L3 Lead Examiner Report 1806

BTEC

June 2018

Level 3 National in Applied Science
Unit 3: Science Investigation Skills (31619H)

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Grade Boundaries

What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark is for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:
http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

Unit 3: Science Investigation Skills

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	9	18	30	43

Introduction to the Overall Performance of the Unit

Section 1 Biology

This was the third time this paper was sat. Learners seemed slightly better prepared and tended to gain 2-3 marks for their results tables. Some learners did not transpose their results into the paper and so this had a negative effect on the graph question as the plot points could not be confirmed as accurate. The majority had produced a good set of results from their investigation.

Learners who did well were able to describe the relationship between the variable, consider controls for the investigation and suggest further developments. Learners showed a good understanding to the theory of enzyme activity. They were able to carry out calculations methodically, showing their working. Learners who did less well, did not always interact with questions sufficiently and therefore did not answer the questions posed appropriately.

Section 2 Physics

Section 2 of this paper consists of two questions which are taken from a different scientific discipline to the questions in section 1. In this paper, section 2 is based on the physics that is indicated in section H of the essential content . The questions are designed to test two parts of the specified content for the examination these being section A 'Planning a scientific Investigation' and section C 'Drawing conclusions and evaluating'.

Question 4 tests the ability of the learner to plan a scientific investigation. This includes the development of a hypothesis, the selection and justification of equipment, techniques and standard procedures, health and safety and methods of data collection including, quantities to be measured, number and range of measurements to be taken, how the equipment is to be used, control variables and a brief method for data collection analysis.

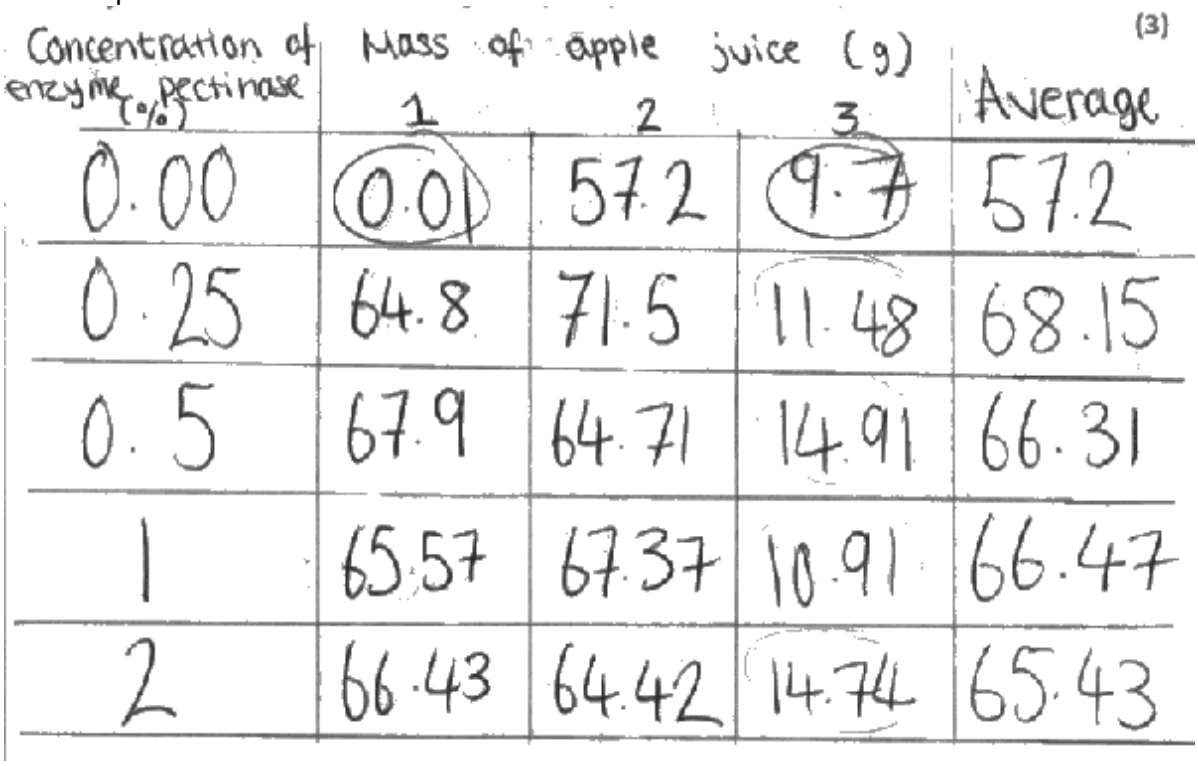
Question 5 gives a description of the method, results and conclusion of an investigation and tests the ability of learners to use this information to make recommendations to improve the method, determine possible sources of error, consider the reliability or otherwise of data and evaluate the conclusions given with respect to the results given for the investigation.

Individual Questions – Biology

Question 1a

Most learners produced suitable tables. The quality of consistent recording was very good, most gave the figures in each column to the same degree of precision, but learners should be more careful to include hanging/ trailing zeros in future to ensure the degree of precision is clear. The presence of trials and a mean were also very good.

This response scored 3 marks



Concentration of enzyme pectinase (%)	Mass of apple juice (g) 1	2	3	Average
0.00	0.0	57.2	9.7	57.2
0.25	64.8	71.5	11.48	68.15
0.5	67.9	64.71	14.91	66.31
1	65.57	67.37	10.91	66.47
2	66.43	64.42	14.74	65.43

(3)

The area where most marks were lost was for the inadequate labelling of the columns. Units were often missed off and the concentration of pectinase was often labelled as 'concentration %' and the mass of juice was absent or mis-labelled.

Learners were not penalised for giving the units within the body of the table providing the unit was also in the heading or if they used an unconventional layout, but learner should attempt to use the most appropriate layout for scientific investigations for good practice.

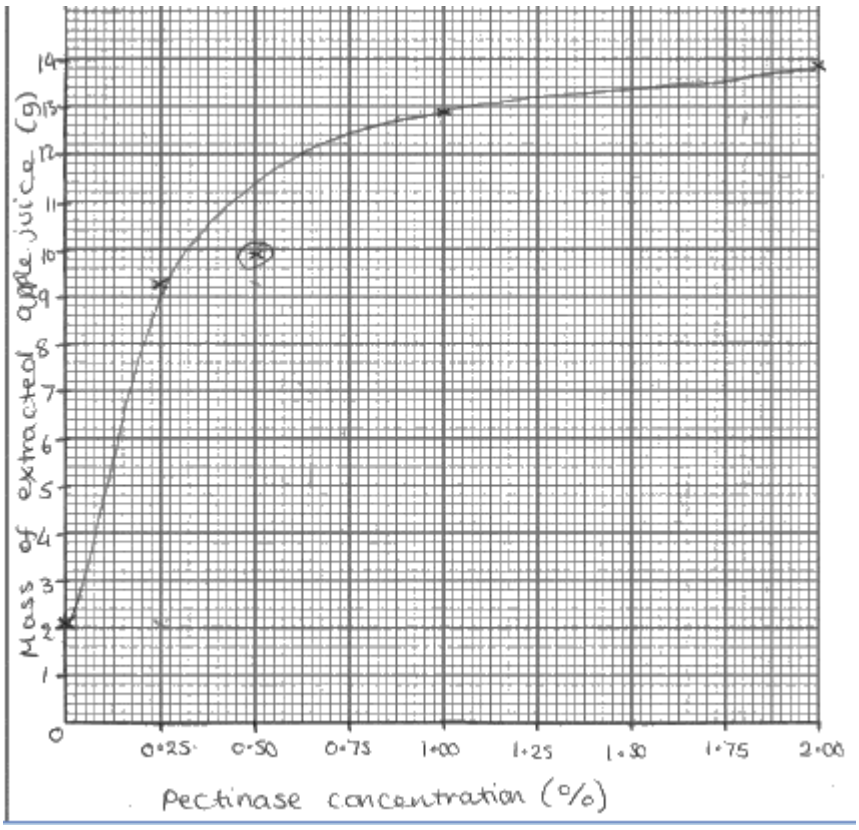
This response scored 1 mark for consistency of decimal places.

Concentration (%)	Mass of apple juice			
	Experiment 1	Experiment 2	Experiment 3	Experiment 4
0	1.97	2.34	5.52	3.28
0.25	3.77	3.12	5.98	4.29
0.5	4.79	2.69	5.27	4.25
1	4.76	3.46	6.37	4.86
2	5.97	5.84	6.53	6.11

Question 1b

Some learners were able to gain all 3 marks from the graph with appropriate labels and scales on both axis and correctly plotted points with an appropriate line.

This response scored 3 marks.

