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Examiners' Report
June 2017

IAL Biology 6 WBI06 01

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Introduction

The paper provided a good spread of marks, but all question parts seemed to be accessible to candidates and many scripts were awarded high marks.

Candidates appeared to be very familiar with the tensile strength of plant fibres and the bacterial inhibition practical techniques relevant to Question 1 and Question 3, and many very good answers to these questions were seen by the examiners.

Most candidates had little difficulty in interpreting the data presented in Question 2, and therefore the construction of an appropriate table and graph proved accessible.

While some candidates continue to produce rather generic answers, the examiners felt that most did better this year in attempting to answer the questions set and giving responses that were specific to the relevant experimental contexts.

It is very encouraging to see progress in this direction, and the examiners hope that future candidates will continue to think for themselves and demonstrate their understanding of the principles of experimental design.

Question 1 (a)

Most candidates described some details of this investigation. The marks most frequently awarded were for suspending fibres, adding weight until the fibre breaks and repeating and calculating a mean. Many candidates did not mention how to standardise the length of fibres or measure the diameter of fibres. The calculation of tensile strength was only described by a minority of candidates.

1 Fibres such as flax and jute are obtained from plants.

These fibres can be used to make man-made materials stronger.

(a) Describe an experiment to compare the tensile strength of flax and jute fibres.

(5)

1. Using a metre rule and vernier calliper, measure the diameter of both flax and jute fibres. Use ~~both fib~~ flax and jute fibres with ~~be~~ diameter 0.25 cm.
2. Use jute and flax fibres with ~~of~~ both length of 30 cm. The length of both fibres can be measured using metre rule.
3. Using different retort stands, clamp the ~~tens~~ fibres horizontally at each end.
4. Add slotted weights, each of mass 10g onto both of the plant fibres, one by one.
5. Count the number of slotted weights needed to break both flax and jute fibres. ~~Convert to force by multiplying 10.~~
6. Convert into tensile strength by dividing the total ~~weight~~ force needed to break fibre (N) with the cross-sectional area of the respective plant fibres.
7. Ensure that ~~both~~ experiment is carried out in a thermostatically controlled ~~room~~ ~~to~~ room to control humidity.
8. Repeat the experiment using both flax and jute fibres for 3 more times to calculate a mean.

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Examiner Comments

This answer gained 5 marks. Marking points 2, 1, 3, 4, 5, 7 can be found.

This is an example of a clear answer that includes knowledge of how to calculate tensile strength.

ResultsPlus
Examiner Tip

You may use a formula to explain how to calculate a value, if it is correct it will gain a mark. Some candidates described how to calculate tensile strength and gave a formula to make sure of the mark.

This is an example of a response that scored 3 marks.

Extract 5 flax and 5 jute fibres from a cellery plant. To make the extracting easier, put cellery in a beaker of water for a week.
The extracted fibres should be the same length.
Attach the fibres between two clamp stands and gradually add small weights until the fibre snaps. Add the weights to the middle of the fibre. Take care every fibre is attached to the clamp stands the same way. Record mass needed to break the fibres. Repeat with all 5 flax and all 5 jute fibres.
Plot data in a suitable table and graph.

ResultsPlus

Examiner Comments

This is an answer that lacks the detail required for more marks; although the answer given was easy to follow.
Marking points 1, 3 and 4 were awarded. Marking point 7 was not awarded as there was no reference to a mean.

The dependent variable is the strength of the fibres and the independent variable is the ~~force~~ mass
The mass should be in range of 5, 10N, 15N, 20, 25N
5 ~~fibres~~ ~~from~~ flax fibres and 5 ~~ff~~ jutes fibres should be used.
They should ~~the~~ have the same thickness and this can be measured by calculating its crossectiona area. They should be obtained from the same plants.
Cut the fibres of same length of 1m. Then add masses until the fibres breaks. ~~Record~~ ~~the~~ ~~mass~~ The fibres are hung on clamps ~~at~~ ~~which~~ ~~the~~ ~~fibres~~ where the ~~breaks~~. ~~The~~ masses are added.
Record the mass at which the fibres breaks.
Other variables to be controlled are temperature, carry out experiments at room temperatures.
Repeats are carried for statical analysis and reliability. Repeat the experiment with different fibres. control experiments is carried out for comparison Record the data in a table and present in a suitable graph. The tensile strength is calculated by

$$\frac{\text{Breaking force}}{\text{crossectional area}}.$$

ResultsPlus

Examiner Comments

This answer did gain 5 marks eventually. The cross sectional area of fibres was measured and then marking points 1, 4, 3 and 5 were awarded.

