Cambridge International A Level

**Cambridge International Examinations**
Cambridge International Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*3255944211*

**BIOLOGY** **9700/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2015**

**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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

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 **8** printed pages.




CAMBRIDGE International Examinations

**1** Many fungi are decomposer organisms which carry out extracellular digestion. To do this they secrete a number of enzymes.

A group of students made a solution of enzyme extract from a fungus. The extract contained the enzyme amylase. They wanted to find out the concentration of amylase in the extract.

They were provided with:

- $0.5\,g\,dm^{-3}$ stock solution of amylase
- starch agar plates with wells into which enzyme solutions can be placed. Starch agar plates are Petri dishes containing agar mixed with starch.

Fig. 1.1 shows how the students used the plates to find the concentration of amylase.

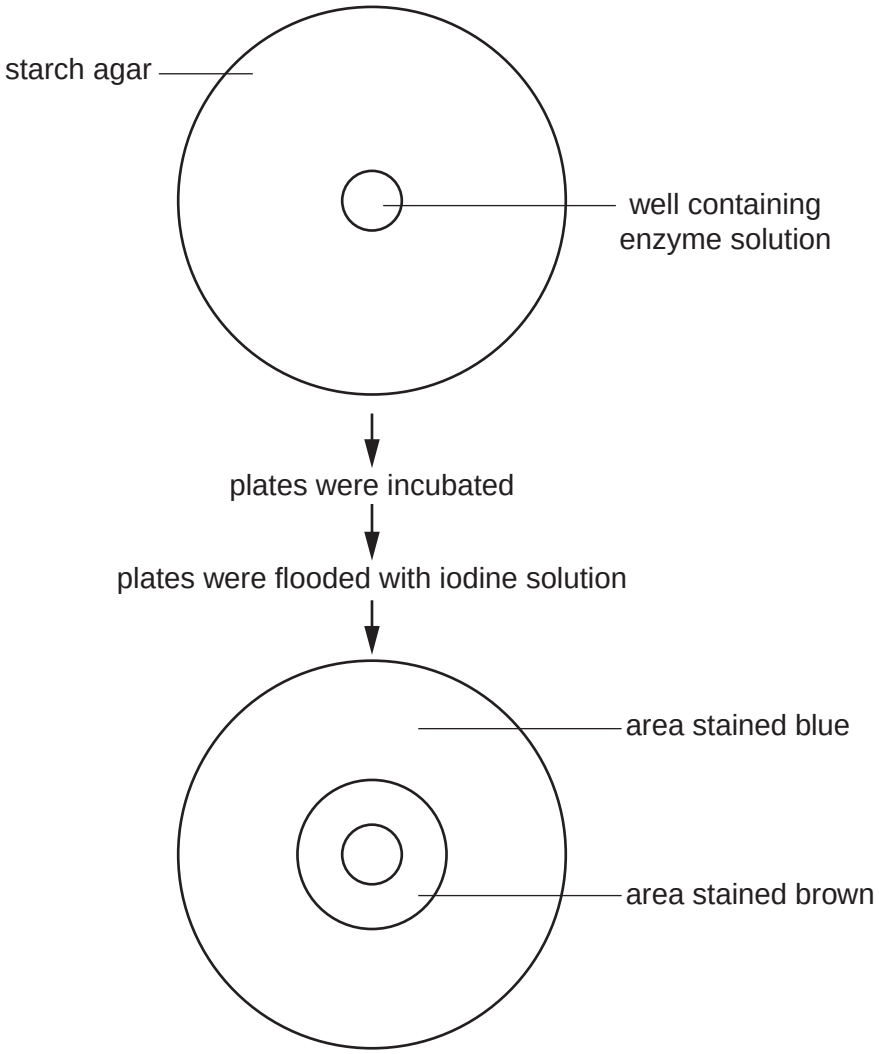


**Fig. 1.1**

The students thought that the area stained brown was proportional to the amylase concentration.

**(a)** Identify the independent and dependent variables in this investigation.

*independent variable* .....

*dependent variable* ..... [2]

**(b)** Describe how the students could use the method outlined in Fig. 1.1 to find out the concentration of the enzyme amylase in their extract.
Your method should be detailed enough for another person to follow.

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**(c)** There are different types of amylase enzyme. They hydrolyse starch in different ways. Two of these enzymes are:

- β-amylase hydrolyses every second α-1,4 glycosidic bond in starch molecules
- γ-amylase hydrolyses all α-1,6 glycosidic bonds and all α-1,4 glycosidic bonds in starch molecules.

In a second investigation, the students were provided with two beakers, **A** and **B**. One contained β-amylase and the other contained γ-amylase. They used these solutions to hydrolyse 25 $cm^3$ samples of 0.5 g $dm^{-3}$ starch solution.

Suggest **and** explain how the students could identify which beaker contained β-amylase and which contained γ-amylase.

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..... [2]

**(d)** Humans produce the enzyme α-amylase in their salivary glands. There may be many copies of the gene coding for α-amylase on chromosome 1. The concentration of the α-amylase in the saliva is positively correlated with the number of copies of this gene.

