L3 Lead Examiner Report 1801

BTEC

January 2018

Level 3 National in
Applied Science
Unit 3: Science Investigation Skills

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Publications Code 31619H

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, Pass and Near 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 (31619H)

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	8	17	28	39

Introduction

Learners will cover the stages involved and the skills needed in planning a scientific investigation:
how to record, interpret, draw scientific conclusions and evaluate.

Advancement in science and technology has produced great benefits for society. This advancement depends on research and investigative approaches in science and technology. In research, development, analytical and industrial laboratories, laboratory technicians and scientists are employed to safely carry out practical investigations, or follow prescribed laboratory procedures.
They repeat measurements to obtain consistent, reliable results. They use investigative skills, including planning, recording and interpreting data, analysing and evaluating findings in order to test a hypothesis to inform further research and development.

Individual Questions

Chemistry

Unit 3 report

This was the second time this paper was sat. Learners seemed slightly better prepared than in the previous session. The majority had produced a good set of results from their diffusion experiments.

Learners that did well were able to plan, collect and use their data, analyze given data and evaluate given results and methods. They were able to carry out calculations methodically, showing their working.

Learners that did less well, did not always interact with questions sufficiently and therefore did not answer the questions posed appropriately.

The first question, 1a, was generally well answered with the majority of learners being able to tabulate their results with suitable headings and units and with all measurements recorded consistently, including repeats.

1 (a) Record all your experimental results, including average time for the colour to disappear, in a suitable table, using the space provided. Circle any anomalous results.

(3)

	Time (s)			
Acid (M) concentration	repeat 1	repeat 2	repeat 3	Average time
0.1	(1193)	1029	1005	1075.6
0.5	597	580	609	595.3
1.0	494	481	512	495.6
1.5	407	(534)	440	460.3
2.0	395	(486)	422	434.3

Learners that drew their table in different ways, still gained full credit.

SECTION 1

1 (a) Record all your experimental results, including average time for the colour to disappear, in a suitable table, using the space provided. Circle any anomalous results. **(3)**

Tries	Concentrations (M)	Time taken (seconds)
1	0.1	623
2		631
3		624
Mean		626
	0.5	424
		(308)
		418
Mean		421
	1	349
		340
		347
Mean		344
	1.5	(306)
		337
		325
Mean		331
	2	268
		262
		267
Mean		265

Where learners lost marks, it was usually as they had given incorrect or missing titles as in the example below or units. There were still a number of learners presenting units within the body of the table rather than the headings, whilst accepted, learners should be taught that this is not good scientific practice.

Trials	Concentrations (M)				
	0.5M	0.1M	1M	1.5M	2M
trial 1	405 seconds	647 seconds	371 seconds	314 seconds	275 seconds
trial 2	400 seconds	650 seconds	366 seconds	320 seconds	285 seconds
trial 3	401 seconds.	632 seconds	363 seconds	315 seconds	290 seconds
mean.	402 seconds.	643 seconds	~~366~~ 367 seconds	316 seconds	283 seconds.

Learners found question 1b quite difficult with many learners confusing accuracy with reliability, discussing repeats, averaging and anomalies which were not creditworthy. Many learners failed to explain their answers and therefore often scored just 2 marks.

Where learners gained credit, it was often for showing an understanding that their results were made accurate by using the white tile to see the colour change clearly or for ensuring that clean equipment was used each time to prevent contamination. The importance of reading from the bottom of the meniscus and reading the volume at eye level was often discussed.

This learner scored two marks as they have stated that they used a pipette to get the acid exactly on the meniscus line.

(b) Explain **two** ways you made sure your results were accurate when carrying out the investigation.

(4)

- When we measured out the volume of hydrochloric acid, we used a 10cm^3 measuring cylinder and a teat pipette to add or remove any final drops to make sure the meniscus sat exactly on the 10cm^3 etched mark.
- We repeated ~~the~~ each concentration 3 times to ensure our results were reliable and not just anomalies. If we did have any anomalies we were able to identify them straight away, and rule them out from our average time.

Learners gained no credit for references to repeats, averages and anomalies nor references to controls.

(b) Explain **two** ways you made sure your results were accurate when carrying out the investigation.

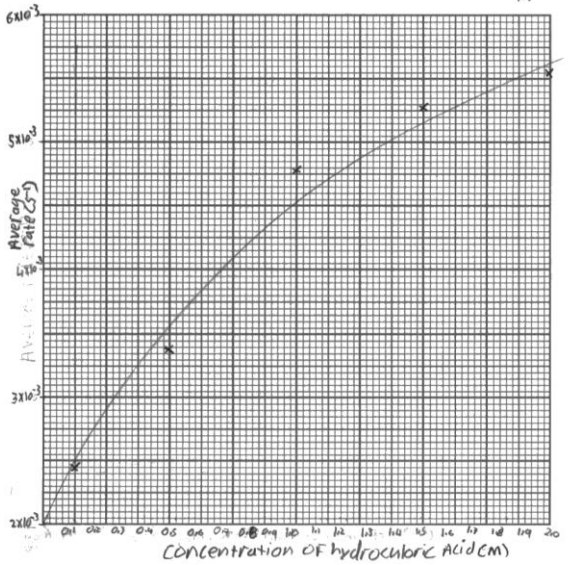
(4)

To ensure the results are accurate you should take lots of repeat readings which can be used to calculate a mean by adding all the results up and dividing by the number of results taken after discounting anomalous results. You should also control the surface area of the agar jelly and all other control variables such as temperature as these would affect the rate of reaction and result in our results not being close to the actual results. Finally to ensure results are accurate you should discount any anomalies and ensure readings are repeated.

