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Examiners' Report
June 2016

IAL Biology WBI06 01

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June 2016

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Introduction

The paper provided a good spread of marks, but all question parts seemed to be accessible to candiates and many high-scoring scripts were marked. Candidates appeared to be very familiar with the core practical techniques relevant to questions 1 and 3, and many very good answers to these questions were seen by the examiners. Some candidates encountered more difficulty in interpreting the data presented in question 2 and therefore the construction of an appropriate table and graph proved challenging. While some candidates continue to produce rather generic answers, the examiners felt that most candidates did better in answering 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)

Candidates that kept the context of the question in mind selected an appropriate range of five temperatures and stated an appropriate incubation time. Suitable control variables were suggested and the gender of the offspring was observed.

Many candidates simply stated the need to repeat the experiment at each temperature without clearly stating that this would allow the calculation of a mean.

Unfortunately some candidates reverted to describing their knowledge of brine shrimp eggs hatching which usually meant that some marks could not be awarded.

(a) In many species of lizard, the gender (sex) of the offspring is influenced by the temperature at which the eggs are incubated.

Describe an experiment that could be carried out to investigate the effect of temperature on the gender of the frilled lizard offspring.

You should include details of how **two** relevant variables are controlled.

(5)

Collect 50 eggs from the same mother lizard from the wild. Divide the 50 eggs into 5 different groups with 10 eggs at each. Place each of the groups into different incubators set to 5 different temperatures of 20, 25, 30, 35, 40°C. Temperature is a controlled variable and is controlled with incubators. Leave the eggs in incubators for two months. The time of incubation is also a variable controlled by keeping the eggs in incubators for exactly 2 months. After two months, count the number of males and females hatched at each temperature at each temperature. Repeat the experiment 3 times by using eggs from the same parent lizard to calculate a mean of ~~egg~~ Males and females hatched at each temperature.

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Examiner Comments

This answer gained 5 marks for all the marking points except 4. The candidate has reviewed their answer and added some detail, for example the number of eggs collected.

ResultsPlus
Examiner Tip

Examiners read your answer very carefully, including any text alterations you have made. It is best to only put a single line through words so they can still be read if necessary.

Question 1 (b)

Most candidates suggested that there could be errors in idenifying the sex of the offspring and also that some eggs may not hatch. Only a small number of candidates gave clear answers about the difficulty of keeping the temperature constant. There were some statements about controlling temperature without any further detail given. These answers did not gain credit.

(b) Suggest **one** possible source of random error in this experiment.

(1)

The temperature of the incubators may not be constant throughout the two months.

ResultsPlus
Examiner Comments

Many candidates indicated that the temperature may not remain constant during the incubation period and scored marking point 2.

ResultsPlus
Examiner Tip

Candidates should try to write their suggestion as clearly as possible. To just write temperature would not be enough to gain the mark.

Question 1 (c)

Many candidates gained both marks. Many answers suggested that the lizards would need food, they should be handled carefully and then returned to the wild. The idea of incubation of the eggs in suitable conditions and leaving some eggs in each nest from which eggs were collected, were infrequently given as answers.

(c) Describe **two** ways to ensure the wellbeing of the lizards in this experiment.

(2)

~~The~~ ~~the~~ The lizards should not be harmed or killed during the experiment. After the experiment, they should be released back and returned to their natural habitat.

ResultsPlus
Examiner Comments

This response gained two marks, marking points 4 and 5

(c) Describe **two** ways to ensure the wellbeing of the lizards in this experiment.

(2)

. check for their organs and health status.
. Put them back to the wild environment to see if they can survive.

ResultsPlus
Examiner Comments

This response only gained marking point 5.

ResultsPlus
Examiner Tip

This candidate did attempt to give two ways. The first comment was not given credit, but the candidate had taken account of the mark allocation for the question.

Question 1 (d) (i)

Many candidates suggested the advantage that there would be more females to lay eggs or produce more offspring. However, although they often referred to males mating with many females, they did not usually express the idea that one male could fertilise many eggs. The idea that there would be less competition for mates between a small number of males was rarely suggested.

Most candidates suggested that the disadvantages would be too few males to mate with all the females and this would lead to reduced genetic diversity.

(d) The results of a similar experiment are shown in the table below.