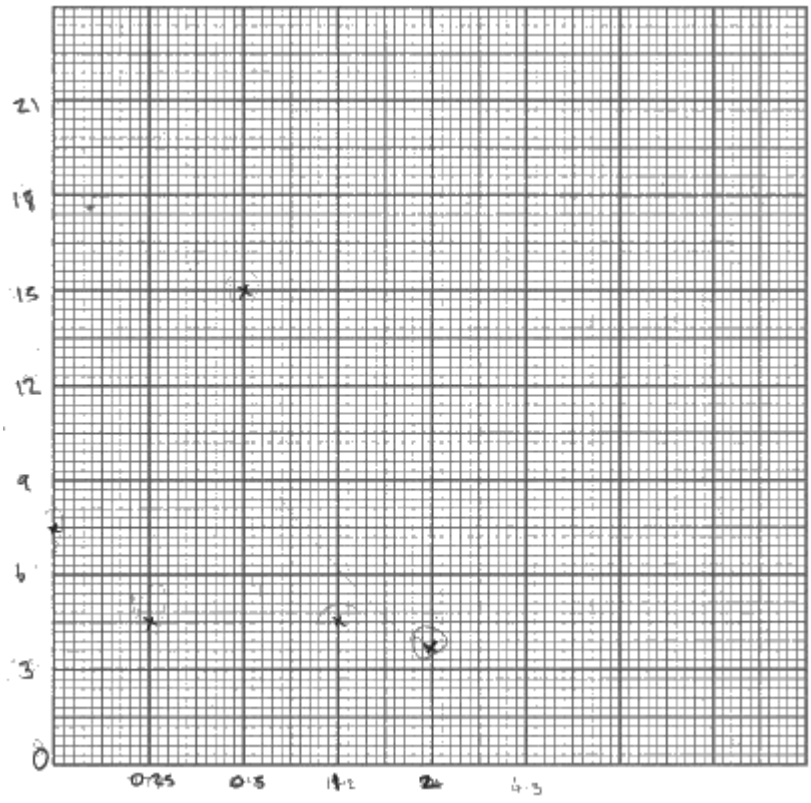


However, most learners scored 2 marks for the graph of their results.

Most learners lost marks on suitable scales, especially on the x-axis as they tended to give 1 large square for each concentration and so the scale was not linear on the jump from 1% to 2%. A significant number produced graphs which were less than half the area of the graph paper in at least 1 direction. This has been a consistent requirement for the graph throughout the previous series.

Difficult y axis scales were chosen by some learners, for example each square of 10 was allocated 3g of apple juice, this made both reading and plotting difficult. Very few got the axes the wrong way around.

This response scored 0 marks.



Although a small number of candidates had unclear/multiple/wavy lines so lost the mark, and even clear lines were not generally well matched to the plots, candidates often drawing straight lines rather than joining the plot points dot to dot or spotting the plateau and drawing in an appropriate curve. Learners may not be aware that a straight line of best fit is often not the best way to deal with biological data.

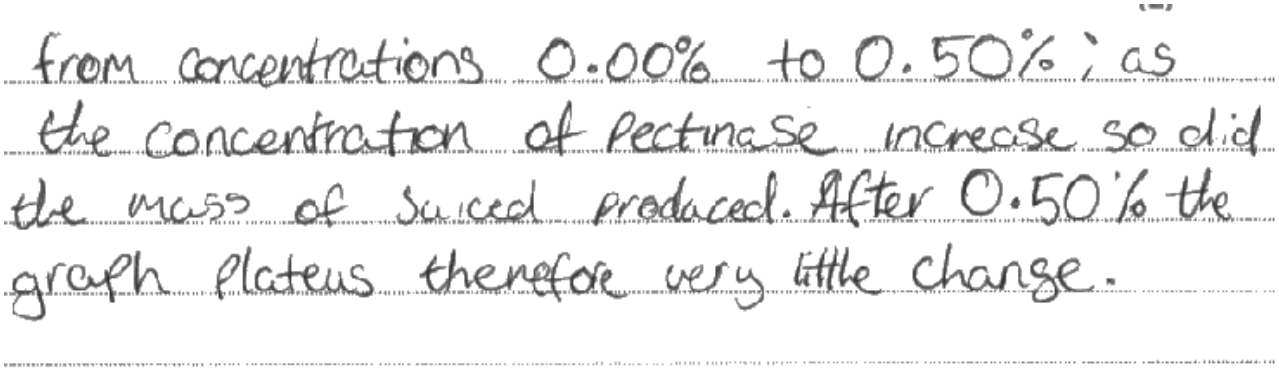
Question 1ci

Most learners were able to state the correct relationship and use the term 'positive correlation' in context. Many were able to support their description with quoted data from their graphs.

Comments on proportionality were quite common as were mentions of positive correlations or the use of data quotes. Use of supporting data was common.

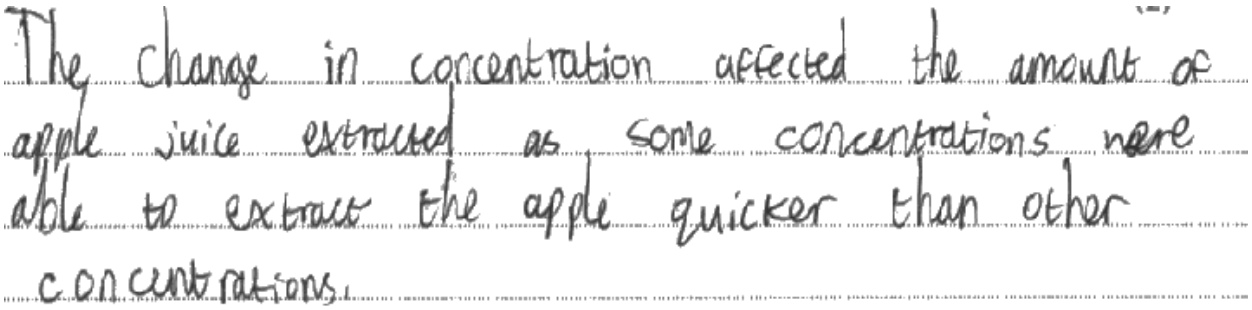
Well answered most learners were able to describe the basic relationship and included data to help the description some learners tended to say it was more at 2% than 1% and they needed to state numbers/data from the graph.

This response scored 2 marks.



However, some learners did not respond appropriately to this question as they were distracted by the qualitative data and observations that they had also recorded and so referred to the speed of the filtrate or the colour of the apple juice.

This response scored 0 marks.



In this example, the learner has stated that the higher concentrations were able to extract the apple juice quicker. This was not the focus of the practical as the mass of the apple juice after 5 minutes of filtering was the dependant variable, not the speed. As this description is not consistent with the graph or the stem of the question no marks can be awarded.

Question 1cii

Most learners gained the mark available for this question.

The investigated concentration of the pectinase solution where the highest mass of apple juice was extracted was the usual response and credited. However, some learners showed their methodology by drawing on this graph a dotted line to indicate that that had used their graph line and read off the percentage of pectinase as the optimum.

This response scores 1 Mark

(ii) Identify, using information from your graph, the optimum concentration of pectinase for extracting apple juice.

(1)

1.14 %

The learner has read a value from their line and so is not one of the investigated concentrations. This is expected when the graph plateaus.

However, some learners were unable to record their highest concentration from their graph, often quoting incorrect values and giving the concentration that gave the lowest amount of apple juice produced.

This example scores 0 marks as the learner had given their lowest data point.

(ii) Identify, using information from your graph, the optimum concentration of pectinase for extracting apple juice.

(1)

0 %

Question 1ciii

Most learners gained this mark by writing 'highest mass of juice'.

This response scored 1 mark.

Because 2% concentration gives the highest mass of apple juice produced.

Some learners did not understand the term optimum and so did not give an appropriate response.

This response scores 0 mark.

because this way the apple juice wouldn't extracted not to fast and not to slow.

Question 1d

Most learners gained this mark. Most commonly by including "to mix" in their response.

This response scored 1 mark.

It is important because the pectinase has to be evened out in the puree, so some parts do not contain more pectinase than other parts.

Question 1e

Some learners were able to refer to calibrating the balance, recording to 2 decimal places, filtering for a set time and cleaning the equipment. The idea of repeats was not credited in this question as repeats would give a more accurate mean but not ensure accuracy in the actual measurement of the juice.

This response scored 2 marks.

The investigation was repeated 3 times to acheive accuracy. Also all equipment was kept the same and thoroughly cleaned after each use. Also they were kept in the water bath and filter for the exact amount of time every time the investigation was repeated.

The majority of learners thought that weighing and reweighing their conical flask was a mark of accuracy. Few, if any, references to using a flat surface for the balance were seen.

This response scored marks.

Weighed the container i going to put it in on a top hand balance then pour my extracted apple into the container take the readings of both and subtract the mass of container from the mass of container and juice.

Question 1fi

Most learners knew that at low temperatures enzyme activity would be reduced and some responses contained clear descriptions of collision theory.

This response scored 2 marks.

A temperature below the optimum would decrease the rate of ~~reaction~~ pecrease activity, because there would be fewer collisions ~~the~~ as particles have less energy so are not as active and ~~at~~ fewer particles with enough activation energy

However, a high proportion of responses stated that the enzyme would be denatured, or that the reaction would stop at the low temperatures which is incorrect.

Not enough energy was a common response, but few linked it to collisions correctly.