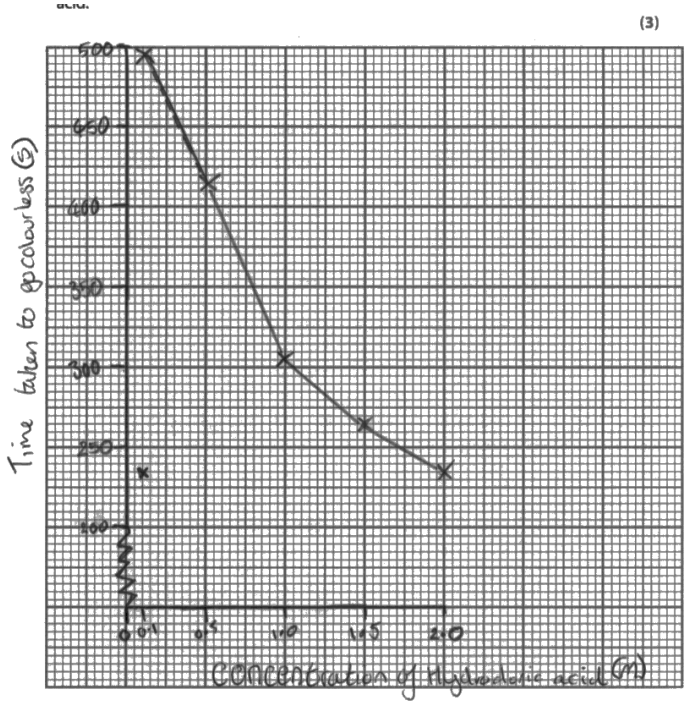
In question 1d, learners found plotting the graph of average rate of diffusion again concentration of acid difficult with only the best gaining full credit.

(d) Plot a graph of average rate of diffusion against concentration of hydrochloric acid.

(3)

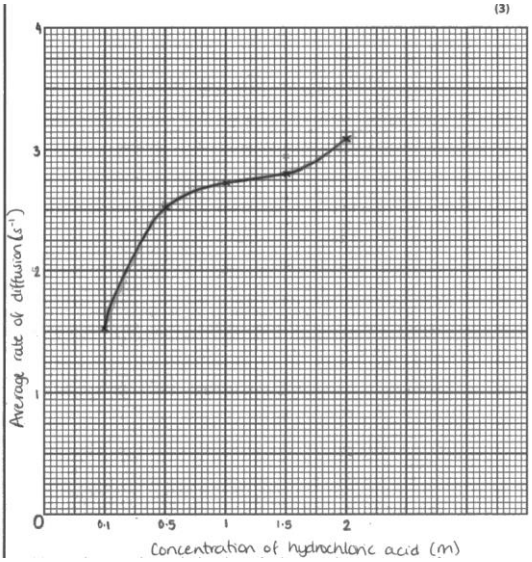


Many learners did not read the question carefully and plotted a graph of time, rather than the average rate of diffusion calculated in part 1c. Units were often missing or incorrect.



Many learners did not consider their scale carefully and did not draw axes with linear scales but used the values direct from their table. Learners found it very difficult to transfer their standard form answers onto the scales. Of those that did draw correct, linear scales, often a very small proportion of the graph paper was used. Learners should be taught to draw graphs so that their data takes up at least half of the graph paper in either direction.

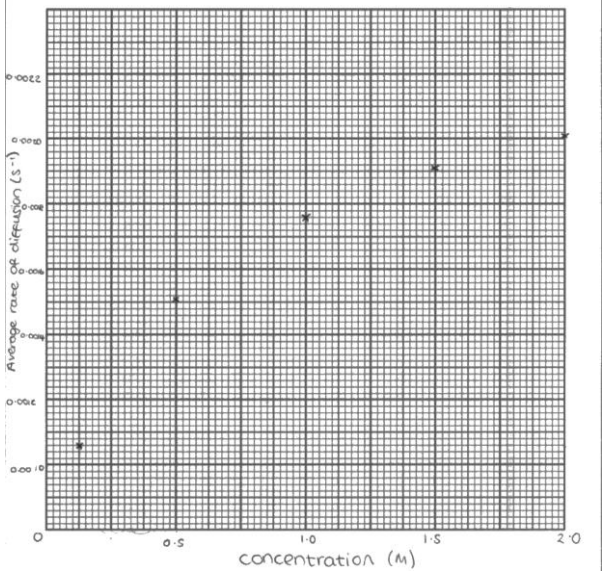
(3)



Learners need to have more practice at drawing suitable lines of best fit to suit the data they obtain. Many learners drew a straight line of best fit through points that clearly had a curved trend. Dot to dot lines or scruffy lines of best fit were also often seen and some learners did not draw a line at all.

(d) Plot a graph of average rate of diffusion against concentration of hydrochloric acid.

(3)



In question 1e, the majority of learners were able to score 1 mark for being able to describe the relationship between concentration of hydrochloric acid and the average rate of diffusion shown in their graph.

(e) Describe, using the graph, the relationship between the concentration of hydrochloric acid and the average rate of diffusion.

(2)

the average rate of diffusion increases as the concentration of the hydrochloric acid increases.

A few good learners described the graph in detail to get the second mark also.

(e) Describe, using the graph, the relationship between the concentration of hydrochloric acid and the average rate of diffusion.

(2)

As the concentration of Hydrochloric acid increases so does the rate of diffusion. However the rate at which it increases decreases with higher concentrations

In some cases, learners stated that their data was directly proportional when this was not shown in their graph and therefore did not gain credit.

In question 2, part bi, most learners were able to calculate the mean of the three figures given and showed their working as directed in the question.

(b) Your colleague calculated three rates of diffusion for 2.5 M sulfuric acid.

The three rates they calculated were 0.0084 s^{-1}, 0.0083 s^{-1} and 0.0088 s^{-1}.

(i) Calculate, using the three values, the average rate of diffusion for 2.5 M sulfuric acid.

Show your working.

$\frac{0.0084 + 0.0083 + 0.0088}{3} = 0.0085\ s^{-1}$ (1)

Average rate of diffusion = 0.0085 s^{-1}

In question 2b part ii, the majority of learners that attempted this question, gained some credit.

A good proportion of learners were able to score the full five marks available for calculating standard deviation. These learners often set their work out well, showing the methodical approach they had taken to get to their answer.