Temperature of eggs	Gender of offspring
low	females only
middle	males and females
high	females only

(i) The managers of a nature reserve would like to increase the population of frilled lizards in the reserve. They plan to incubate the lizard eggs at temperatures that will produce more females than males.

Suggest possible advantages and disadvantages of this plan.

(3)

Advantages If they incubate eggs at a low temperature less energy will be used so they save up money because they dont need to spend it on heating. Its cheaper Also one male mates with many females so their number they should produce offspring

Disadvantages If some of the males are infertile, there are not many males that can reproduce so not many offspring would be produced. This would also reduce the gene pool because there's not much variation.

ResultsPlus
Examiner Comments

The first suggested advantage is not relevant. The second statement was taken by the examiner to refer to the idea of more females to produce offspring.

The marking points 4 and 7 were awarded for disadvantages.

ResultsPlus
Examiner Tip

Clear statements are required to answer this type of question rather than vague statements. For example in the advantage section one male could fertilise many eggs but references to mating were ignored. In the disadvantage section too few males to mate was an appropriate response.

(d) The results of a similar experiment are shown in the table below.

Temperature of eggs	Gender of offspring
low	females only
middle	males and females
high	females only

(i) The managers of a nature reserve would like to increase the population of frilled lizards in the reserve. They plan to incubate the lizard eggs at temperatures that will produce more females than males.

Suggest possible advantages and disadvantages of this plan.

(3)

Advantages The hatch rate will increase. As more females means more eggs. So more offsprings. Hence the ~~lizards~~ ~~w~~ abundance of lizards will be more. So their number will be maintained for generations to come minimize the threat of extinction.

Disadvantages low genetic variation in the lizards as one male lizard mates with several female lizards. So the hatched baby lizards will have a low genetic variation so ~~if the male lizard es~~ The lizards might not be able to survive in harsh conditions.

ResultsPlus
Examiner Comments

This response clearly gave marking point 1 and then marking point 7.

Question 1 (d) (ii)

Most candidates clearly explained the effect of temperature on enzyme action and that this would increase the rate of reactions or a named process or reaction.

(ii) To produce more female offspring, the eggs could be incubated at either a high or a low temperature. The reserve managers chose a high temperature because this causes the young lizards to hatch more quickly.

Explain why a high incubation temperature might cause the young lizards to hatch more quickly.

(2)

At higher temperatures the enzymes in the body of lizards get the optimum contions, so they can function efficiently. ~~Metaballic reactions~~ Rate of metaballic reactions in the body od lizards increase. So eggs are hatched quickly.

ResultsPlus
Examiner Comments

This answer gained marking points 1 and 3.

(ii) To produce more female offspring, the eggs could be incubated at either a high or a low temperature. The reserve managers chose a high temperature because this causes the young lizards to hatch more quickly.

Explain why a high incubation temperature might cause the young lizards to hatch more quickly.

(2)

Higher incubating temperature, lead to increase in kinetic energy of molecules, so more enzyme-substrate complex formed, greater rate of reaction, so young lizards can hatch more quickly as they are developed at a higher rate.

This answer gained marking points 1 and 2.

(ii) To produce more female offspring, the eggs could be incubated at either a high or a low temperature. The reserve managers chose a high temperature because this causes the young lizards to hatch more quickly.

Explain why a high incubation temperature might cause the young lizards to hatch more quickly.

(2)

Enzymes controll the metabollic reactions in our body. As the temperature rises, it gradually becomes the optimum temperature for enzymes to work best. However, when the temperature rises beyond its optimum temperature level, enzymes denature causing the break down of enzymes into smaller units, thus, the lizards hatch more quickly.

ResultsPlus
Examiner Comments

This response was a general description of enzyme action and it only gained marking point 1.

ResultsPlus
Examiner Tip

This answer only gained marking point 1.

Question 2 (a)

The majority of candidates gave a clear null hypothesis stating that there was no significant difference between the sugar content of modern and traditional apples. There were incorrect statements about no significant correlation and a small number of candidates incorrectly included type 2 diabetes in their answer.

(a) Write a suitable null hypothesis for this investigation.

(2)

There is no significant difference in the sugar content of modern and traditional varieties of apple.

ResultsPlus
Examiner Comments

This is an example of a typical answer that gained 2 marks.

(a) Write a suitable null hypothesis for this investigation.