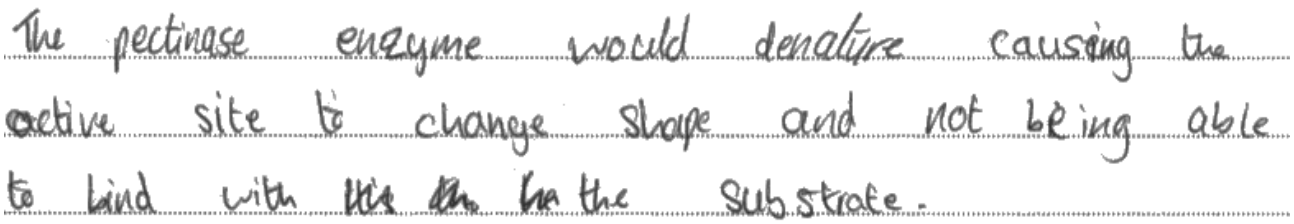
This response scored 0 marks as the learner has incorrectly stated that the enzyme production is effected not the rate of activity.

Because the enzyme production would slow down and eventually stop as the enzymes would denature.

Question 1fii

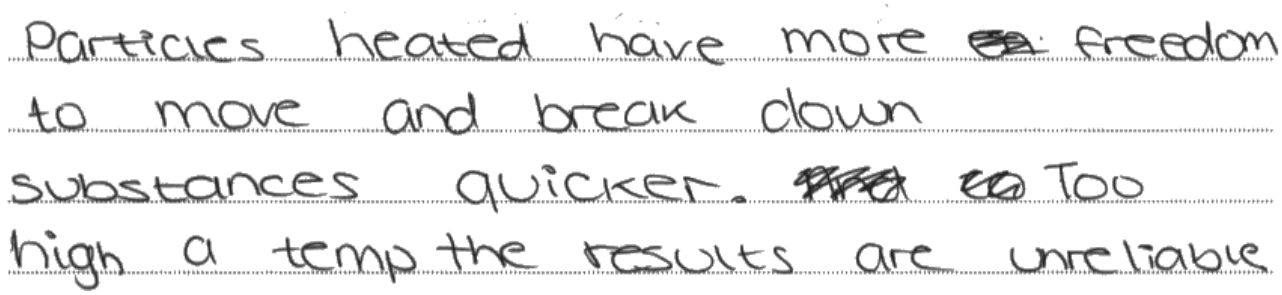
The concept of denaturation was well understood. References to breaking bonds, altering the active site and reduced enzyme-substrate complexes were seen.

This response scored 2marks.



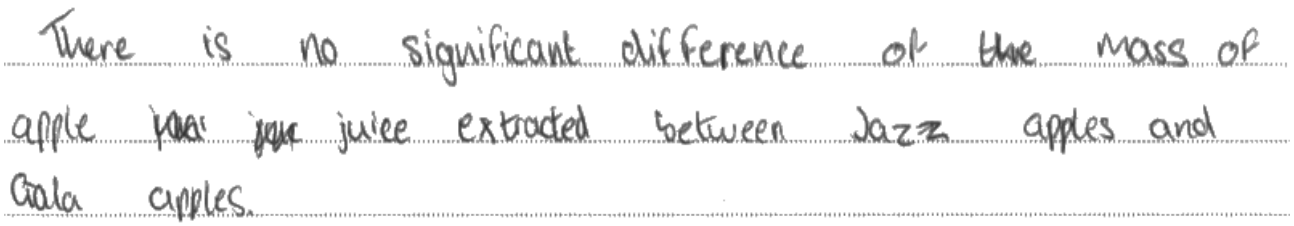
Some learners did not give sufficient detail and responses about changing shape were too vague as the learners needed to be specific and say that the active site changes shape not the whole enzyme.
Some learners stated that the increased temperature would increase the kinetic energy and therefore increase the rate of reaction, which is not the case for enzymes.

This response scored 0 marks.



Question 2ai
Very few learners scored maximum marks for this question.

This response scored marks.

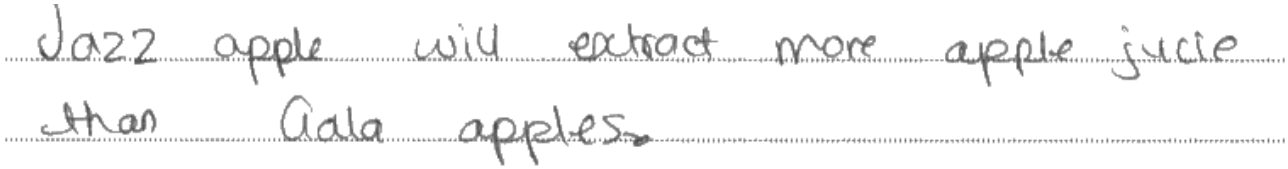


The common error was to leave out 'significant' from the null hypothesis. There was hardly any reference to chance in the observed answers.

Many learners did not know what a null hypothesis was and how it differs from an

experimental hypothesis (a prediction). Many stated what the effect of concentration or mass/size of apples would be on the juice extracted.

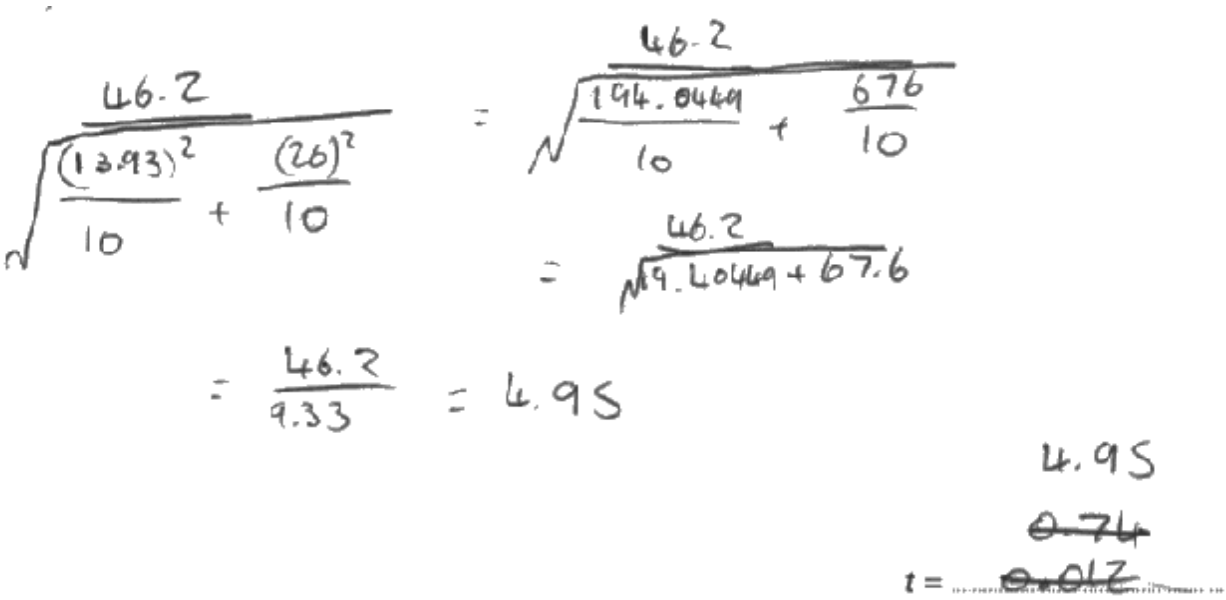
This response scored marks.



Question 2aii

A high number of learners scored all 6 marks for their t-test value calculation.

This response scored 6 marks.



Marks were allocated for the processes carried out and so error carried forward marks from incorrect substitutions or calculations could be awarded, if the learner showed their working out.

This response scored 4 marks. The learner has correctly calculated the difference in the mean and so is awarded with 2 marks. The learner has incorrectly calculated the standard error as they have not squared either standard deviation correctly and have not divided the standard deviation values by 10. However, as the learner has then used their calculated value and calculated the square root they can be awarded a mark for this part of the process as an error carried forward. They have

then divided their difference in the means by that figure for a further mark.

$$160 - 113.8 = 46.2$$

$$\sqrt{\left(\frac{s_1}{n_1}\right)^2 + \left(\frac{s_2}{n_2}\right)^2} = \sqrt{\left(\frac{13.93}{4.41}\right)^2 + \left(\frac{26.00}{8.22}\right)^2} = 4.47$$

$$\frac{13.93}{\sqrt{10}} = 4.41 \quad \frac{26.00}{\sqrt{10}} = 8.22$$

$$\frac{46.2}{4.47} = 10.34$$

Some learners were not familiar with the mathematical short hand used in statistical analysis equations or did not use the cues from the data table given to substitute the correct values.

Common errors were not squaring the standard deviations, not square rooting the sum of the standard errors, confusing '$\bar{x}$' and 's' values and using the wrong value for 'n'. A common misconception was 'n' being 1 less than the sample number so instead of 10 learners used 9.