Question 1 (b)

(i) At least one of the variables identified on the mark scheme was given by nearly all the candidates.

(ii) Most candidates attempted to describe a control method for one of the variables stated in part (i), usually the description was sufficient to be awarded a mark. Very few candidates commented on the need for validity in experimental design, and most made a sensible comment on the effect on the tensile strength of fibres.

(b) (i) State **two** variables, other than the independent variable, that could affect this experiment.

(2)

time soaked in water, length of the fibres

(ii) Choose **one** of the variables you have identified in (i). Explain how this variable could be controlled. Describe what effect it could have on the results if it is not controlled.

(2)

Variable length of the fibres

How this variable could be controlled use a ruler or graph paper to make sure the fibres are of the same length

Effect it could have on the results if it is not controlled the tensile strength may be bigger or smaller if one of the fibres has a different length

ResultsPlus

Examiner Comments

This is an example of a clear answer to both parts of this question; it gained a total of 4 marks. The length of the fibres was commonly given as a variable.

ResultsPlus

Examiner Tip

Read the whole question before giving your answers. Some candidates could not describe how to control the variable they had just given in (i) but they did not then go back and change the variable to one for which they could provide an explanation of how it could be controlled.

(b) (i) State **two** variables, other than the independent variable, that could affect this experiment.

(2)

Temperature.

Humidity

(ii) Choose **one** of the variables you have identified in (i). Explain how this variable could be controlled. Describe what effect it could have on the results if it is not controlled.

(2)

Variable Temperature

How this variable could be controlled using a thermostat in a ~~dot~~ closed room.

Effect it could have on the results if it is not controlled Temperature could affect the breaking force because it has an effect on the kinetic energy ~~to~~ of the molecules in the fibre. higher temperatures could cause the ~~fe~~ fibre to snap easily.

ResultsPlus

Examiner Comments

This example described the possible change in the fibres adequately and gained full marks.

Question 1 (c)

Candidates often gave answers that could only be awarded the marks for fibres containing cellulose and lignin. Many candidates stated these molecules would break down slowly rather than saying they were difficult to break down. There were very few references to enzymes or cellulase and that only some microorganisms can produce these.

(c) Suggest why flax and jute fibres decompose slowly.

(3)

Both flax and jute fibers have ~~short~~ sclerenchyma fiber which ~~are dead~~ ~~because~~ have no living content. Moreover the fiber have lignified walls which are impermeable to the ~~e~~ digestive enzyme secreted by saprotrophic bacteria and fungi.

ResultsPlus

Examiner Comments

This answer only identifies the presence of lignin but does not quite say enough to gain marking point 3. It was awarded 1 mark in total.

The flax and jute fibres are part of the plant made up of xylem tissue which is almost very dead matter. The fibres do not have any living tissue inside them and therefore no metabolic reactions will take place and therefore micro organisms would not feed on them. There are no release of enzymes to digest on the fibre. The break down therefores becomes slow and hence the fibre decomposes slowly.

ResultsPlus

Examiner Comments

This is an example of an answer giving some correct biological detail that does not answer the question. No marks were awarded.

ResultsPlus
Examiner Tip

Avoid agreeing with the question, in this case 'decompose slowly' without giving a reason as to why the decomposition is slow. This answer does give a reason but it is incorrect.

(3)

- Because flax and jute fibres are made up of cellulose which is insoluble in water.
- Because cellulose is joined by 1,4 glycosidic bonds in a condensation reaction, the chain of cellulose is very difficult to break down
- the fibres have a very strong and dense structure which is hard for decomposers to break down

ResultsPlus
Examiner Comments

This answer identifies cellulose and then goes on to say it is hard to breakdown for marking point 3. It was awarded 2 marks in total.

Question 2 (a)

Nearly all candidates gave clear statements that gained both marks.

The student investigated the sizes of fish in two pools, **A** and **B**.

(a) Write a null hypothesis for this investigation.

(2)

There is no significant difference in the size of fish in pool A and B.