(2)

There is no possible correlation between the amount of sugar content in apples and type 2 diabetes.

ResultsPlus
Examiner Comments

This is an example of an answer that gained no marks as there is confusion between correlation and difference. In addition the inclusion of type 2 diabetes is not relevant.

Question 2 (b)

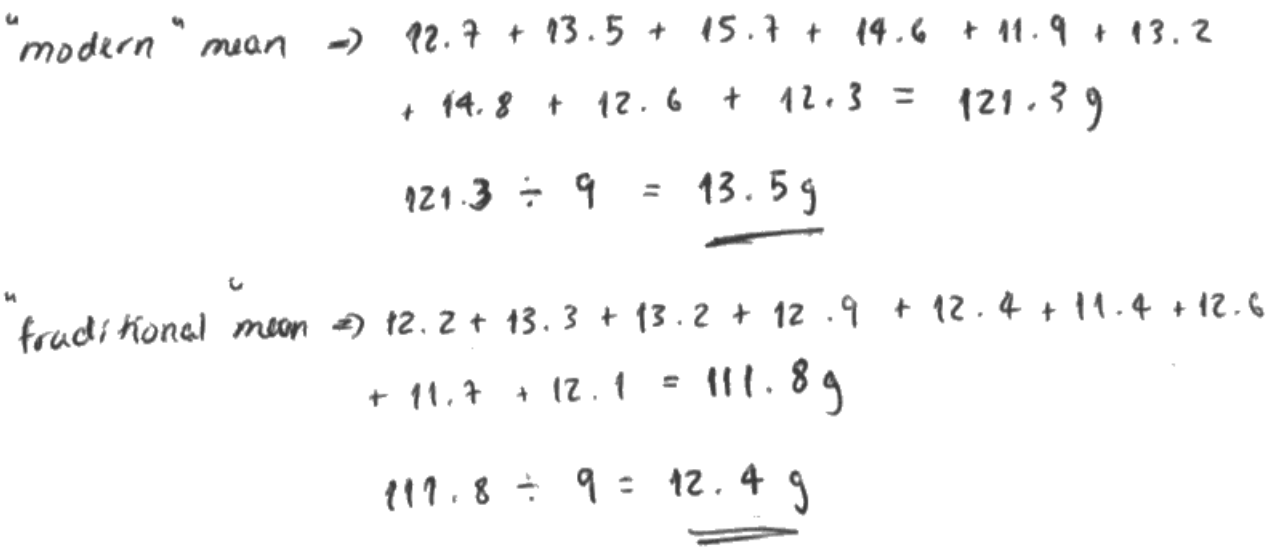
The tabulation of the given data gave candidates several different ways they could make errors. In some cases the heading for sugar content did not have any units. However, there were only a few examples of units being repeated in the data cells.

There were different ways of gathering the data into two groups, modern and traditional, all of which could gain a mark. Most candidates correctly expressed their calculated mean to one decimal place. The examiners noted that the mean for modern apples was often incorrectly calculated.

(b) Calculate the mean sugar content for the modern apples and for the traditional apples.

Prepare a suitable table to display the **raw data** and the **two** calculated **means**.

(3)



ResultsPlus
Examiner Comments

This table gains all three marks, the headings are clear and complete, all the raw data has been entered and the means are correctly calculated and given to one decimal place. The mean for modern apples was sometimes stated as 13.4.

ResultsPlus
Examiner Tip

Candidates should think carefully about the graphical presentation of the tabulated results. This will help selection of a suitable format. Always check that table headings have units when required and check their calculations on means.

(b) Calculate the mean sugar content for the modern apples and for the traditional apples.

Prepare a suitable table to display the **raw data** and the **two** calculated **means**.

(3)

	Modern Apples			Traditional apples		
	Cox	Braeburn	Gala	Egremont Russet	Adams' Pearmain	Lord Lambourne
Sugar content (g) in 100g sample of apple	12.7	13.5	14.8	12.2	11.4	13.3
	11.9	13.2	15.7	12.4	12.1	13.2
	12.3	12.6	14.6	11.7	12.9	12.6
Mean sugar content (g)	13.48			12.42		

ResultsPlus

Examiner Comments

This table has included the means to two decimal places so only marking points 1 and 2 were given.