This response scores 5 marks. The learner has completed each part of the equation correctly but has not square rooted the standard error sum and so does not gain that mark but does gain the other 5 marks.

$$t = \frac{113.8 - 160.0}{\frac{13.93^2}{10} + \frac{26.00^2}{10}}$$

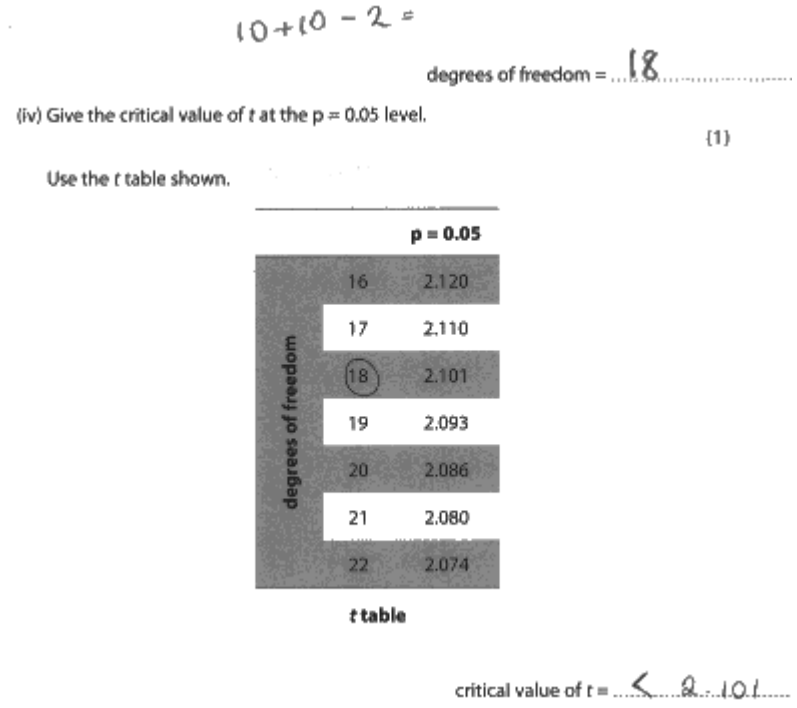
$$t = \frac{46.2}{19.4 + 67.6} = \frac{46.2}{87}$$

$$t = 0.53$$

Question 2aiii and 2aiv

These questions were generally well answered. Most candidates who got '18' in 2aiii were then able to get 2.101 in 2aiv.

This response scores 2 marks.


10+10 − 2 =

degrees of freedom = 18

(iv) Give the critical value of t at the p = 0.05 level.

(1)

Use the t table shown.

degrees of freedom	p = 0.05
16	2.120
17	2.110
18	2.101
19	2.093
20	2.086
21	2.080
22	2.074

t table

critical value of t = < 2.101

Some candidates added the wrong values initially (usually the means instead of the sample size) but did subtract 2 and so were awarded an error carried forward mark for the correct process.

Some learners were credited with an error carried forward mark when they used their incorrect value from 2aiii to select a response for 2aiv.

Question 2v

This was poorly answered as many learners didn't understand the t test, null hypothesis and what to do with the critical values and t value.

The stronger students were able to give coherent reasons for correctly rejecting the null hypothesis.

This response scored 3 marks.

The null hypothesis should be rejected as the value of 't' for the investigation was 4.95 and the critical value of 't' at the p level 0.05 with 18 degrees of freedom was 2.101. 4.95 > 2.101 and so therefore there IS a significant difference between the average mass of juices extracted from the two types of apples and the null hypothesis must be rejected

(Total for Question 2 = 14 marks)

Some learners had incorrectly used a negative value for the t-test value or omitted significant from significant difference.

Most that did stay there was a significant difference did not make it clear whether they were referring to the numerical values of the mass of juice from the apples or between the t-test and critical value.

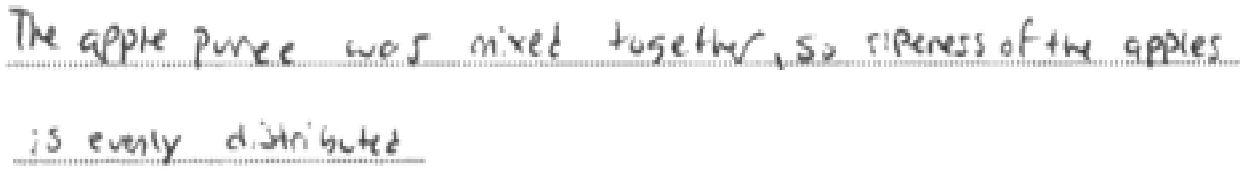
This response scored 1 mark.

The null hypothesis should be rejected because there is a difference between the results.

Question 3ai

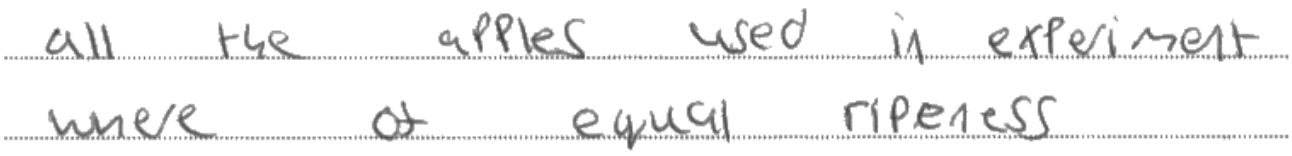
Most learners scored the first marking point about the apple being puree but failed to understand that it meant the ripeness was spread throughout the puree.

This response scored 2 marks.



A lot of learners simply said that ripeness didn't affect the results at all, or that all the apples were the same ripeness/age/type.

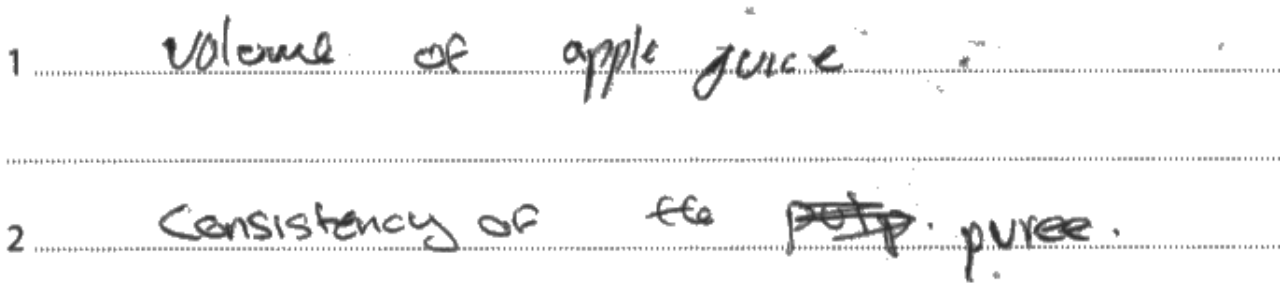
This response scored marks.



Question 3aii

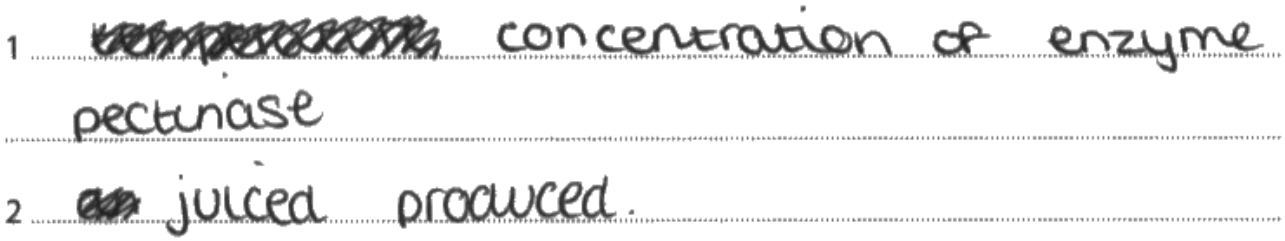
Most learners gained 1 for reference to the age of pectinase or the consistency/ size of lumps in the puree.

This response scored 1 mark.



Very few learners gained 2 marks. The most common incorrect answers were about human error such as getting all the puree out of the flask, comments about filter paper but not with respect to absorbency and lots of references to issues with equipment such as conical flasks or water bath availability. Some learners gave the independent and the dependent variable as things that they could not control, showing that they did not understand the term control in a scientific context.

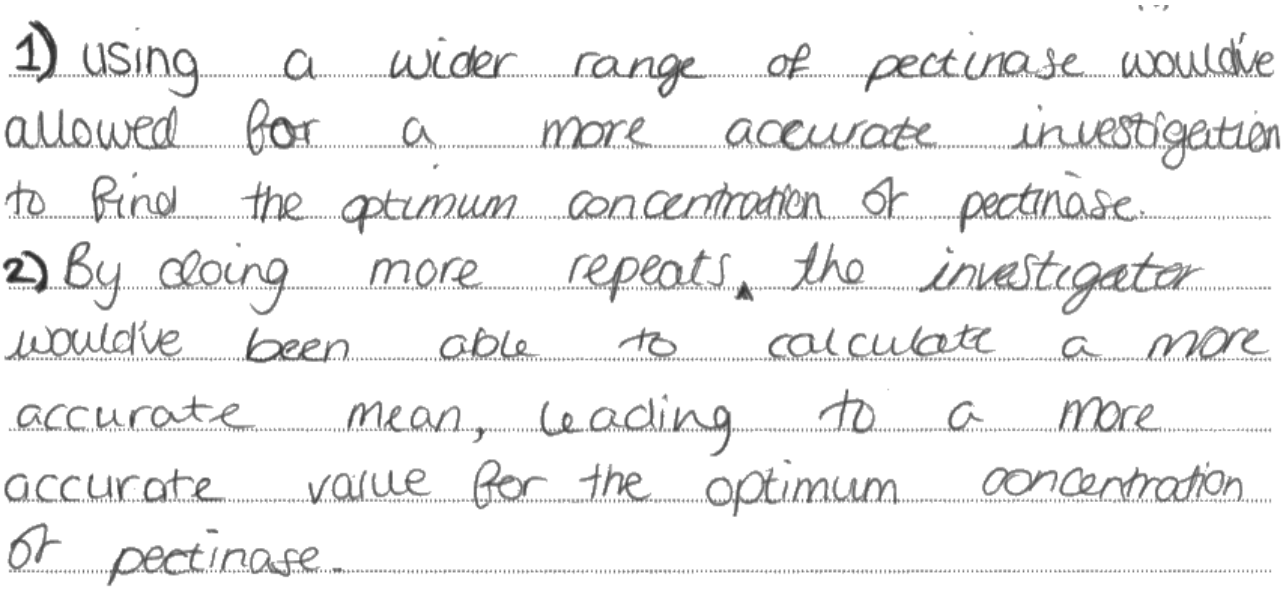
This response scored 0 marks.



