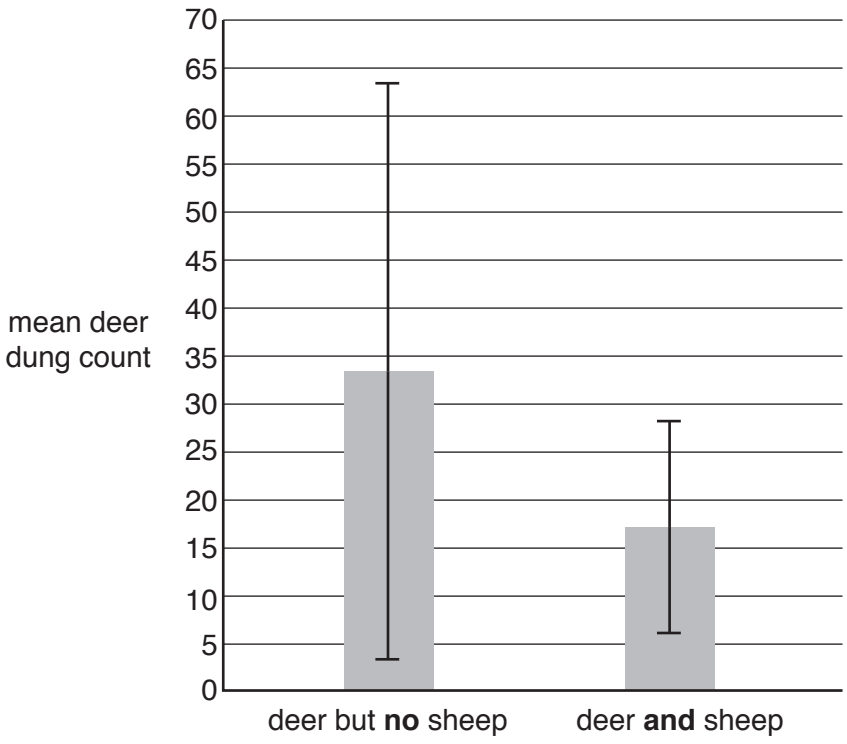


Fig. 2.3

The report that the scientists read suggested that allowing sheep to graze alongside the deer significantly reduces the need to cull the deer in order to maintain species diversity.

Explain why the results shown in Fig. 2.2 and Fig. 2.3 do **not** support this suggestion.

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..... [3]

[Total: 8]

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