Question 2 (c)

The bar chart for the mean sugar content of modern and traditional apples was usually correctly plotted. If a mean had been incorrectly calculated in part b the mark was still awarded as an error carried forward. A significant number of candidates did not label the y axis **mean** sugar content/g. The range bars were sometimes omitted and some were incorrectly plotted.

(b) Calculate the mean sugar content for the modern apples and for the traditional apples.

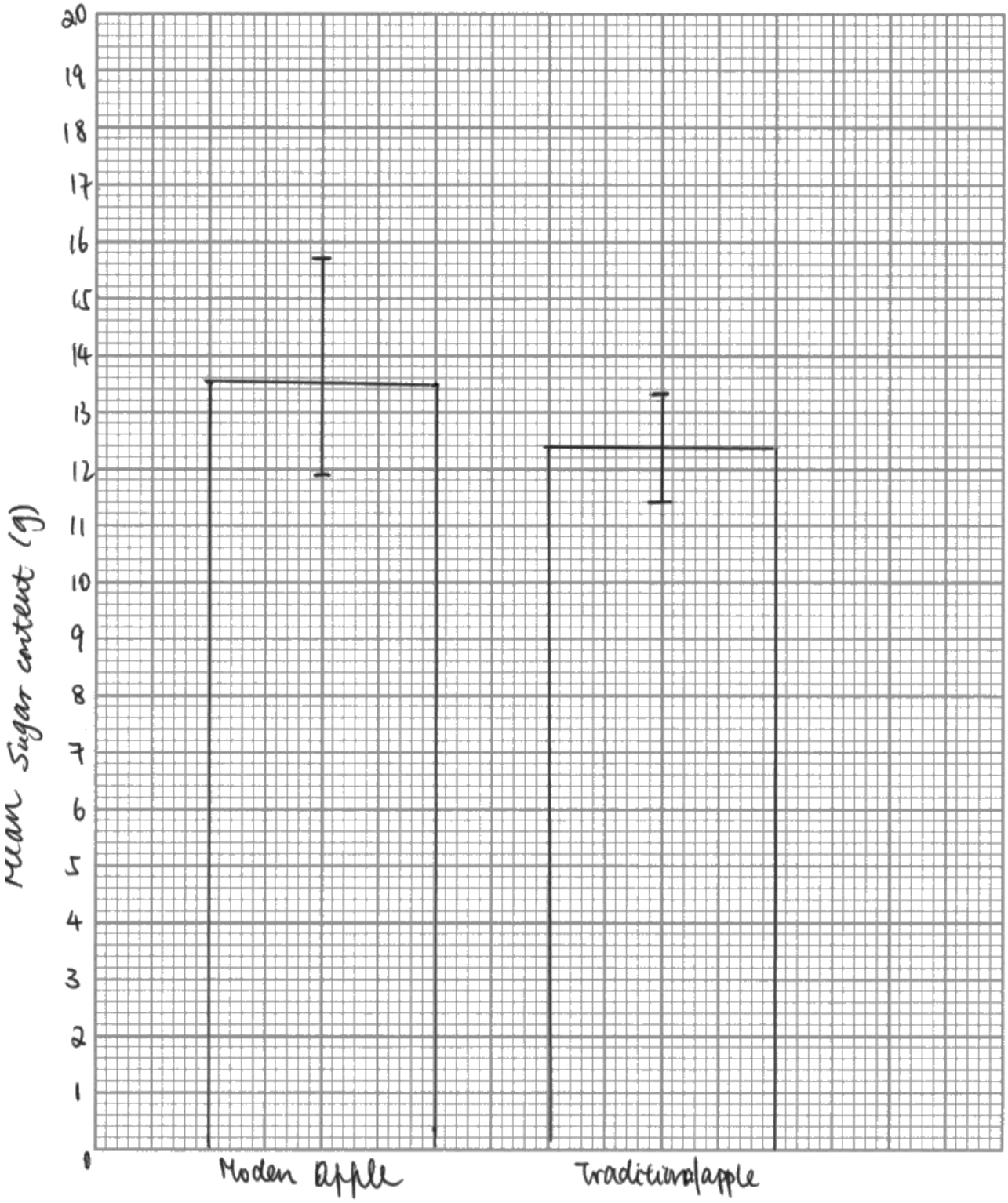
Prepare a suitable table to display the **raw data** and the **two** calculated **means**.