Question 3b

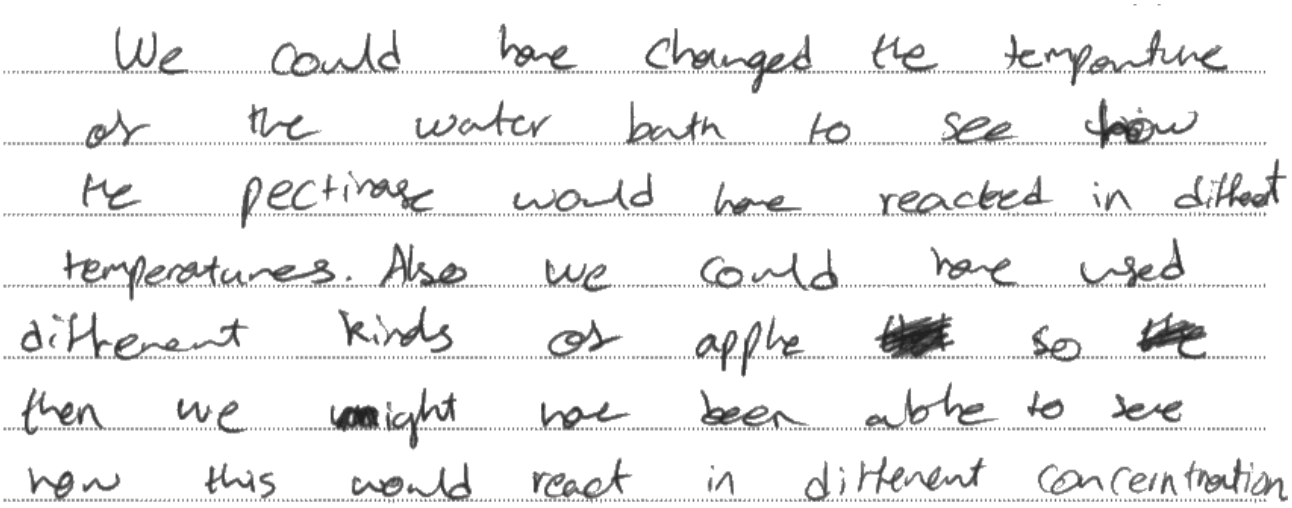
A lot of learners were able to refer to taking repeats to increase accuracy. Some learners suggested using a wider range of concentrations or smaller increments around the optimum, which needed to be consistent with their results and so both ideas could not be accepted in the same response.

This response scored 3 marks.



Some learners failed to link the correct parts together so there were many standalone comments without the explanation.
Some learners just described ways to extend the investigation, without acknowledging the second part of the question and so their suggestion would not allow for a more accurate value of the optimum concentration of pectinase.

This response scored 0 marks.


We could have changed the temperature of the water bath to see how the pectinase would have reacted in diffent temperatures. Also we could have used different kinds of apple so then we might have been abbe to see how this would react in different concentration

Individual Questions – Section 2

Question 4

This is a level based question using four levels of attainment. The attainment is indicated by a mark out of twelve. For each level there is a range of three marks and once the level is decided looking at the work as a whole, the quality of work presented within that level is assessed. The four levels of attainment are described by the generic mark scheme.

The investigation is titled 'Variation in resistance with light brightness'. The learners are given the information that the brightness of the lamp can be altered by changing the power supplied to it and the resistor to be used is a light dependent resistor (LDR), which has a resistance which changes with the brightness of the light falling on it. The lamp and LDR are also shown in their respective circuits and learners are told that their plan can include any standard laboratory apparatus, electrical components or electrical meters.

Learners need to read the whole question before attempting to write the hypothesis or produce a plan. The change in power to the lamp to change the brightness is the independent variable and the resistance of the LDR is the dependent variable so a plan which relates the power supplied to the lamp to the resistance of the LDR should be produced.

Learners are not expected to have prior knowledge of the investigation given in the question but should be sufficiently familiar with the setting up of electrical circuits to be able draw a circuit diagram or describe how a circuit could be set up. Learners should be encouraged to draw circuit diagrams showing a voltmeter in parallel, to measure the potential difference across a component and an ammeter in series, to measure the current in a circuit as this indicates a good understanding of the basic measurements to be made using electrical circuits. However, the use of a variable power supply to change potential difference across the lamp and an ohmmeter (multi-meter) to measure the resistance of the LDR would be sufficient in this case.

The following are examples or responses which exemplify work at each of the four levels which can be awarded.

Level 1.

This response shows a good attempt at producing a hypothesis. As only resistance appears on the specification learners are not expected to know how resistance varies with light intensity for an LDR they are only expected to be able to put forward a hypothesis based on the information in the question. The learner has done this by linking power to resistance but has not considered the device for which the power is to be measured or the device from which the resistance is to be taken. There is a list of equipment with an attempt at justifying how this is to be used and an attempt at giving a method but it appears that it is intended that only

one circuit is used.

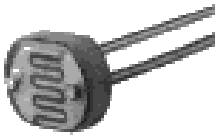
SECTION 2

4 Variation in resistance with light brightness

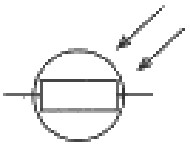
The brightness of a lamp can be altered by changing the power supplied to it.

The resistance of a light-dependent resistor (LDR) changes with the brightness of the light falling on the LDR.

The images show an LDR and the circuit symbol used to represent it.

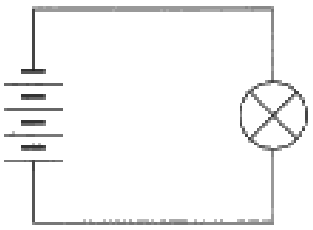


LDR

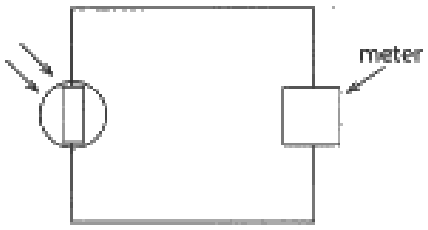


Circuit symbol for the LDR

You have been asked to write a plan for an investigation to find out how the power supplied to the lamp in circuit A is related to the resistance of the LDR in circuit B.



A



B

Changing the brightness of light produced by the lamp in circuit A can change the resistance of the LDR in circuit B.

Your plan should include the following details:

- a hypothesis
- selection and justification of equipment, techniques or standard procedures
- health and safety associated with the investigation
- methods for data collection and analysis to test the hypothesis:
  - quantities to be measured
  - the number and range of measurements to be taken
  - how equipment may be used
  - control variables
  - brief method for data collection analysis.

You may include in your plan the use of any standard laboratory apparatus, electrical components or electrical meters.

(12)

The hypothesis for this experiment is "As The more power that is applied to the circuit, the ~~tighter~~ higher the ~~brightness~~ resistance will be."

Equipment

- LDR bulb
- Resistor
- Wires
- Batteries
- Ammeter

The list of equipment above makes up the circuit that is needed to carry out this investigation, the standard procedure includes setting up the circuit without the ammeter switched on and slowly turning the ammeter knup while recording the resistance down each time the ammeter is turned up 1. Health and safety includes switching off the ammeter when it is not in use This is to reduce the flow in the circuit and stop the circuit working. Another is ~~reducin~~ not touching the hot bulb / LDR, this is to reduce burns to the hands.

Level 2. This response gives a hypothesis in terms of the brighter of the light higher the resistance (assuming this to be the resistance of the LDR). Some equipment has been given, the selection of the battery pack has been justified but the learner believes the LDR is to measure resistance although later adds a meter is used. Also, the two circuits appear to be linked so that one circuit can be created. To achieve level 2 there needs to be a method, the experiment does not have to work in practice but there must be an indication that measurements can be made and that some quantity can be changed to bring about change in a second quantity. Here the brightness is changed (but there is no way of quantifying this) and no indication of how the resistance is to be measured but there are two variables linked with some scientific reasoning

SECTION 2

4 Variation in resistance with light brightness

The brightness of a lamp can be altered by changing the power supplied to it.