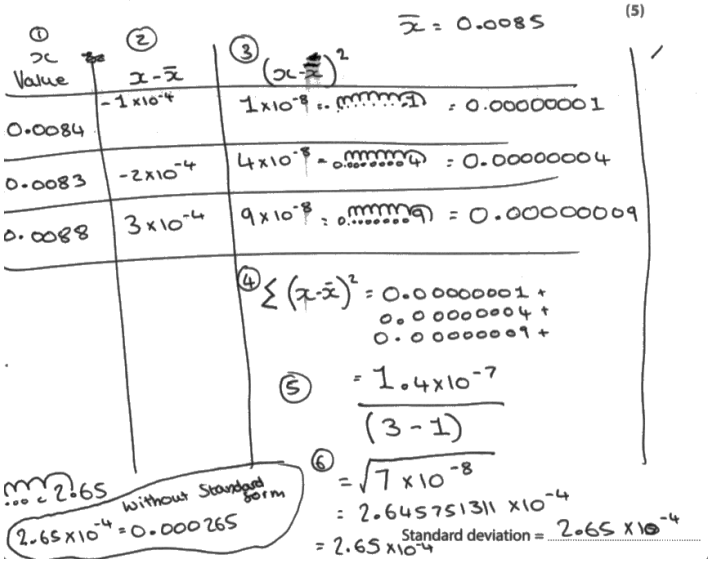
(ii) Calculate the standard deviation for 2.5 M sulfuric acid.

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{N - 1}}$$

x = Number / value

Show your working.

(5)



In some cases, learners forgot to take the square root of their final answer and so therefore scored 4 out of the 5 marks available. It is important to note here, that if this answer had been given but with no marking, a mark of 0 would have to have been awarded rather than 4, so it is of the utmost importance that learners are taught to show their working.

(ii) Calculate the standard deviation for 2.5 M sulfuric acid.

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{N - 1}}$$

Show your working.

(5)

	$x - \bar{x}$	$(x - \bar{x})^2$
0.0084	0.0001	0.00000001
0.0083	0.0002	0.00000004
0.0085	0.0003	0.00000009

$= 0.00000014$

0.00000014

$N = 3 - 1 = 2$

Standard deviation = 0.0000007

Question 2ci was frequently misread, with many learners describing any similarities or differences in the results themselves, rather than giving the reasons why these might have occurred.

Although many learners scored on this question, only the best scored the full three marks available.

(c) (i) Your colleague used sulfuric acid instead of hydrochloric acid.

Give **three** other reasons for any similarities or differences between your results and theirs.

(3)

- There could have been a different concentration of sodium hydroxide used or another alkali instead.
- The volume of acid used could have been different
- The agar cylinders could have been a different size.

Question 2c ii The majority of learners were able to score at least 1 mark on this question for understanding that the acid may have dissolved or reacted or corroded the agar. Fewer were able to link this to the sulfuric acid being a high concentration.

(ii) Your colleague observed that the agar cylinder became smaller in the 2.5M sulfuric acid.

Explain why the agar cylinder became smaller in the 2.5M sulfuric acid.

(2)

because the acid molecules are heavier than the water molecules and so they take up more space in the agar and so it shrinks because the concentration of the acid is so strong that it disolved some of the agar and started eating away at it.

Many learners repeated the stem of the question, stating that the agar cylinder reduced in size.

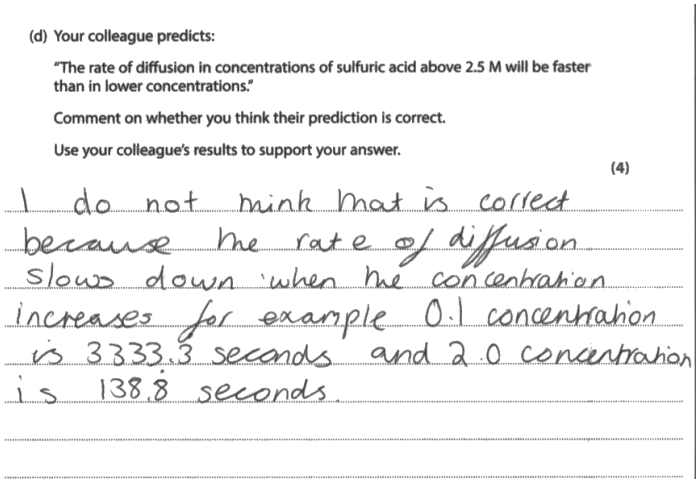
(ii) Your colleague observed that the agar cylinder became smaller in the 2.5M sulfuric acid.

Explain why the agar cylinder became smaller in the 2.5M sulfuric acid.

(2)

The sulfuric acid will have reacted with the agar cylinder - breaking it down - this leading to a reduced size for the agar cylinder.

In question 2d, many learners were confused as they referenced data of time of diffusion rather than rate of diffusion and therefore found that the 'rate' got slower. Many learners tried to explain their answer in terms of diffusion.



(d) Your colleague predicts:

"The rate of diffusion in concentrations of sulfuric acid above 2.5 M will be faster than in lower concentrations."

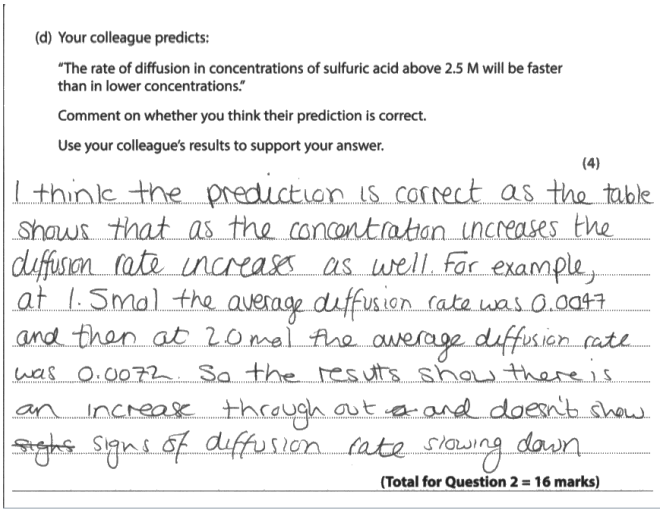
Comment on whether you think their prediction is correct.