ResultsPlus

Examiner Comments

This is a clear answer, both marks were awarded.

reject the hypothesis
There is significan differen in fish

ResultsPlus

Examiner Comments

The candidate is answering a different question to the one being asked. No marks were awarded. This type of response was very rare. Most candidates gained both marks.

ResultsPlus

Examiner Tip

This is an example of a candidate not carefully reading and thinking about the question before writing a response.

Question 2 (b)

(i) Most candidates provided a suitable table format with raw data and means entered correctly. However, there was a tendency to provide incomplete headings for the table so the first marking point could not be awarded.

(ii) Most graphs were awarded all three marks. Only a small number of candidates provided an incomplete label for the y axis or made an error in plotting the range bars.

Pool A

51mm, 39mm, 45mm, 38mm, 35mm, 32mm, 39mm, 47mm,
40mm, 41mm, 31mm, 42mm, 43mm, 50mm, 44mm

Mean = 41.133

Pool B

45mm, 54mm, 50mm, 48mm, 45mm, 44mm, 41mm, 43mm,
47mm, 37mm, 48mm, 42mm, 50mm, 42mm, 46mm

45.467

Mean = 45.5

46

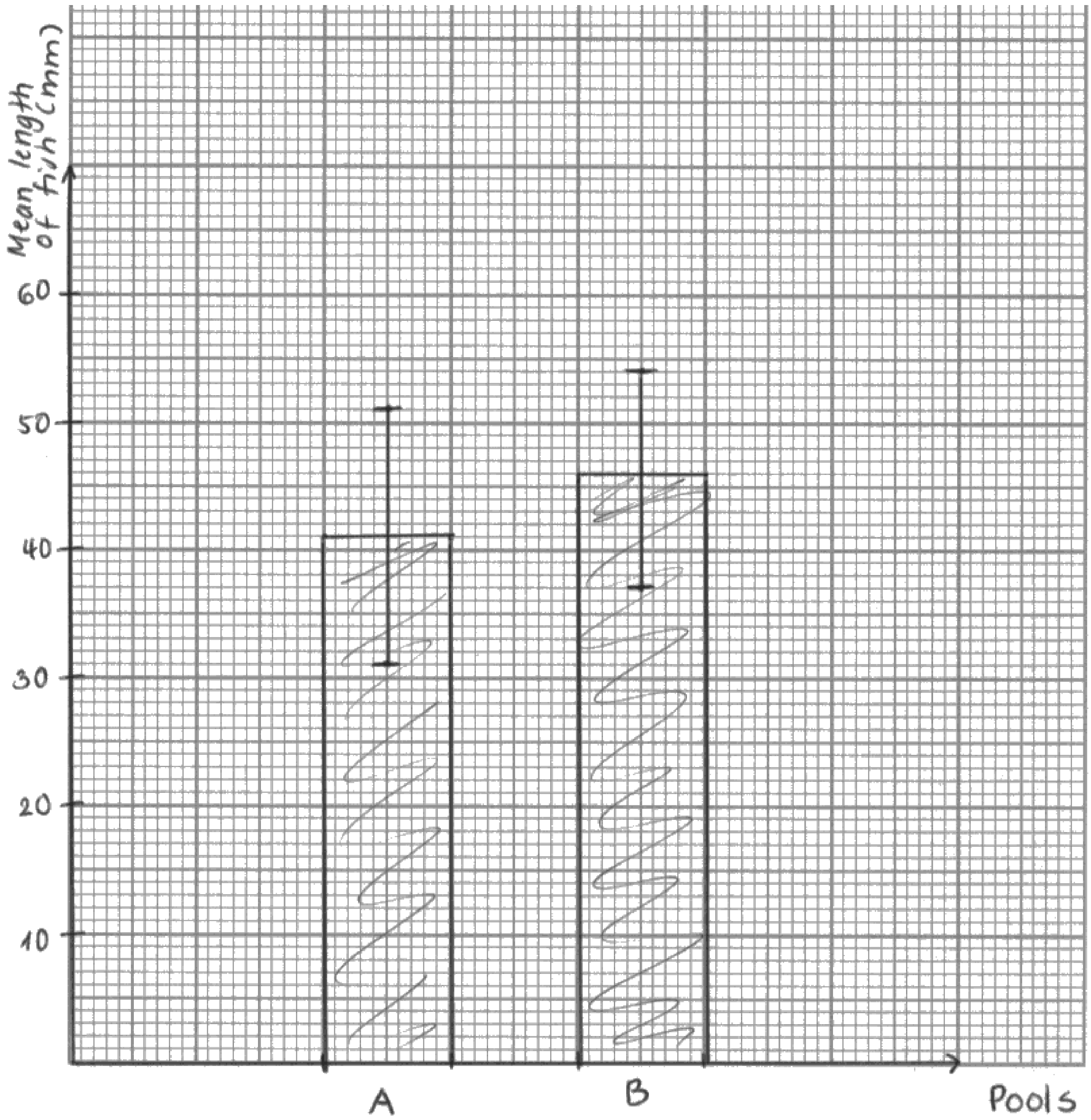
(i) Calculate the mean length of the fish for pool **A** and for pool **B**.