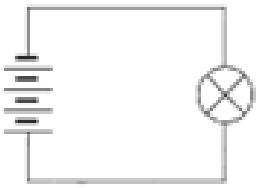
The resistance of a light-dependent resistor (LDR) changes with the brightness of the light falling on the LDR.

The images show an LDR and the circuit symbol used to represent it.

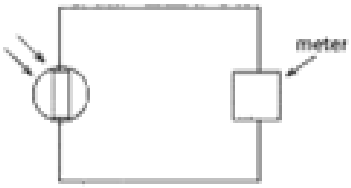
LDR

Circuit symbol for the LDR

You have been asked to write a plan for an investigation to find out how the power supplied to the lamp in circuit A is related to the resistance of the LDR in circuit B.



A



B

Changing the brightness of light produced by the lamp in circuit A can change the resistance of the LDR in circuit B.

Your plan should include the following details:

- a hypothesis
- selection and justification of equipment, techniques or standard procedures
- health and safety associated with the investigation
- methods for data collection and analysis to test the hypothesis:
  - quantities to be measured
  - the number and range of measurements to be taken
  - how equipment may be used
  - control variables
  - brief method for data collection analysis.

You may include in your plan the use of any standard laboratory apparatus, electrical components or electrical meters.

(12)

The hypothesis for this experiment is:

The brighter the light the higher the resistance reading

For this experiment you will need a battery pack this is to provide power and electrical energy into the circuit. Secondly you will need a lamp this is to show how bright the light can go. Next an LDR is needed to measure the resistance in the circuit. Next a meter is needed to power the circuit, on the meter will show the resistor reading and to link up to the other circuit A. Lastly electrical wires will be needed to create the circuit.

In order to keep safe during this experiment it is vital that health and safety is followed. A hazard of this experiment is the lamp. The lamp can cause risk as it gets hot and can burn. To prevent this from happening make sure the equipment is in the centre of the table and no one reaches over the lamp. Secondly as it is an electrical circuit there is a risk that electrocution can occur. To prevent this from happening only touch the circuit when the electric is switched off.

In this experiment carry out 3 different measurements, the first one should be a low brightness the resistance should be measured, secondly turn up the brightness to the middle and measure the resistance again

Lastly put the brightness on full and measure the resistance.

The control variable for this experiment is to keep the circuit the same and in the same position. keep the same battery pack.

Level 3.

This example gives a correct hypothesis, equipment is justified and health and safety is considered although there is very little risk in doing this experiment. The method gives results although the learner does not actually identify the meter used to measure resistance and changes the brightness of the light reaching the LDR by covering it with increasing numbers of pieces of paper. The brightness of the lamp is changed and resistance of the LDR measured. There is a range given and repeats, there are quantitative results which can be plotted on a graph although one variable is discrete and the other continuous. The experiment does not relate the power of the lamp to resistance of the LDR but does relate brightness to resistance and gives a logical plan which will provide reliable results.

SECTION 2

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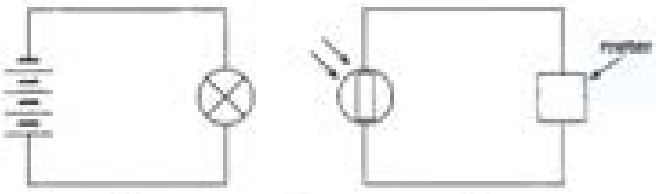

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Your plan should include the following details:

- ✓ a hypothesis
- ✓ selection and justification of equipment, techniques or standard procedures
- ✓ health and safety associated with the investigation
- ✓ methods for data collection and analysis to test the hypothesis:
  - ✓ quantities to be measured
  - ✓ the number and range of measurements to be taken
  - ✓ how equipment may be used
  - ✓ control variables
  - ✓ brief method for data collection analysis.

You may include in your plan the use of any standard laboratory apparatus, electrical components or electrical meters.

My hypothesis would be as the light (12) decreases dimer the light-dependant resistor will increase

Equipment needed are: the light-dependant resistor and a LDR meter to measure the resistance of light, a bulb to see changes to the brightness, wires and Crocodile clips to construct the circuit, a power source to Produce energy and Small cut up Squares of paper to place one on top of the resistor each time.

Health and Safety

A risk of Small electrical shock from the Circuit. To prevent it is to use a low voltage in the power source and if the bulb or the power source get too hot the close the Power Source and wait for it to cool down. Another risk would be that if the bulb breaks Surface of the tiny glass might cut the surface of the Skin. To Prevent it from happening handle the equipments with Care.

Method

- First wear a lab coat then, set up the equipment (Shown on the left side of the page). Then cut out 10 pieces of small square paper. Next, draw a table to place your results. Then turn on the Power Source and write down the first result from the LDR meter. Then place one paper on top of the LDR and write the results

and repeat this step till add 10 square paper covere ~~is covered~~ the LDR. Also state the brightness of the lamp bulb as the resistance decrea

Then this experiment is repeated ~~$~~ three or four times to calulate the mean value.

To contol this experiment is to use the same power source otherwise it could give out an different voltage. The same voltage each time to increase it accuracy. The same cut out square papers so that it does not affect the ~~resis~~ resistance.

To collect the data. ~~On~~ On the left ~~right~~ side of the table is the number of square ~~sm~~ paper. and on the right side is the resistance ~~ristance~~ with the unit of ohm (Ω) and repeats of three times and the advrage. ~~So~~

Number of square paper	Resistance (Ω)			Advrage.
	1	2	3	
0				
1				
2				
3				
4				
5				
6				
7				

Level4

This example shows a hypothesis which links voltage to brightness and relates this to resistance inceasing rather than decreasing but this is a possible hypothesis The eqipment is justified, an ohmmeter is uses to measure resistance and a powerpack to change the voltage across the lamp. The method is in sequence has range and repeats, controls such as distance apart of lamp and LDR are given and there is a method of collecting data. The plan will produce a relaible set of results and will show the relationship between voltagedrop acoss the lamp and the resistance of the LDR. The question asks for the power of the lamp and a voltmeter and ammeter would need to be added to the circuit to provide this information but this response fulfills the requirements of the generic statements at level 4 for this question.

SECTION 2

4 Variation in resistance with light brightness

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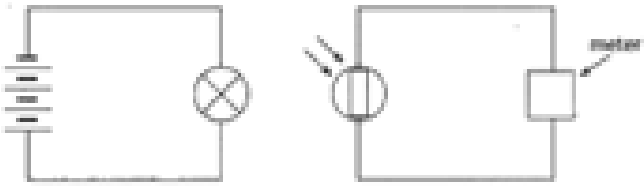

Changing the brightness of light produced by the lamp in circuit A can change the resistance of the LDR in circuit B.

Your plan should include the following details:

- a hypothesis
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  - control variables
  - brief method for data collection analysis.

You may include in your plan the use of any standard laboratory apparatus, electrical components or electrical meters.

(12)

Hypothesis: the higher the ~~power~~ voltage supplied to the lamp, the brighter the lamp; therefore, the higher the resistance of the LDR.

Equipment:

Lamp

LDR

Wires – to connect components in each circuit

Power pack – to provide and change power supplied to the lamp

Ohm meter – to measure resistance of the LDR

Ruler – to make sure the lamp and LDR stay the same distance away.

Risk assessment:

- As the lamp can get hot don't touch it will in use and turn it off between readings to prevent it heating too much
- Do not use any damaged wires as you may get electric caused
- Work next to an emergency off switch so if it becomes dangerous you don't have to touch the equipment
- Make sure someone is in the room with you in case you become incapacitated.
- The light bulb is made of glass so handle with care to prevent smashing.
- If the light bulb does smash, sweep it up carefully and dispose it in the correct way

method:

- Collect equipment
- Set up Circuit A and B
- use the ruler to keep the lamp and LDR the same distance apart.
- Starting with 0v take a reading of the resistance of the LDR 6 times, increasing the voltage on the power pack by 5v each time. Make sure to turn the power pack off after each reading and then back on before the next.
- Repeat this 2 more times and make an average for each voltage.

record the results in this table

Voltage /v	resistance /Ω			
	1	2	3	Avg
0				
5				
10				
15				
20				
25				

Once the results have been collected plot the average resistance on the x-axis and voltage on the y-axis of a graph. the shape will tell you the relationship

Control Variables :

- temperature of the circuit (by turning it off several readings)
- distance between the lamp and LDR
- Dampness of circuits
- ~~Resistance of the wires~~