Use your colleague's results to support your answer.

(4)

I do not think that is correct because the rate of diffusion slows down when the concentration increases for example 0.1 concentration is 3333.3 seconds and 2.0 concentration is 138.8 seconds.

Learners found it hard to discuss the answer, often giving the data which supported the prediction but then not going back to the question and explain how this might support the prediction.



(d) Your colleague predicts:

"The rate of diffusion in concentrations of sulfuric acid above 2.5 M will be faster than in lower concentrations."

Comment on whether you think their prediction is correct.

Use your colleague's results to support your answer.

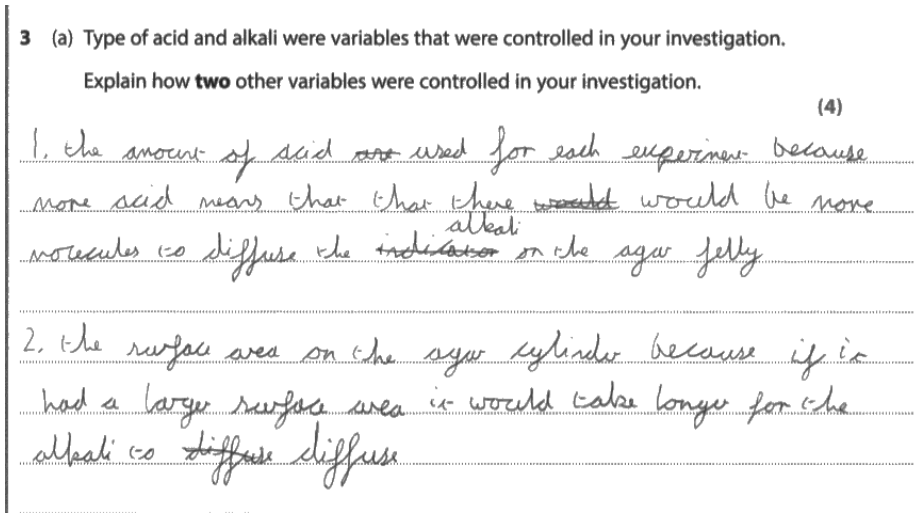
(4)

I think the prediction is correct as the table shows that as the concentration increases the diffusion rate increases as well. For example, at 1.5mol the average diffusion rate was 0.0047 and then at 2.0mol the average diffusion rate was 0.0072. So the results show there is an increase through out and doesn't show ~~signs~~ signs of diffusion rate slowing down

(Total for Question 2 = 16 marks)

Learners generally performed well in question 3a with the majority able to gain at least two marks for explaining how one variable was controlled.

In cases where marks were lost, this was often as learners did not read the question carefully and explain why the variable was controlled rather than how it was controlled.



3 (a) Type of acid and alkali were variables that were controlled in your investigation.

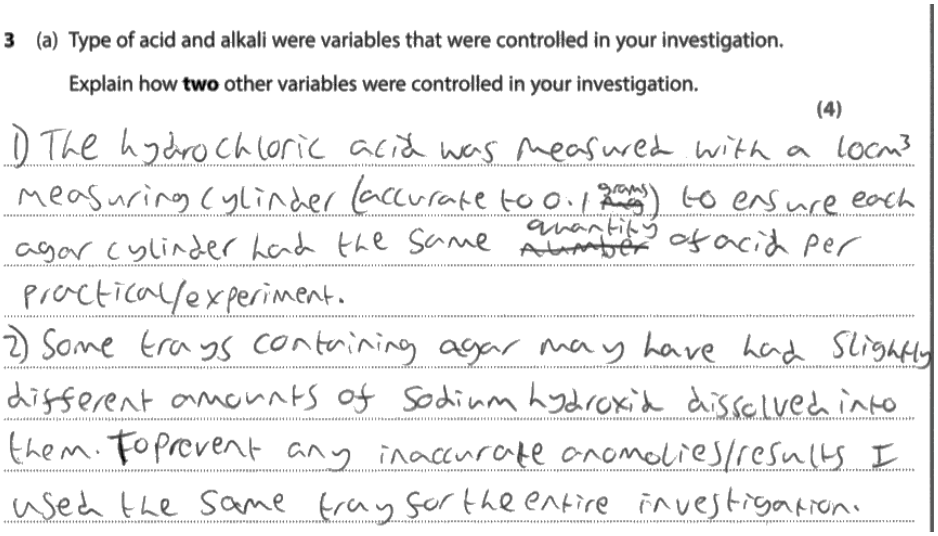
Explain how **two** other variables were controlled in your investigation.

(4)

1. the amount of acid ~~one~~ used for each experiment because more acid means that that there ~~would~~ would be more molecules to diffuse the ~~indicator~~ alkali on the agar jelly

2. the surface area on the agar cylinder because if it had a larger surface area it would take longer for the alkali to ~~diffuse~~ diffuse

In this example, the learner has given two controls but they have described why the variables were controlled rather than how they were controlled, so scored just 2 marks.



3 (a) Type of acid and alkali were variables that were controlled in your investigation.

Explain how **two** other variables were controlled in your investigation.

(4)

1) The hydrochloric acid was measured with a $10cm^3$ measuring cylinder (accurate to 0.1 ~~grams~~) to ensure each agar cylinder had the same ~~number~~ quantity of acid per practical/experiment.

2) Some trays containing agar may have had slightly different amounts of Sodium hydroxid dissolved into them. To prevent any inaccurate anomalies/results I used the same tray for the entire investigation.

In question 3b, most learners linked high temperature to the reaction or diffusion happening faster, of these a good proportion were able to explain that this was because the higher temperature particles have more kinetic energy.