T-test

In the space below, draw a table to show the raw data and your calculated mean values.

(3)

Pools	length of fish (mm)	Mean (mm)
A	51, 39, 45, 38, 35, 32, 39, 47, 40, 41, 31, 42, 43, 50, 44	41
B	45, 54, 50, 48, 45, 44, 41, 43, 47, 37, 48, 42, 50, 42, 46	46



ResultsPlus

Examiner Comments

This response gained 3 marks for the table and another 3 marks for the graph.

ResultsPlus

Examiner Tip

Candidates must make sure they inspect the headings they have written in the table and on the graph, especially the y axis. Otherwise complete answers can lose 2 of the six marks for two minor errors.

(b) The student caught a sample of fish from each pool. The length of each fish was measured and recorded.

The results are shown below.

<u>Pool A</u> 572 38

51mm, 39mm, 45mm, 38mm, 35mm, 32mm, 39mm, 47mm,
40mm, 41mm, 31mm, 42mm, 43mm, 50mm, 44mm

<u>Pool B</u> 682 45

45mm, 54mm, 50mm, 48mm, 45mm, 44mm, 41mm, 43mm,
47mm, 37mm, 48mm, 42mm, 50mm, 42mm, 46mm

(i) Calculate the mean length of the fish for pool **A** and for pool **B**.

In the space below, draw a table to show the raw data and your calculated mean values.

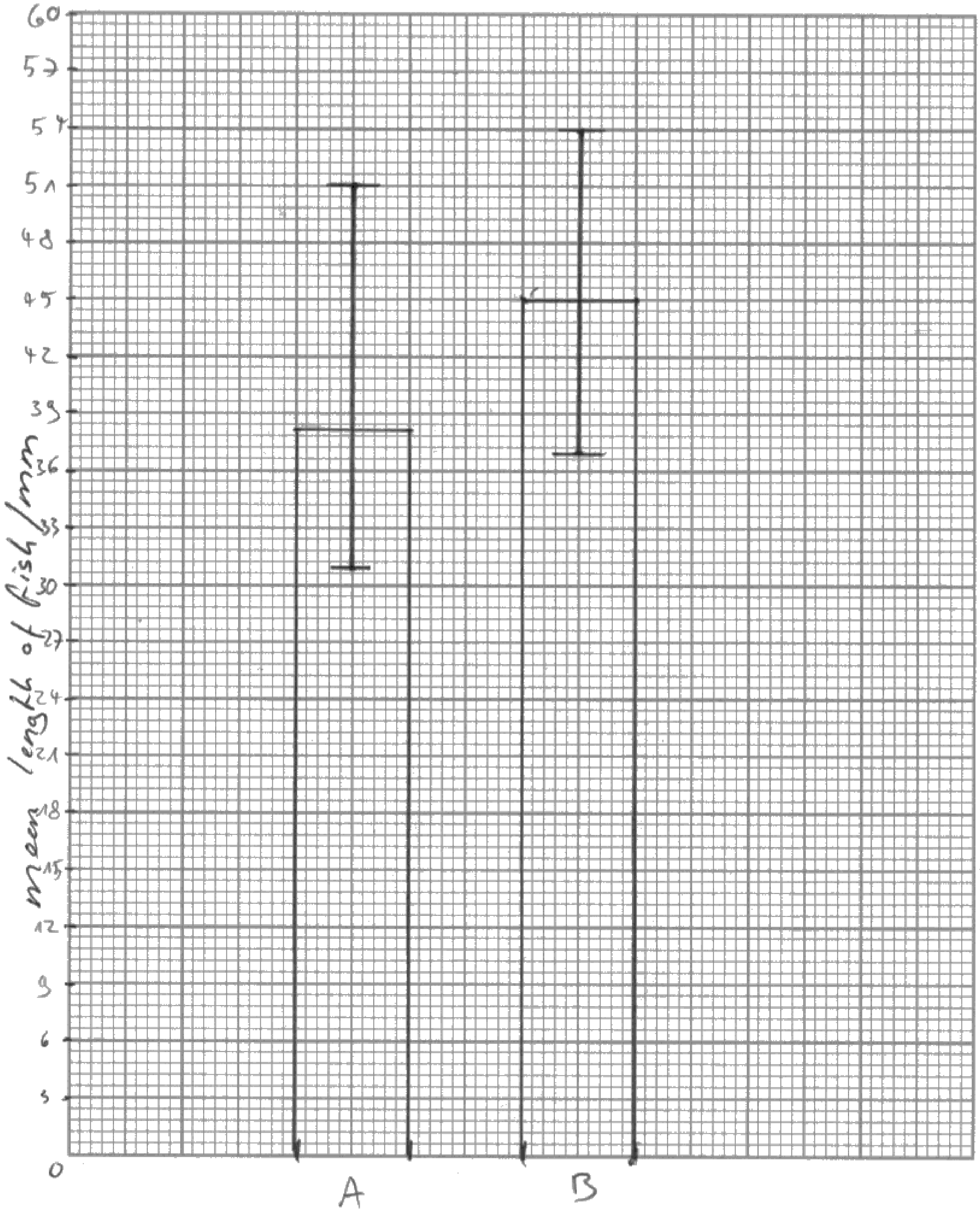
(3)