Question 5

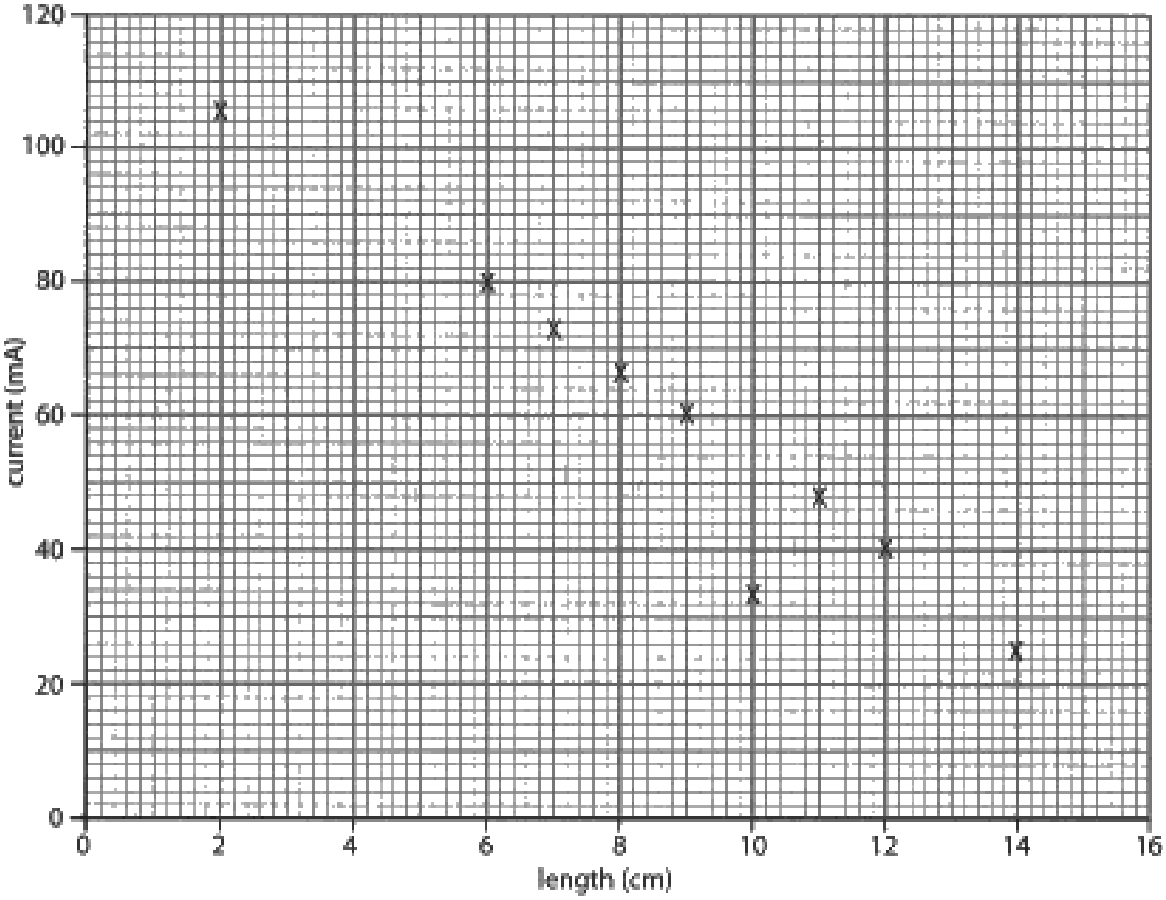
This is a level based question and the eight marks available are awarded across three levels. The question requires learners to evaluate the method, results and conclusion an experiment given . In this case the experiment is designed to measure the current through a roll of conducting putty as the length of the putty is changed. The length of the putty is changed by cutting it to different lengths . The results are then shown as points on a graph and a conclusion, which purports to relate to the results is then given. Again it is advised that learners should read the whole question before attempting to provide the evaluation. This should include noting relevant information from the circuit diagram such as the meters it contains and noting the labels on the axes of the graph as well as carefully reading the conclusions that have been ascribed to the graph. Learners are asked to evaluate ,the method of the experiment, the results collected and the conclusions made.

The following are examples or responses which exemplify work at each of the three levels which can be awarded.

Level 1

There is an attempt to evaluate the conclusion but the learner has not noted that the conclusion given does not support the results shown on the graph. The graph shows that the current passing through the conducting putty decreases as the length increases. There is little evaluation of the method apart from noting that the circuit is set up correctly. The evaluation of the results is limited to noting that there is an anomaly at 10cm. This evaluation is adequate and sufficient to gain marks at Level 1 .

The graph shows the results of the learner's investigation.



The learner concludes that:

'The current passing through the conducting putty cylinder decreases as the length of the cylinder decreases'.

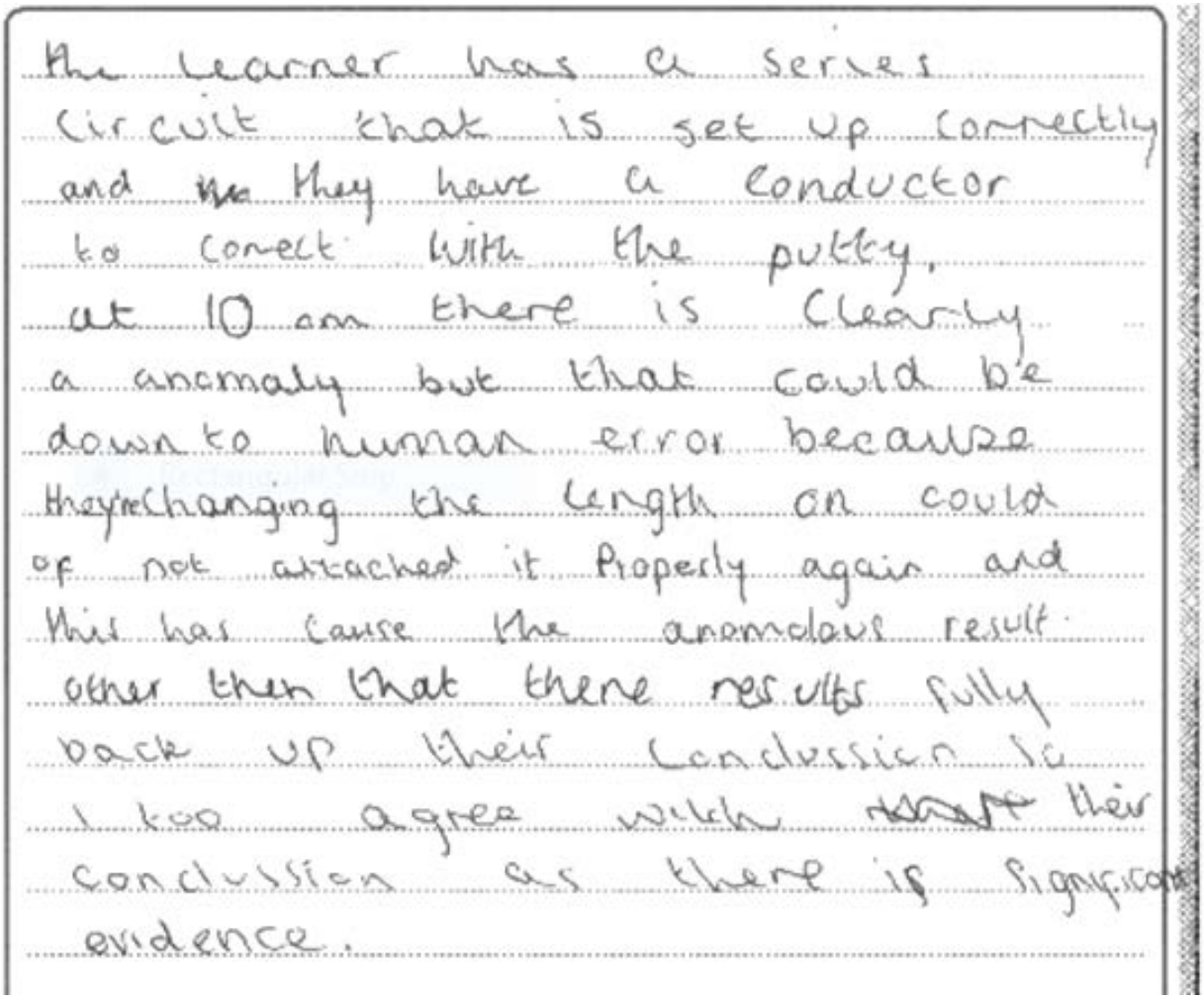
Evaluate the learner's investigation.

Your answer should include reference to the:

- method of the experiment
- results collected
- conclusion made.

