6114543401

Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

CANDIDATE NAME **Script 5**

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.

CAMBRIDGE International Examinations

[Turn over

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.

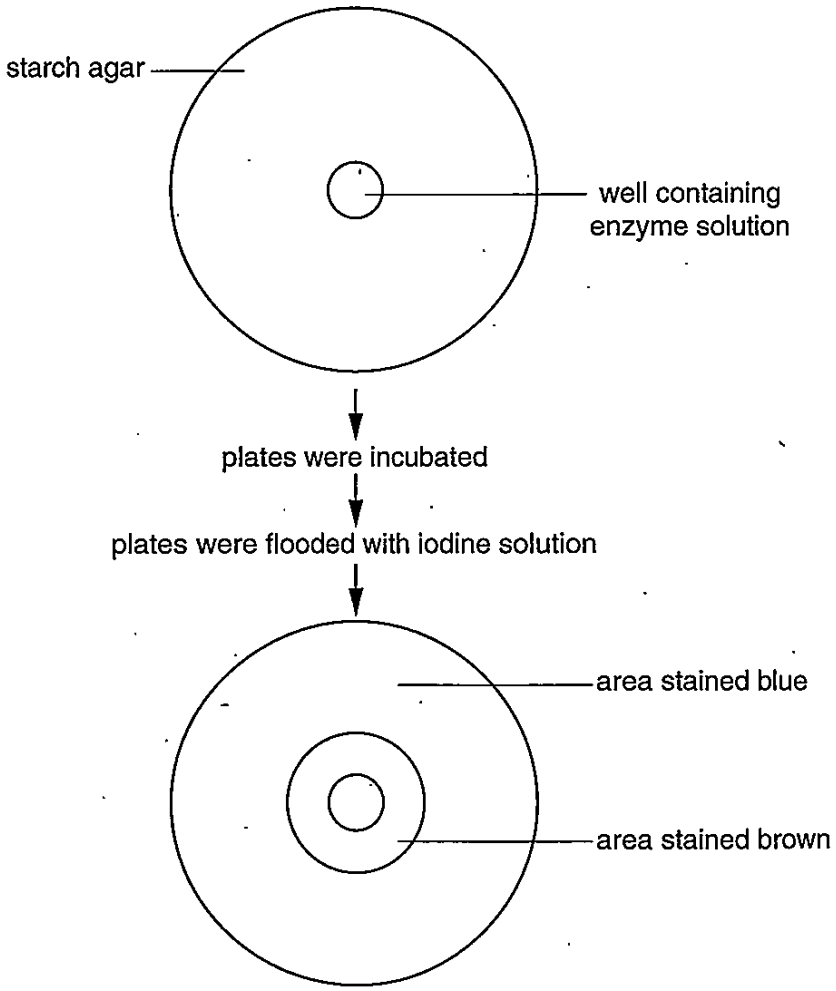


Fig. 1.1

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

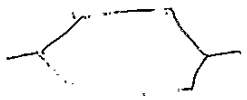
(a) Identify the independent and dependent variables in this investigation.

independent variable concentration/volume of enzyme solution

dependent variable area stained brown [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.

For this given investigation, the concentration/volume of the extract is the independent variable and the concentration of amylose found by the area of the solution which stained brown is the dependent variable. The total volume of the solution must be the same in all experiments. The temperature is standardised by keeping the solution in a thermostatically controlled waterbath and the PH is controlled by using PH buffers. The depth of the well is also standardised. 0.5 g/dm^3 stock solution is placed into the well using a graduated pipette and left for twenty minutes. Time is measured by using a stop watch. After the given time, plates are incubated using an incubator and iodine solution is added to the agar. The volume of iodine added must be same in all extracts. The dishes are left for ten more minutes. The area stained brown is calculated by measuring the diameter of the area. The diameter is divided by two to obtain the radius. The formula: (πr^2) is used to determine the relative area of the agar stained brown. Metric rule is used to measure the diameter. Colorimeter can also be used. The experiment is repeated several times and the mean area is calculated to increase reliability. A control experiment is also set up with distilled water instead of enzyme solution. This is a low risk experiment however gloves should be used to in case of fungi allergy and irritation. Care must be taken while extracting. [8]



(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.

The students would carry out Benedict's test on both beakers A and B to detect the concentration of glucose in the beakers. The solution with the highest amount of glucose will be γ-amylase and vise versa. The two beakers are incubated in water baths and benedict solution together with starch solution are added. The colour is measured by using a colorimeter. The darker the colour, the higher the concentration of glucose. [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

3704

(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.

Repeat the experiment and take mean. [1]

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

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

Key to Symbols

s = standard deviation x = a result $\bar{x}$ = mean Σ = 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	$x-\bar{x}$	$(x-\bar{x})^2$
1	298	−5.3	28.09
2	298	−5.3	28.09
3	314	10.7	114.5
4	314	10.7	114.5
5	298	−5.3	28.09
6	298	−5.3	28.09
Σ	1820		341.5
$\bar{x}$	303.3		

answer 8.26 [2]

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

The concentration of α-amylase decreased with increasing extract from A to F. This suggest that person F had the lowest number of copies of the gene and person A had the highest. This could. Person F may have a faulty allele coding for amylase gene or may be heterozygous for the recessive allele coding for the gene which produce low concentration of amylase [3]

[Total: 20]

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.

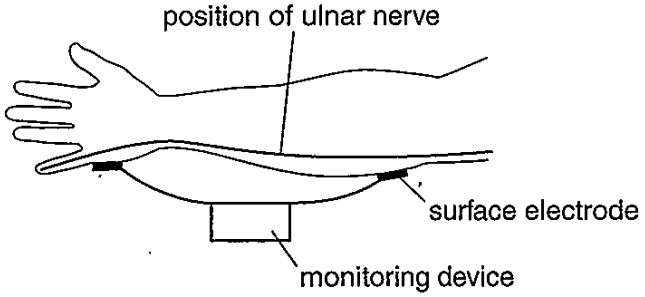


Fig. 2.1

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.

~~The age of the females should~~ The location at which the surface electrodes are placed must be standardised to compare as the speed might be different at different locations. The number of individuals of same age being test must be the same according to the range of ages chosen. The distance between the surface ~~ea~~ electrodes should be same for all individuals and the time taken for the electrical impulses must be calculated. The current (electric charge) produce shall be kept constant by using variable resistor.

[3]

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	50.85	53.55
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.

upper limit = mean + 2 S_M
= 52.2 + (2 × 0.675)
= 53.55

Lower limit = mean − 2 S_M
52.2 − (2 × 0.675)
= 50.85.

[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 40 – 49 *and* 70 – 79

reason The lower and upper limit of both age categories donot overlap.

[2]

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

test Chi -squared.

reason the data is discontinuous

[2]

(iii) State a null hypothesis for this test.

There is no significant difference in the mean velocity of conduction between two different ranges. [1]

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

Standard error is low which indicates reliability. [1]

[Total: 10]