Pool	length of fish /mm								mean length of fish /mm
A	51	39	45	38	35	32	39	47	38
	40	41	31	42	43	50	44		
B	45	54	50	48	45	44	41	43	
	47	37	48	42	50	42	46		45

(ii) On the graph paper below, draw a suitable graph to compare the mean length of the fish from pool **A** and from pool **B**.

Indicate on your graph the variability of the data.

(3)



ResultsPlus
Examiner Comments

The table presented is not very neat but still worth 2 marks. The means were not correctly given; however, the graph was given all 3 marks as the means from the table were plotted correctly. This is an example of an error carried forward.

ResultsPlus
Examiner Tip

Check your calculations carefully. If data is given in whole numbers a mean should be given to one decimal place.

Question 2 (c)

Most candidates selected the correct critical value of 2.05 from the table provided and then completed their answer as shown on the mark scheme.

(c) The student carried out a *t*-test to analyse the data.

The analysis produced a value of $t = 2.31$

The number of degrees of freedom is calculated using the formula

$$\text{degrees of freedom} = (n_1 - 1) + (n_2 - 1)$$

where n_1 and n_2 represent the size of each sample.

The table below can be used to find the critical value of *t* for this investigation.

Number of degrees of freedom	Significance level	
	p = 0.05	p = 0.01
14	2.15	2.98
15	2.13	2.95
16	2.12	2.92
17	2.11	2.90
18	2.10	2.88
19	2.09	2.86
20	2.09	2.85
25	2.06	2.79
28	2.05	2.76
60	2.00	2.66

What conclusions can be drawn from this investigation?

Use information from the table and your graph to help explain your answer.

(4)

The calculated value (2.31) is greater than the critical value (2.05) at a 95% confidence level so we reject the null hypothesis and accept that there is a significant difference between the size of a fish and the pool its in at the end of the dry season. The error bars overlap this shows that the difference is minor.

ResultsPlus

Examiner Comments

This is a clear answer gaining all 4 marks.

ResultsPlus

Examiner Tip

Some candidates did not mention the critical value of 2.05 in their writing; however, if this value was marked on the table and the critical value correctly referred to then the first marking point was still awarded.

(c) The student carried out a *t*-test to analyse the data.

The analysis produced a value of $t = 2.31$

The number of degrees of freedom is calculated using the formula

$$\text{degrees of freedom} = (n_1 - 1) + (n_2 - 1)$$

where n_1 and n_2 represent the size of each sample.