(b) Explain why temperature should be controlled when investigating the effect of concentration of acid on rate of diffusion.

(2)

Because the additional heat could have caused an increase in kinetic energy meaning that the particles would have seen a higher rate of diffusion.

Most learners were able to score some credit on question 3c for giving one or two ways to extend the investigation, of these only the better learners were able to say give the further detail to gain the third and fourth marking points.

Again many learners confused the idea of extension of the experiment with reliability and accuracy and gave suggestions for alternative equipment that could be used in the same investigation or simply stating to repeat the experiment again.

(c) Your colleague extends their investigation by using a larger range of concentrations of sulfuric acid.

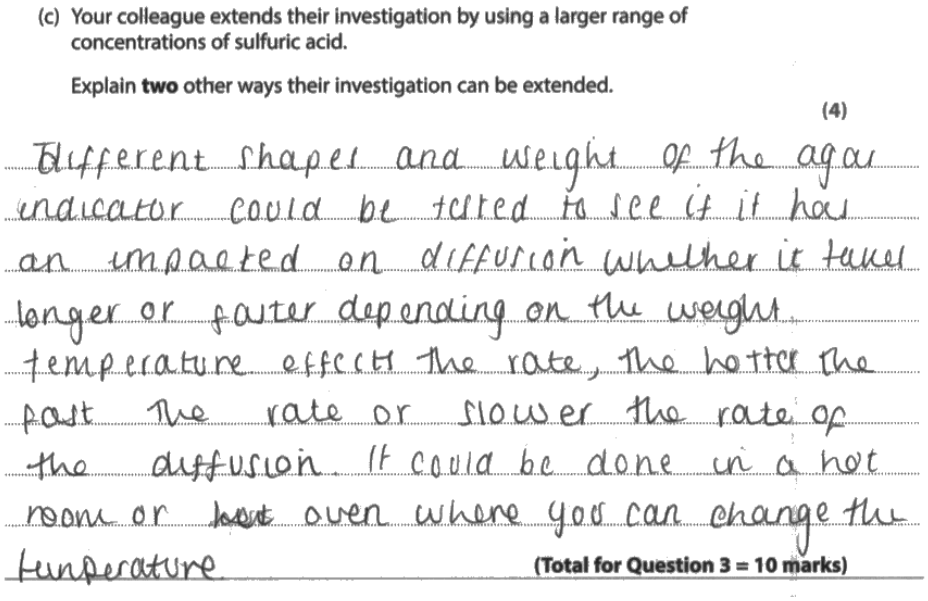
Explain **two** other ways their investigation can be extended.

(4)

You could have done repeats, which would allow investigations to be ~~expe~~ extended. Also you could have ~~dro~~ done the same experiment with a different acid, to compare rate of diffusions.

(Total for Question 3 = 10 marks)

This example scored 3 marks for understanding that different shapes/sizes/surface area could be tested. They also understood that changing the temperature is an acceptable extension to the task, they gave detail that using a hot room or an oven to change the temperature which was accepted.



(c) Your colleague extends their investigation by using a larger range of concentrations of sulfuric acid.

Explain **two** other ways their investigation can be extended.

(4)

Different shapes and weight of the agar indicator could be tested to see if it has an impacted on diffusion whether it takes longer or faster depending on the weight. temperature effects the rate, the hotter the fast the rate or slower the rate of the diffusion. It could be done in a hot room or ~~hot~~ oven where you can change the temperature

(Total for Question 3 = 10 marks)

Physics

Lead Examiners Report

BTEC Applied Science Level 3 Unit 3 Section2

Section 2 of this paper consists of two questions which are taken from a different scientific discipline to the questions in section1. In this paper section 2 is based on the physics that has to be studied to cover the specification. The questions are designed to test two parts of the specified content for the examination.
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.
Question 5 gives a description of the method, results and conclusion of an investigation and tests the ability of learners to use this information and make recommendations to improve the method, determine sources of error, consider the reliability of data and evaluate the conclusions made.

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 question gives the symbol for a diode and presents learners with the information that diodes only allow current to pass in one direction in a circuit and that the potential difference that allows a current to pass is called the threshold potential difference. Many learners did not appreciate that no current will pass through the diode until the threshold potential is exceeded. A frequent error seen in the hypothesis was that either there was a threshold current or that the current ceased to pass

through the diode when the threshold potential difference was reached. Only a few learners reversed the connections to the power pack or turned the diode in the circuit to show that current only passes through a diode in one direction. Learners need to read the whole question and note the quantities that are to change before attempting to produce a plan.
Learners are not expected to have prior knowledge of the investigation given in the question. However, learners should be sufficiently familiar with the setting up of electrical circuits to enable them to draw a circuit diagram or describe how a circuit could be set up. Learners should be encouraged to draw circuit diagrams which show a voltmeter in parallel, to measure the potential difference across a component and an ammeter in series, to measure the current in a circuit. A circuit diagram with an ammeter and voltmeter in the correct positions indicates a good understanding of the basic measurements to be made using electrical circuits.

The response shown below is awarded level 1. The learner has attempted to make a hypothesis but does not appreciate that the threshold potential difference has a specific value of voltage, which when exceeded will allow a current to pass through the diode. The learner gives a list of equipment but does not attempt to describe the experiment but there is a reference to health and safety

SECTION 2

4 Diodes and conduction

Diode

Diodes are semiconductor devices.

Diodes only allow a current to pass in one direction in a circuit (forward direction).

The potential difference (p.d.) at which the diode will allow a current to pass in the circuit is called the threshold p.d.

Write a plan to find the threshold p.d. and its direction to enable a current to pass.

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 including:
  - the 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.

(12)

Hypothesis : higher the threshold potential difference, more current to pass through the circuit.

Equipment:

Diode, red wire, black wire, light bulb, voltmeter, Ammeter,

Hazard : could get an electrick shock so stand on wood when carrying out this experiment.