(8)

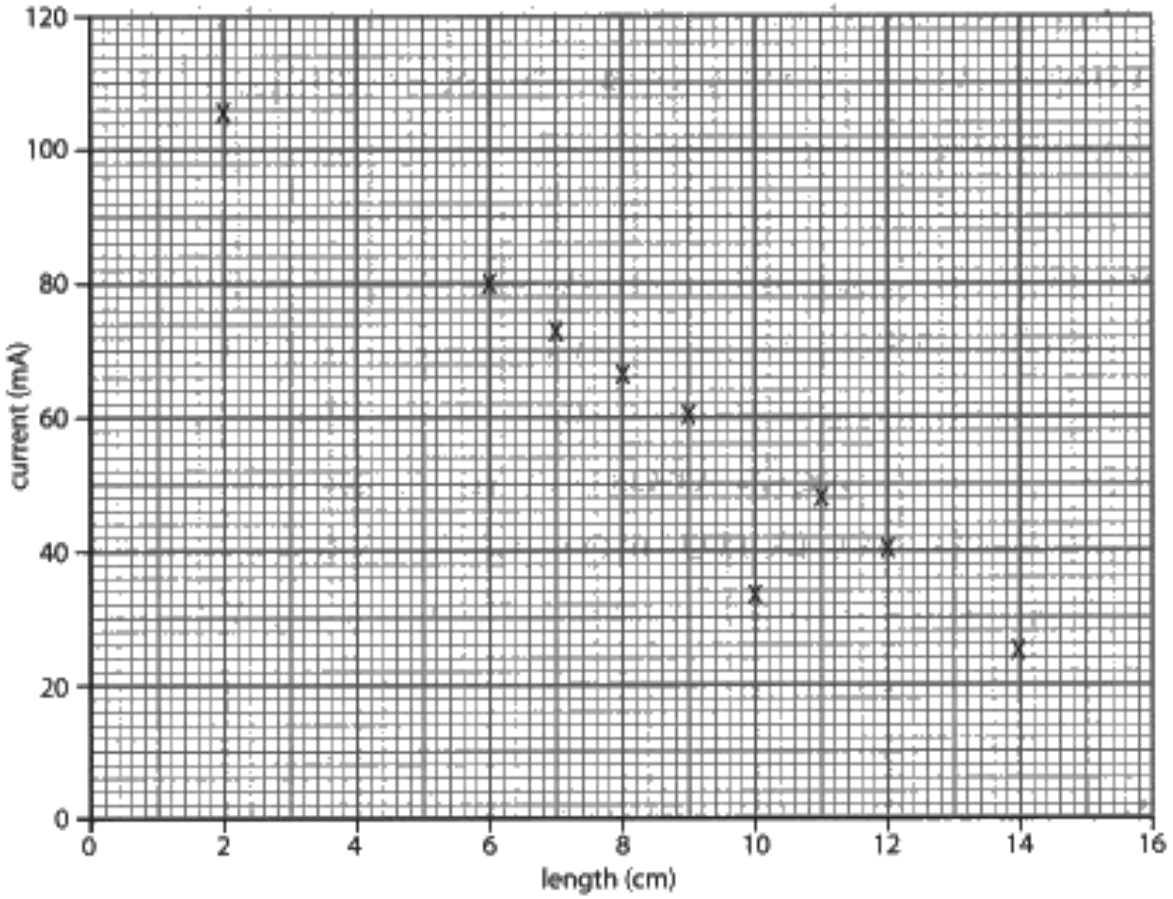
the experiment in my opinion has been conducted very well and I fully agree with the learners conclussion, because the evidence in the graph confirms this.


The learner has a series circuit that is set up correctly and they have a conductor to conect with the putty, at 10 cm there is clearly a anomaly but that could be down to human error because they're changing the length an could of not attached it properly again and this has cause the anomalous result. other then that there results fully back up their conclusion so I too agree with their conclusion as there is significant evidence.

Level 2

There is some evaluation of the method 'doesn't say how short he is going to cut the putty' this is adequate and is given as 'measure specific lengths' in the indicative content. The evaluation of the results is good mentioning the anomaly and the large gaps between some of the readings. There is a comment on the conclusion and the relationship from the graph has been correctly quoted but it was not noted that the conclusion given in the question did not correspond to the results on the graph.

The graph shows the results of the learner's investigation.



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(8)

The method has no measurements. This makes it hard to understand what he is measuring for. Its also short and very not descriptive making hard for anyone else to use his experiment

It doesn't say how small he is going to cut the putty each time either making it unreliable if he does not have a set amount.

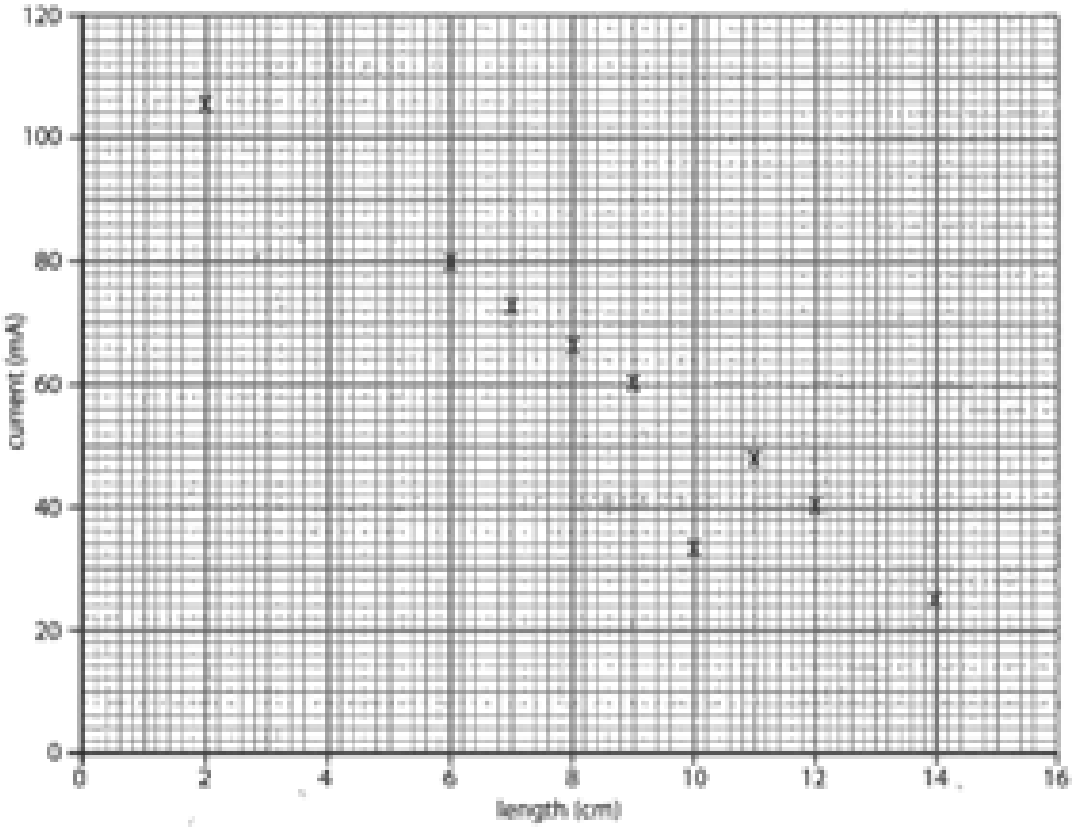
The results show that there is an anomaly within the graph at the length of 10 cm. Also there is a very large gap in between the results. This shows that there is no results for 4 cm length of putty making it hard to conclude accurately without all of the results

The conclusion is correct as the length of putty increases the current decreases. This is proven by the results that he recorded

Level 3

This example shows a comprehensive analysis, with evaluative comments supported by relevant reasoning

The graph shows the results of the learner's investigation.



The learner concludes that:

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Evaluate the learner's investigation.

Your answer should include reference to the:

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- conclusion made.

(8)

THE RELATIONSHIP BETWEEN THE LENGTH OF THE CYLINDER AND THE CURRENT HAS A NEGATIVE CORRELATION. THE LEARNER SHOULD MAKE SURE THE LENGTH OF THE CONDUCTING PUTTY CHANGES TO ISN'T RANDOM AND ONES CHANGES AT SET

AMOUNT: AS I CAN SEE FROM THE RESULTS THE LENGTHS WERE 2, 6, 7, 8, 9, 10, 11, 12, 14, AND CHANGING THE SAME EACH TIME. THE CONCLUSION MADE IS IN COLLECT AND I SAY BACKED UP BY THE GRAPH.

IT IS IMPORTANT THAT THE VOLTAGE REGISTERED THE AMMETER 3 TIMES TO ENSURE IT WAS ACCURATE BY GETTING AN AVERAGE RESULT. THE RESULTS SHOW THE AMOUNT OF CURRENT DECREASING AS THE LENGTH INCREASES AS THE LENGTH OF THE WIRE CHANGES. IT IS IMPORTANT THE WIDTH AND THICKNESS OF THE WIRE IS KEPT THE SAME AS THIS COULD EFFECT RESULTS I ASSUME AS THIS THE METHOD SHOULD STATE THAT THE WIRE NEEDS TO BE MEASURED BEFORE IT IS CUT, GOING DOWN IN LENGTH SO THE WIRE ISN'T SHORTED THEREFORE CHANGING THE WIDTH/THICKNESS AGAIN EFFECTING THE RESULTS.

WHICH CONTRADICTS THE LEARNERS HYPOTHESIS.

AT 10 CM LENGTH THERE SEEMS TO BE AN ANOMALY. THIS COULD BE BECAUSE THE LENGTH OF THE WIRE WASN'T MEASURED ACCURATELY AND WAS LONGER

THAN 10CM THEREFORE MEANING A LOWER CURRENT PASSING THROUGH.

To improve on section 2 of the paper learners should :

- Ensure that sufficient time (30 mins)is left to complete the section
- Read the questions completely, if necessary more than once.

Question4

- Note the variables
- Produce a hypothesis using the variables
- Decide how the variables are to be measured
- For electrical circuits draw a circuit diagram.
- State meters or instruments used to make measurements
- Use bullet points to describe the method

Question 5

- Look for the range, intervals between results and not just repeats, averages and anomalies.
- Read the conclusion carefully,anduse quantitative support from the results table or graph to support the evaluation the conclusion .

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