The table below can be used to find the critical value of *t* for this investigation.

Number of degrees of freedom	Significance level	
	p = 0.05	p = 0.01
14	2.15	2.98
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18	2.10	2.88
19	2.09	2.86
20	2.09	2.85
25	2.06	2.79
28	2.05	2.76
60	2.00	2.66

What conclusions can be drawn from this investigation?

Use information from the table and your graph to help explain your answer.

(4)

The critical value of 2.05 at 95% confidence level is lower than the statistical test value of 2.31 thus accepting the null hypothesis which states that there is no significant difference between the sizes of fish in pools A & B. Also the range bars are overlapping showing a lesser difference overall.

ResultsPlus
Examiner Comments

The candidate gained the first two marking points. However marking points 3 and 4 are the wrong way round so they did not gain marks. The last marking point was given credit as an independent point.
This answer was awarded a total of 3 marks.

Question 2 (d)

This question proved to be challenging for most candidates. Although suitable biotic or abiotic factors were frequently stated only a very small number of candidates suggested how these factors could be measured. Many candidates tried to answer this question as if they were going to carry out a laboratory investigation.

(d) Suggest how this investigation could be modified to identify factors affecting the size of the fish in the pools. - ~~reliabitity and validity~~

(4)

Have a larger sample size using fishes of the same source or clones.

Have variables such as temperature, pH of the pools of pools and food diet the same. Control temperature by using thermostatically controlled water bath or pool, control pH by using a buffer and feed the fish the same food.

Have a control experiment with all the same factors controlled.

Repeat this experiment 3 times to find the mean size in length of the fish.

ResultsPlus
Examiner Comments

This type of response was widely given. It was awarded only 2 marks for the factors.

ResultsPlus
Examiner Tip

Take careful note of the number of marks that are allocated for a complete answer to a question. In fieldwork many factors have to be measured using some sort of instrumentation.

One should investigate the pH of the water with a sample and universal pH indicator paper, the temperature should also be compared with a thermometer because it affects the fish's enzymes and the rate of reaction which may lead to increased growth or decreased growth depending on the temperature. Also, the fish length may also vary depending on their gender so gender should also be controlled, as well as the availability of food which affects their growth rate and thus their size.

![ResultsPlus]

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Examiner Comments

This response identified two factors and stated how each factor could be measured. All 4 marks were awarded.

Question 3 (a)

Nearly all candidates understood the function of antimicrobial substances. However, the answers given sometimes lacked sufficient clarity to be awarded marks.

(a) Suggest how a plant may benefit from producing a chemical with antimicrobial properties.

(2)

The plant will be able to kill or stop the reproduction of microorganisms
The plant would benefit as ~~If~~ the chemical can kill pathogens ~~micro~~ bacteria or fungi which could cause infection. If a bacterial disease spread the organism plant is more likely ~~to survive breed and~~ ~~pass on its favorable allele to its offspring~~ to survive to breed and pass on its favorable alleles to its offspring.

ResultsPlus
Examiner Comments

Both marks were awarded for this response.

ResultsPlus
Examiner Tip

Candidates should realise that examiners do their best to read responses and give credit wherever possible.

A plant could ward off potential pathogens or not allow them to grow once the microbes ~~are~~ have infected it, thus it will be sure not to be a victim of pathogens and grow more freely.

ResultsPlus
Examiner Comments

This answer gained both marks.

Question 3 (b) (i)

The examiners were pleased to see candidates frequently suggested some sensible preliminary work that was relevant to the main investigation. There was little evidence of generic answers being given by candidates here.

(i) A description of appropriate preliminary work that you might carry out to ensure your proposed method would provide meaningful data.

(3)

- carry out the experiment before hand to ensure it will work.
- find out the optimum temperature for the plant to release its chemicals
- find out the concentration of bacteria which will be used.
- determine the volume of bacteria to be used
- determine the light intensity the plant will be exposed too.

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Examiner Comments

This response only gained the first marking point. The optimum temperature statement was not in the context of incubation, so marking point 6 could not be awarded.

ResultsPlus

Examiner Tip

This answer could have gained 2 more marks with careful wording in a statement about bacteria and temperature as shown in the mark scheme.