The response shown below is typical of those awarded a level 2. The learner has attempted to produce a hypothesis but this is incorrect. The list of equipment includes an ammeter and it is stated that the ammeter measures the current but a voltmeter is not included. The circuit diagram shows the ammeter correctly placed in series. The learner indicates that the power from a power

pack would change the voltage this would allow some results to be taken although not enabling the threshold voltage to be determined.

SECTION 2

4 Diodes and conduction

Diode

Diodes are semiconductor devices.

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Your plan should include the following details:

- a hypothesis
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- health and safety associated with the investigation
- methods for data collection and analysis to test the hypothesis including:
  - the 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.

(12)

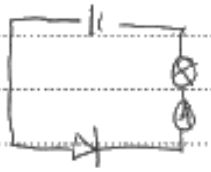
If we increase the current it will reach the threshold only in one direction

equipment

- Diode - ammeter to measure the current
- wires to connect the circuit
- power supply - Bulb to show current passing through

method

- connect the bulb, ameter, diode, and power supply to form a circuit like this



- Input a power of 6v and measure the current flowing through
- Increase the power by 4w each time recording the current
- Repeat this with the ammeter and bulb on the left side of the circle

Variables

- Control - The circle being used
- Independent - The power being supplied in
- Dependent - The current flowing through

(Total for Question 4 = 12 marks)

The response below is holistically a level 3. The diagram indicates that an ammeter and a voltmeter are used and these are both placed correctly in a circuit according to the circuit diagram. There is an attempt to produce a hypothesis but this is incorrect. The learner has produced a plan with a logical sequence but has not mentioned that the ammeter reading needs to be taken or that the lamp would light up if the current was sufficiently large. However, changing the potential difference and repeating the measurements have both been included.

SECTION 2

4 Diodes and conduction

Diode

Amp = current
Volts = P.D.

Diodes are semiconductor devices.

Diodes only allow a current to pass in one direction in a circuit (forward direction).

The potential difference (p.d.) at which the diode will allow a current to pass in the circuit is called the threshold p.d.

Write a plan to find the threshold p.d. and its direction to enable a current to pass.

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 - no water near - don't put to much current through
- methods for data collection and analysis to test the hypothesis including:
  - ✓ the quantities to be measured - voltage across the diode for each
  - ✓ the number and range of measurements to be taken
  - ✓ how equipment may be used
  - ✓ control variables
  - ✓ brief method for data collection analysis.

(12)

Hypothesis: ~~The more current passing through a~~ circuit the higher the threshold P.D will get this ~~is due to the fact that the~~ As the current in the circuit is increased so will the Potential difference across the diode until the threshold Potential difference is reached at which point the ~~about~~ amount of current passing ~~through~~ across the diode will remain the same.

Equipment:-

- Power Pack - to use as a power source for the circuit
- Bulb - so that you can see if the circuit is working
- Diode - to find out the threshold Potential difference.

Volt metre - to measure the Potential difference across the circuit

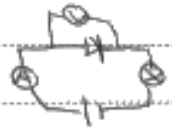
Amp metre - to measure the ~~cur~~current across the circuit.

wires - to connect the circuit up with.

Health + Safety:- As electricity is being used water should not be anywhere near the equipment and circuit.

Only go up to a sensible watts of 10 on the power pack.

Method:-



1) Set up the equipment as shown

2) Once the circuit is set up switch the power pack on and check the circuit is working.

3) After you have checked turn the power pack up to 1 watt and record the Potential difference across the diode.

4) Repeat the experiement to get 3 results for 1 watt.

5) Repeat steps 1-4 for each watt from 1-10 making sure each experiement is repeated 3 times.

6) record the results collected in a table so they can easily be compared.

7) using the results ~~recorded~~ recorded work out which value would be the threshold P.d.

Variables:-

Controlled:- The same diode ~~so~~ as different diodes may vary.

Dependent:- The Potential difference across the diode

Independent:- The watts going into the circuit

(Total for Question 4 = 12 marks)

The response below is awarded a level 4. The hypothesis is correct but does not mention reversing the input to the diode. The method used to set up the circuit is described correctly but would have been improved with a circuit diagram. The whole piece of work shows a comprehensive understanding of scientific concepts and gives a rationale for the method which would allow a set of results to be obtained as incremental increases in potential difference are included. It is also noted that observations need to be repeated. The response is not perfect but there is sufficient to meet the level 4 descriptors.

SECTION 2

4 Diodes and conduction

Diode

Diodes are semiconductor devices.

Diodes only allow a current to pass in one direction in a circuit (forward direction).

The potential difference (p.d.) at which the diode will allow a current to pass in the circuit is called the threshold p.d.

Write a plan to find the threshold p.d. and its direction to enable a current to pass.

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 including:
  - the 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.

(12)

Hypothesis

As the voltage is increased, the diode will become active, allowing current to pass. This is due to diodes having a switch on voltage, allowing the current to flow forward biased.

Equipment

- Diode (to test the hypothesis)
- Power Pack (to supply current/voltage to diode)
- Voltmeter (to see how many volts)
- 6x leads (to attach equipment).
- Ammeter (to measure current)

Risk Assesment

- Don't touch Diode when Powered on, as it becomes very hot. Power off circuit, and leave to cool before handleing.
- Ensure that no metal or water is left near circuit, to reduce risks of electric shocks.

Method

- To start, connet the circuit together. Attach leeds from Possitive supply from power Pack to the Positive terminal on diode. And negative terminal on diode to negative supply on Power Packs. Attach the volt meter in parallel with diode. Attach ameter in series with Power Pacts and diode.
- Begin by increasing the voltage in 0.5 V increments, in your table record the current and voltage after each increase once the diode has reached the switch on voltage. Stop the experiment.
- Repeat this experiment 3 times, to work out an average and spot anomilies.

Independent Variable – Voltage (V)

Dependent Variable – Current. (A)

Control variables - Diode, Power Pack, temperature, Ameter.