In a third investigation, the students obtained saliva from six people, **A** to **F**. Equal volumes of saliva were added to wells in agar plates similar to those shown in Fig. 1.1.
The plates were incubated for the same length of time and the area of the brown zone for each sample of saliva was calculated.

Table 1.1 shows results of this investigation.

**Table 1.1**

| enzyme extract | area of brown zone / $mm^2$ | | | | | |
|---|---|---|---|---|---|---|
| | plate 1 | plate 2 | plate 3 | plate 4 | plate 5 | plate 6 |
| **A** | 3632 | 3848 | 3632 | 3632 | 3632 | 3848 |
| **B** | 2827 | 2827 | 2642 | 2463 | 1963 | 2827 |
| **C** | 2124 | 1963 | 1963 | 2124 | 1963 | 2124 |
| **D** | 1385 | 1257 | 1809 | 1257 | 1257 | 1385 |
| **E** | 656 | 707 | 707 | 656 | 707 | 656 |
| **F** | 298 | 298 | 314 | 314 | 298 | 298 |

**(i)** Identify **two** results in Table 1.1 that may be anomalous. Show your answers by circling the two values. [2]

**(ii)** State how the students should deal with these anomalies.

.....[1]

**(iii)** The students decided to calculate the standard deviations of their results using the formula:

$$s = \sqrt{\frac{\Sigma(x - \overline{x})^2}{n - 1}}$$

*Key to Symbols*

$s$ = standard deviation $x$ = a result $\overline{x}$ = mean $\Sigma$ = sum of $n$ = sample size

Use Table 1.2 and the formula above to calculate the standard deviation for the results for person **F**.

**Table 1.2**

| plate | $x$ | $x - \overline{x}$ | $(x - \overline{x})^2$ |
|---|---|---|---|
| 1 | 298 | | |
| 2 | 298 | | |
| 3 | 314 | | |
| 4 | 314 | | |
| 5 | 298 | | |
| 6 | 298 | | |
| $\Sigma$ | | | |
| $\overline{x}$ | | | |

answer ..... [2]

**(iv)** Suggest an explanation for the results shown in Table 1.1.

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..... [3]

[Total: 20]





**[Turn over**

**2** The speed at which an electrical impulse travels along a nerve can be determined by carrying out a nerve conduction velocity (NCV) test.

Surface electrodes are placed on the skin over nerves at various locations. They produce a very mild electrical charge, which stimulates the nerve.

The resulting electrical activity in the nerve is measured by a recording electrode. The distance between the electrodes and the time it takes for electrical impulses to travel between them are used to determine the nerve conduction velocity.

Fig. 2.1 shows how the NCV is measured in the ulnar nerve of the human forearm.

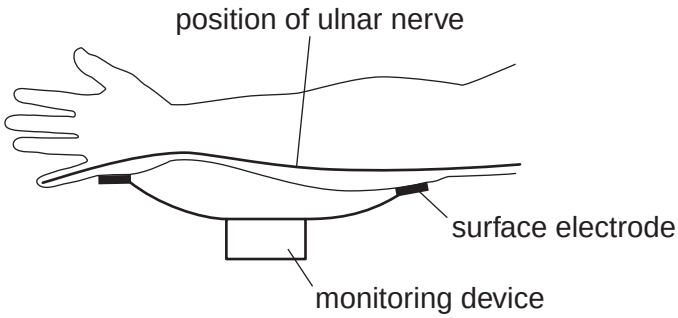


**Fig. 2.1**

An investigation to measure the NCV in the ulnar nerve in females of different ages was carried out on 394 individuals.

**(a)** Suggest **three** variables which the investigators should have standardised.

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Table 2.1 shows the results of this investigation.

**Table 2.1**

| age category / years | mean conduction velocity ± $S_M$ | confidence limits | |
|---|---|---|---|
| | | lower limit | upper limit |
| 30–39 | 54.3 ± 1.200 | 51.90 | 56.70 |
| 40–49 | 54.7 ± 0.645 | 53.41 | 55.99 |
| 50–59 | 52.4 ± 0.600 | 51.20 | 53.60 |
| 60–69 | 52.2 ± 0.675 | | |
| 70–79 | 49.0 ± 1.075 | 46.85 | 51.15 |

$S_M$ = standard error

**(b)** The confidence limit = mean ± 2 $S_M$.

Use this formula to calculate the missing confidence limits. Use the space below for any working and enter your answers in Table 2.1.

[1]

One conclusion from these data is that mean conduction velocity in the ulnar nerve varies significantly with age.

**(c)** **(i)** Identify **two** age categories which appear to support this conclusion and give a reason for your choice.

*age categories* ..... *and* .....

*reason* .....

.....

..... [2]

**(ii)** State which statistical test could have been used to confirm this conclusion and give a reason for your choice.

*test* .....

*reason* .....

..... [2]

**(iii)** State a null hypothesis for this test.

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..... [1]

**(d)** State **one** reason why the results of the investigation were considered to be reliable.

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..... [1]

[Total: 10]