Practice the proposed method to see if it will work. Select a suitable type of bacteria to be tested. Carry out several trials to select the optimum pH at which the ~~chemicals~~ bacteria and chemicals work at their best. Select ~~a range of~~ a suitable timescale to measure the activity of the chemicals. Choose the best method to measure the dependant variable.

ResultsPlus

Examiner Comments

This response gained marking points 1, 3 and 6. The last sentence is insufficiently specific to award MP7 but it has already achieved full marks.

Question 3 (b) (ii)

Nearly all the candidates gave very detailed accounts in a logical order that confirmed they had carried out this type of investigation in a laboratory.

(ii) A detailed method, including an explanation of how important variables are to be controlled or monitored.

[2 marks are available in this section for the quality of written communication.]

(10)

In this experiment the antimicrobial properties are checked from different parts of the oregano plant. ~~to see the highest con~~ The independent variables are the different parts of a oregano plant with different ~~chemi~~ chemical & concentrations. The dependent variables is the effect of different parts of oregano on ~~on bacteria~~ inhibition of bacteria First the whole laboratory is desinfected using aseptique techniques to create a sterile environment. Then ~~dif~~ the oregano plant is diveded into different groups that will be tested; leaves, stem and roots. ~~The~~ Now the agar is made and set in a petri dish, close the lid * so that no unwanted bacteria come in contact with the agar. When the agar is set a bacterium is spread on the agar using a spattula. In this experiment we use the bacterium E.Coli. The lid is closed again. Now we make the leaves smaller by using a pestle and mortar and ethanol, then a sterile paper disc is placed in the solution and then placed on the agar.

Repeat the same for the roots and stem. A paper disc ~~soaked~~ only soaked in ethanol and placed on the agar, is used as a control. The petri dish now is marked with the students name, the bacteria name and the date of incubation. On the petri dish we also clearly show which paper disc has which part of oregano plant and which one is the control disc. The petri dish is now closed with adhesive tape at 4 points and incubated at 30°C for 48 hours. The ~~t~~ agar plate is afterwards analyzed and the zones of ~~eac~~ inhibition of each paper disc is measured by using a ruler to see the diameter and ~~furtheron~~ on ~~it~~ is the values are written down in a table. The experiment is repeated five times to make it more reliable and to see anomolous results. All the information together will allow us to calculate a mean and plot it in a bar graph. Never close the petri dish with the ~~tap~~ adhesive tape completly as anaerobic pathogenic bacteria could grow. Also don't open again after incubation.

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Examiner Comments

This response gained marking points 3, 6, 1 and then 2 and 4, all on the first page. Then marking points 7, 5 and 9 were awarded on the second page.

Marking point 8 was not awarded as 'to incubate' is not the same as using an incubator. The question scored a total of 10 marks (QWC of 2 plus the 8 marking points).

• Dependant variable: zone of inhibition.
• Independant variable: ~~Rgge~~ Sample of oregano
• prepare a Petri dish with suitable conditions for E-coli. Drop the E-coli on a petri dish and lawn.
• Crush small sample from oregano by Pistel and morter.
• Pipette $1cm^3$ of alcohol to the extract.
• Take 3 paper disks, 2 of them should be soaked into extract and 1 with alcohol to act as a control.
• place the disks ~~too~~ in the petri dish and gently press.
~~• Incubate at 30°c and leave it for a week.~~
• Seal Petri dish with clear tape but make sure that gasses can pass in and out ~~too so that~~ to prevent ~~growth of~~ an aerobic conditions.
• Make sure light intensity is kept contant by carrying the experiment with one source of light.
• Incubate at 30°c and leave it for a week.
• Measure the diametre of zone of inhibition.
• Repeat the experiment and get the mean zone of inhibition

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Examiner Comments

This response gained marking points 3, 2, 4, 7 and 9.
Although the dependent variable was identified no measurement apparatus was used so marking point 5 could not be awarded. QWC was awarded 2 marks as the answer is in sequence and in prose.
The question gained a total of 7 marks overall.

Question 3 (b) (iii)

Most candidates presented tables in an appropriate format. However, some tables were not given headings with units or the heading and the unit given did not match up. A table does need to show that repeats could be recorded. The majority of candidates did suggest an appropriate statistical test.