(3)

	Types of apple					
	Traditional apple			Modern Apple		
	Egremont Russet	Adams' Pearmain	Lord Lambourne	Cox	Braeburn	Gala
Sugar content (g)	12.2	11.4	12.6	12.7	13.5	14.6
	11.7	12.9	13.3	11.9	13.2	15.7
	12.4	12.1	13.2	12.3	12.6	14.8
Mean Sugar content (g)		12.4			13.5	

(c) On the graph paper below, draw a suitable graph to show the mean sugar content of modern apples and traditional apples. Include an indication of the variability of the data.

(3)



ResultsPlus
Examiner Comments

The candidate has sucessfully transferred the data onto a suitable scale and correctly plotted range bars. This gained all three marks.

ResultsPlus
Examiner Tip

Check that your chosen scale will allow the range bars to be plotted clearly on the graphical background.

Question 2 (d)

This question was usually well answered. The numerical values were nearly always quoted in their correct context leading to correct statements about the null hypothesis and the difference in sugar content between the two groups.

What conclusion can be drawn from this investigation?
Use your graph and the information in this table to explain your answer.

(4)

The calculated value which is 2.196 is greater than critical value at 16 degree of freedom as (9 + 9 - 2 = 16) at 95% confidence level, 2.120. So we reject the null hypothesis. Also the mean values in the graph is different from each other in addition to low variability of data so we conclude that there is significant difference between sugar contents of modern and traditional apples, with modern apple having higher mean as we can observe in the graph.

ResultsPlus
Examiner Comments

There were many responses of this standard that clearly answered the question and gained all four marks.

ResultsPlus
Examiner Tip

There were a small number of answers that claimed that 2.12 was a larger value than 2.196 which is not the case. Candidates should always aim to read through each answer to check for this type of mistake that could very easily be changed.

Question 2 (e)

Candidates usually suggested that the sample size was small and that only three examples of traditional and three examples of modern apples were tested. When range bars, error bars or standard deviation were discussed in answers they were identifying as overlapping which indicated that the difference was not significant. Factors concerned with growing or post harvest conditions were not frequently suggested and in some cases the answer was too vague to be given credit.

(e) Suggest why it may **not** be reasonable to draw valid conclusions from this investigation.

(3)

The data may not be valid as firstly some variables have not been described such as age of the apples, source of the apples etc and these variables can affect the sugar content hence validity can be questioned. Furthermore, a small sample of both modern and traditional apples have been used hence the results found cannot be generalized to all other apples.

ResultsPlus
Examiner Comments

This answer just gained three marks, marking points 1,2 and 4. The examiners accepted described as an alternative to be considered for the identification of the age variable. The sample size was clearly identified as small and not representative.

ResultsP
Examiner Tip

This is an example of a question where candidates need to take account of the mark allocation. In this case three marks. Many answers might have led to a third mark with a little more thought.

(e) Suggest why it may **not** be reasonable to draw valid conclusions from this investigation.

(3)

Very few ~~samples~~ apples were chosen hence sample is small. Conditions both types of modern and traditional apples grew in are different. ~~Hence~~ Other ~~factors~~ ~~were~~ variables affecting the sugar content weren't controlled.

ResultsPlus
Examiner Comments

This response only gained marking point 1. If the candidate had carried on to give a suitable example of a different growing condition they could have gained marking point 4.

Question 3 (a)

Some candidates suggested there were no safety or ethical considerations that related to this investigation. However the candidates that thought about this specific practical investigation suggested the risk of injury, infection and exposure to soda lime. The ethical considerations of participants needing to give consent and not being allowed to take part if they had health issues were suggested by a minority of candidates.

(a) A consideration of whether there are any safety or ethical issues you would need to take into account.

(2)

As far as safety effects are concerned we have to disinfect the mouth piece of the spirometer before using it. There are no significant ethical issues for this experiment.

ResultsPlus
Examiner Comments

This response gained one mark of an appropriate saftey issue. However the second statement is not an appropriate answer.

ResultsPlus
Examiner Tip

Candidates should always think about the context of the investigation to help suggest suitable answers. Some responses only stated that there were no safety or ethical issues with this investigation, which was clearly not the case.

(a) A consideration of whether there are any safety or ethical issues you would need to take into account.