(Total for Question 4 = 12 marks)

Question 5

This question sets out the method, circuit diagram, results and conclusion for an investigation into how the electrical power supplied to a resistor placed in a beaker of water affects the temperature rise of the water. The question requires learners to evaluate the investigation described with reference to method, results and conclusion. To do this, learners need to read the whole question carefully and assimilate all the information given before attempting an answer.

The mark scheme is level-based, work being assessed at three possible levels. There is also 'indicative content' but it is not intended that all rewardable material is to be found in the indicative content. It is only an indication of what learner might include in their answer and any other correct answers must also be duly rewarded.

The level-based mark scheme requires that to gain level 2 'the conclusion must be mostly focused and developed and draw on some of the information presented', therefore if there is no conclusion given only level1 can be awarded. This caused problems for some learners as they ran short of time and 'conclusion made' is that last of three things that the question asks them to refer to in the evaluation. Time management was quite frequently an issue with the completion of this question. Also, some learners did not refer to the conclusion given in the question but gave the conclusion that they would make from the information provided. The validity of the conclusion given in the question must be considered.

Most learners were able to identify inaccuracies in the method and suggest improvements to the method. In evaluating the results obtained the most frequently seen answer was 'there were no repeats' so 'anomalies could not be found' or 'averages could not be taken'. The need to extend the range of results or reduce the size of the increments was rarely mentioned. To achieve level 2 the evaluation of the conclusion could be qualitative. This could be, agreement because there was proportionality or doubt because of lack of data. For level 3 to be achieved learners needed to support their evaluation using quantitative values to show proportionality and the lack of proportionality for the readings above 36 W

The response below is limited to level1. Although there is an evaluation of the method by considering time and an evaluation of the results because 'lack of repeats or averages 'are mentioned there is no evaluation of the conclusion.

The learner concludes that:

"Up to 36 W the increase in temperature is proportional to the power supplied. Above 36 W the increase in temperature is no longer proportional to the power supplied."

Evaluate the learner's investigation.

Your answer should include reference to:

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

(8)

The method the learner has bourght up has no detail and is quite basic for an experiment like this. It does not indicate after ~~when~~ how long the water ~~long the~~ should be measured, as if its not the same with the previous ones then the results collected would be innaccurate. Rosults dont contain the average temprelu per ~~se~~ power (watts) supplied, ~~30~~ repeats should be done

The exemplar response given below is awarded a mark in level 2. There is an evaluation of the method, results and conclusion but the conclusion does not include any quantitative support of the comments made.

The learner concludes that:

"Up to 36 W the increase in temperature is proportional to the power supplied. Above 36 W the increase in temperature is no longer proportional to the power supplied."

Evaluate the learner's investigation.

Your answer should include reference to:

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

(8)

Method:

- how many is 'a few' mililitres, that can affect the stability of the reading
- what was the temp of water before we began
- do repeats need conducting to accuracy, or, is this an average

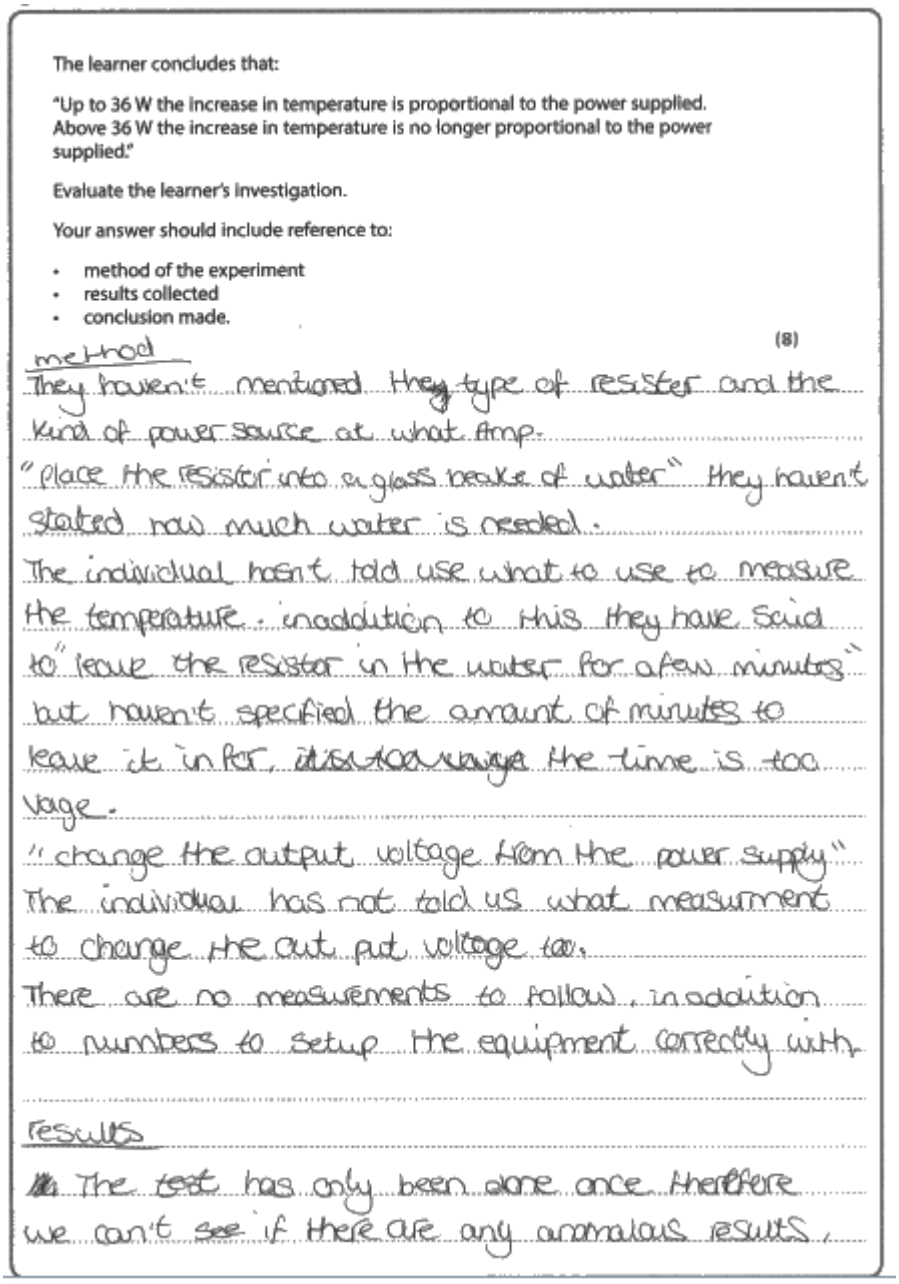
Results

- could ~~can~~ an identified range of Powers been used to collect more results.
- Are there any repeats.