(iii) A clear explanation of how your data are to be recorded, presented and analysed in order to draw conclusions from your investigation.

(4)

we would calculate a mean for each part of the plant.

Part of the plant	Inhibition zone (mm)			Mean
	measurement 1	measurement 2	measurement 3	
A	mm	m m	mm	
B	mm			
C				
D				

We would use a t-test to find the most effective / antimicrobial part

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Examiner Comments

This is a poor example of a table as units are in the table. The heading could be for area or diameter, so no mark could be awarded. There was no graph or a description of a graph.

Only marking points 2 and 4 could be awarded.

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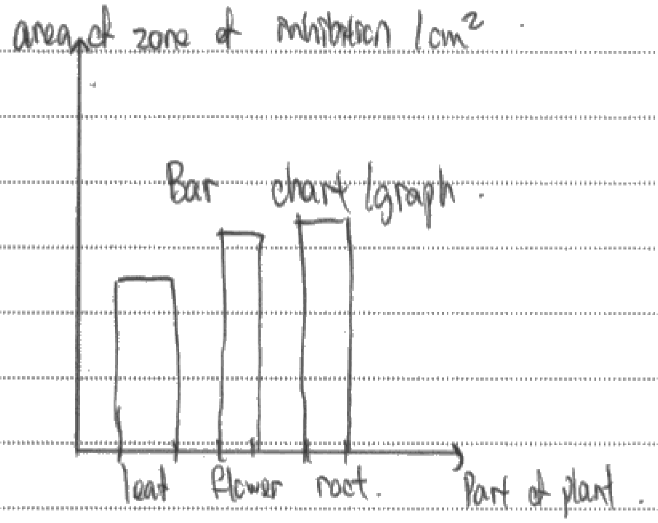
Examiner Tip

Candidates should never put units in a table; however, units should always be given correctly in headings or on labels for graph axes.

(iii) A clear explanation of how your data are to be recorded, presented and analysed in order to draw conclusions from your investigation.

(4)

Part of plant.	Diameter of zone of inhibition / cm 1	2	3	Mean	Area of zone of inhibition. / cm^2
flower					
shoot					
root					
leaf.					
control (distilled water)					



null hypothesis = no significant difference between the part of plant and concentration of antimicrobial chemical.

tested with ~~the~~ Mann Whitney U test ~~on~~ at a 5% significant level.

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Examiner Comments

All four marking points are clearly presented and 4 marks are awarded.

Question 3 (b) (iv)

There was evidence that candidates were less reliant on generic answers to this question than in the past. All the marking points were seen regularly except the last marking point. The idea that different parts of a plant might produce different inhibitors was only suggested by a very small number of candidates.

(iv) The limitations of your proposed method.

(3)

Time of incubation may not be long enough to see significant results. It is difficult to control all the variables, e.g. vol. of bacteria in petri dish, plus: even coverage of bacteria. It is hard to measure an accurate diameter of clear zone because it is unlikely that it is a perfect ~~~~. cyrcle. Use of bad aseptic techniques could lead to unwanted microorganism growth and thus a change in results. Possibly the wrong strain ~~~~ of bacteria used.

ResultsPlus

Examiner Comments

Marking point 1 was not awarded as a controlled variable was not correctly qualified as shown in the mark scheme. Marking point 3 was awarded on line 5.

This response was awarded 1 mark in total.

ResultsPlus

Examiner Tip

Try to always aim your answer at the investigation you have just described rather than just make a list of possible limitations to fit any investigation.

You may not be able to controll all the variables that affect the dependant variable in this experiment. One bacteria does not represent all the bacteria thus the effect of different plant parts may act differently on different bacteria. You may not be able to control the concentrations of the various extracts that have been removed from plants. Different oregano plants may have different results of the part that acts best due to the genetic diversity of both plants.

ResultsPlus

Examiner Comments

This answer gained 2 marks. Marking point 4 was given at the end of line 4 and marking point 2 on line 6.

Marking point 4 could have been awarded on the last line as well but full marks had already been given.

Paper summary

Candidates can improve their performance in this paper by:

- reading the question carefully before providing an answer
- carefully checking all calculations and rounding up values
- drawing neat, fully labelled tables and graphs
- using subject specific terms to help support their answers
- planning descriptions of investigations before writing them, to give the best chance of gaining the marks available.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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