(2)

Ethical issues – Permission and willingness of the volunteers/ participants must be taken into account.
There are no other major ethical issues.

Safety issues – The mouthpiece of the apparatus used must be completely cleansed to prevent contamination. It should either be properly sterilized after each use or new mouthpieces must be provided.

ResultsPlus
Examiner Comments

This is a good example of an answer that clearly described one safety and one ethical issue.

ResultsPlus
Examiner Tip

Candidates could gain two marks by describing two ethical or two safety issues.

Question 3 (b)

Most candidates suggested that the proposed method should be practised to see if it works. The other points on the mark scheme were rarely suggested. To simply determine a timescale without any reference to the context of this investigation did not gain credit. Candidates needed to qualify this statement by explaining that the timescale may show a measurable effect on vital capacity.

(b) Suggestions for preliminary practical work that you might undertake to ensure your proposed method would provide meaningful data.

(3)

Find out the intensity of yoga ~~etc~~ exercise that is suitable for the experiment. The spirometer used to ~~meas~~ measure the VC has also to be calibrated. To try out the experiment to see if it works.

ResultsPlus
Examiner Comments

This response gained marking points 2 and then 1.

(b) Suggestions for preliminary practical work that you might undertake to ensure your proposed method would provide meaningful data.

(3)

Practice the proposed method by preparing a mini trial experiment to see if it works or not. Determine suitable timescale for subjects to participate in yoga course and timescale for measuring the increase in vital capacity. Determine suitable age of athletes to be used in this investigation. Decide on suitable range of frequency of participation in yoga classes.

ResultsPlus
Examiner Comments

This response gained three marks, marking points 1, 3 and 4. Here the timescale was linked to finding a measurable effect on vital capacity.

ResultsPlus
Examiner Tip

Many candidates did not score three marks either because they did not take account of the mark allocation or because their statements were not clear enough.

Question 3 (c)

Candidates were asked to give a detailed description of a practical method to investigate the effect of exercise on vital capacity. All the points on the mark scheme were regularly given in the answers to this question. Some candidates did not include a group that did not do yoga. To gain two marks three different variables needed to be controlled. Many candidates only stated two variables.

There were often references to repetition, but if this was fully discussed two marks could be awarded. One mark was given for repeating the measurements for each person and a second mark for measuring several people from each frequency of yoga class.

Most answers were well organised without undue repetition.

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

(10)

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

In this investigation, the independent variable is the frequency of people taking yoga classes. The dependent variable is the changing vital capacity of these people after finishing their yoga sessions first of all, choose 5 volunteers who are approximately at the same weight. ~~and~~ Make sure their genders are the same. Also if possible, use people that have the same height. Spirometer will be used in this investigation. The most accurate thing to the is ~~that by spirometer~~ to choose people that has the same vital capacity at the beginning of the experiment. ~~&~~ Determine this

by using a spiroeter. Also by the same way, choose one more person apart from the 5 chosen people and use that person as a control. During a period of 2 months, let these 5 people to take yoga classes. at different frequencies; once a week, twice a week three days a week, four days a week and five days a week. ~~for Cont~~ The person chosen for control will not take yoga classes. At the end of 2 months, measure the vital capacities of these 5 people by using ~~a spiroeter.~~ the same spiroeter. Give them nose clip and let them put the mouthpiece with their ~~mouth~~ mouth. Calibrate the apparatus by marking ~~with the pen on the apparatus~~ the kymograph with the pen on the apparatus before giving the apparatus a constant volume of oxygen. Let them breath ~~several~~ as fully as they can and ~~se~~ record their vital capacity. Control temperature with a termometer regularly ~~at~~ and keep it at 25°C. Also control the humidity of the room by using a ~~kymograph~~ hygrometer. ~~Calculate~~ Substract the ~~fi~~ initial ~~capa~~ vital capacity of each person from their final vital capacity. Repeat the experiment to allow mean calculation.

ResultsPlus
Examiner Comments

This response gained ten marks. The marks awarded were marking points 1, 2, 3, 4, 5, 7, 9 and 10 and two marks for the clear account.

ResultsPlus
Examiner Tip

Examiners read extended answers carefully. After awarding marks for specific points from the mark scheme, they awarded up to two marks for well organised accounts. This means that some alterations may be expected and do not prevent two marks being awarded for the quality of the account.