Conclusion

The paper to ~~prefered~~ proportional vs a ~~theory~~ basic statement if no repeats have been made. This could be an anomalous result from the equipment fault or time taken for the resistor to cool down. Furthermore has the math $p = v \times i$ been done correctly?

The response given below is an example of a response worthy of being awarded a level 3 The method, results and conclusion are evaluated and there is quantitative support for the evaluation of the conclusion.



The learner concludes that:

"Up to 36 W the increase in temperature is proportional to the power supplied. Above 36 W the increase in temperature is no longer proportional to the power supplied."

Evaluate the learner's investigation.

Your answer should include reference to:

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

(8)

method

They haven't mentioned they type of resister and the kind of power source at what Amp.

"place the resistor into a glass beake of water" they haven't stated how much water is needed.

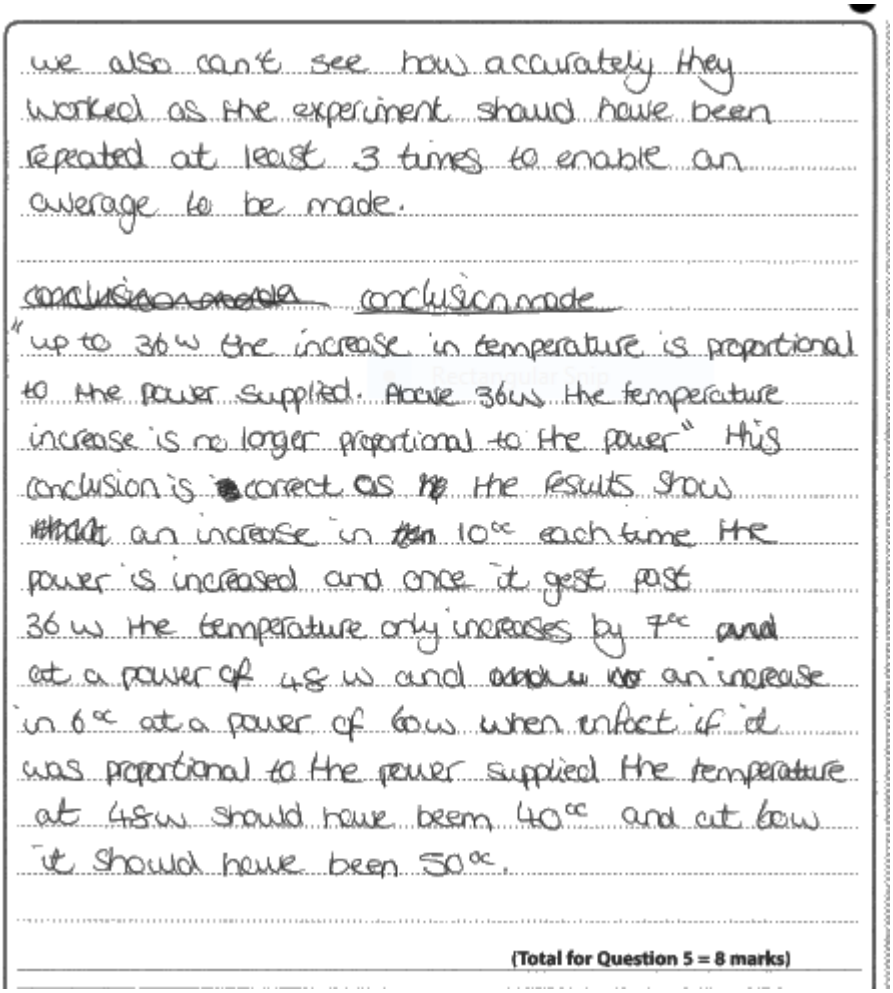
The individual hasn't told use what to use to measure the temperature. inaddition to this they have said to "leave the resistor in the water for a few minutes" but haven't specified the amount of minutes to leave it in for, this is too vauge the time is too vage.

"change the output voltage from the power supply" The individual has not told us what measurment to change the out put voltage to.

There are no measurements to follow, inaddition to numbers to setup the equipment correctly with

Results

The test has only been done once therefore we can't see if there are any anomalous results,



we also can't see how accurately they worked as the experiment should have been repeated at least 3 times to enable an average to be made.

conclusion made

"up to 36w the increase in temperature is proportional to the power supplied. Above 36w the temperature increase is no longer proportional to the power" This conclusion is correct as the results show an increase in 10°c each time the power is increased and once it gest past 36w the temperature only increases by 7°c and at a power of 48w and an increase in 6°c at a power of 60w when infact if it was proportional to the power supplied the temperature at 48w should have been 40°c and at 60w it should have been 50°c.

(Total for Question 5 = 8 marks)

To improve the answers given in 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
- For electrical circuits draw a circuit diagram;
  - State meters or instruments used to make measurements
  - State what these meters or instruments will measure.
- Use bullet points to describe the method
  Question 5
- Make sure the conclusion is evaluated.
- Use quantitative support to evaluate the conclusion where possible.

Summary

- This includes LE recommendations, e.g. Based on their performance on this paper, learners should: (then include between five and ten bullet points)
- If appropriate, refer and link to the specification and/or sample assessment materials (SAMs) located on the BTEC Nationals qualification webpage located here

For more information on Edexcel qualifications, please visit
http://qualifications.pearson.com/en/home.html

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