Question 3 (d)

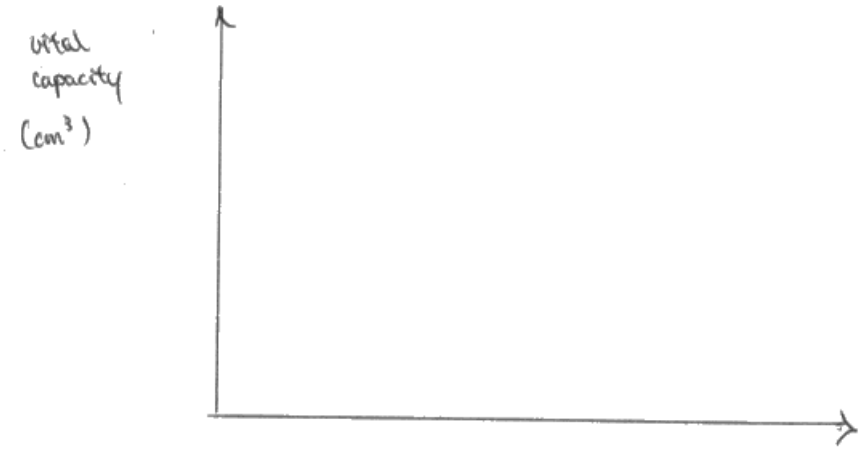
This question was usually well answered. Tables were presented with suitable headings. In some cases columns for initial and final vital capacity were not shown. Most sketch graphs were correctly presented and an appropriate named test was suggested.

(d) A clear explanation of how your data are to be recorded, presented and analysed in order to draw conclusions from your investigation. **(4)**

table

Frequency (hrs of yoga/week) ↓	Vital Capacity (cm^3) raw data					Mean	Standard deviation
0							
1							
2							

graph



The height of the spirometer trace is measured and the heights are ~~used~~ used to ~~calculate~~ calculate the vital capacity of the participants. A table (like the above one) is drawn and the mean and standard deviation is calculated.

Then a scattered graph is plotted (like the above). The trend of the data is observed and ~~the~~ a statistical test (e.g. Spearman's ~~rank~~ Correlation Rank Test) is performed to find out whether there is any statistically significant correlation between the number of yoga performed and the vital capacity

ResultsPlus
Examiner Comments

This response gained marking points 1, 3, 4 and 5. Many candidates were not awarded marking point 2 as they did not include columns for initial and final vital capacity or alternatively a column with final-intitial vital capacity.

ResultsPlus
Examiner Tip

This question is best answered by producing an example of a suitable table and a labelled sketch graph rather than attempting to answer only in writing.

Question 3 (e)

Candidates that considered the investigation they had just described suggested some ideas that were worthy of credit. A generic statement about it being difficult to control all the variables was not sufficient for a mark. This comment had to relate to variables that affect vital capacity. The suggestion that participants might differ in their effort in yoga classes or that they might not exhale fully were the most frequently given answers.

(e) The limitations of your proposed method.

(3)

The fitness and lung capacity of different athletes ~~are dif~~ will be different and hard to control and identify, which will affect the validity of the results. ~~the~~ The activity inside of ~~the~~ a yoga class may be the same but the physical exertion of each participants will vary, which is difficult to control and may affect the results.

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Examiner Comments

This response only gained marking point 2.

(e) The limitations of your proposed method.

(3)

The fitness and lung capacity of different athletes ~~are dif~~ will be different and hard to control and identify, which will affect the validity of the results. ~~the~~ The activity inside of ~~the~~ a yoga class may be the same but the physical exertion of each participants will vary, which is difficult to control and may affect the results.

ResultsPlus
Examiner Comments

This response clearly makes the point about differences in the effort made by participants.

ResultsPlus
Examiner Tip

Aim to discuss specific variables and limitations

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- Make sure you understand the difference between monitoring a variable and actively controlling it.
- It will be easier for you to discuss variables you have controlled or manipulated before.
- Remember to fully label both axes of a graph. The x axis sometimes has no label or a label without any units.
- Read the question carefully and look for information that will help you answer the question.
- When you do a Core Practical think about the limitations of the methods being used. These limitations are likely to be relevant when similar methods are used in an investigation.

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