Examiners' Report/
Lead Examiner Feedback

March 2014

NQF BTEC Level 1/Level 2 Firsts in Applied Science

Unit 8: Scientific Skills (20474E)

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March 2014
Publications Code BF037904

Introduction

This report has been written by the lead examiner for the BTEC Principles of Science unit. It is designed to help you understand how learners performed overall in the exam. For each question, there is a brief analysis of learner responses. You will also find example learner responses from Level 2 Pass and Distinction learners. We hope this will help you to prepare your learners for future examination series.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link: http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

Grade	Unclassified	Level 1 Pass	Level 2		
			Pass	Merit	Distinction
Boundary Mark	0	19	26	33	40

General comments

This was the first time this paper has been set. Many learners appeared to be well prepared for the paper, in that most learners were aware of key variables and how to control them. They were able to plot line and bar graphs and attempted the long answer questions with confidence. Many learners were able to analyse results and were able to draw simple conclusions.

Learners that did well with this paper, did so because they were able to follow their descriptions of patterns or analysis of results with linked consequences or conclusions. They were able to manipulate formula and draw faultless graphs and add appropriate trend lines. They were able to apply their understanding of variables, planning, data manipulation, conclusions and evaluations to new situations.

However, it is evident that some learners did find the examination difficult and in many cases this is because learners were not prepared for the examination in terms of the use of key skills such as numeracy and literacy. Learners often found it difficult to put their ideas into good English and this resulted in them not communicating effectively what they were trying to say, thus losing marks. Many learners clearly had not had to complete a blank results table before and struggled to comprehend what column headings to place where, even when given the correct labels and data.

It was also apparent that some learners lacked basic equipment needed for the examination such as a calculator and ruler. This made it difficult for them to draw the graphs, bars and lines of best fit accurately and precise enough to be given credit. Learners who tried to complete the calculations without a calculator often wrote a whole series of numbers or part calculations in an attempt to get the answer. Some learners clearly had no idea how to rearrange a formula and tried to use the numbers given in a variety of ways in search of the answer.

Centres need to work with learners in assisting them with building their skills in sentence construction and writing methods, conclusions and evaluations. Reading the question may be self-evident, but many learners evidently did not do this and need to practice this. Also learners should have the opportunity to plan their own results tables during practical work so that they understand how variables and data should be presented. Learners need to be introduced to the command words through practicing exam technique and questions. Few learners appeared to understand that when they are asked to explain that they need to answer in more depth. Ensuring that learners have access to appropriate equipment during the examination will perhaps go some way to preventing learners losing marks unnecessarily.

Q1a

Most learners scored one mark here for identifying light meter as the piece of equipment needed to measure light intensity.

(a) Identify the piece of equipment they will use to measure the light intensity.

(1)

Light meter

However, a few learners evidently did not read the question properly and realise that the equipment for the experiment was shown in the stem of the question. Also answers such as 'volts' and 'solar panel' tend to suggest that learners were not reading the questions carefully enough

(a) Identify the piece of equipment they will use to measure the light intensity.

(1)

Volts

(a) Identify the piece of equipment they will use to measure the light intensity.

(1)

Solar Panel

Spelling was also an issue which was rather surprising as the correct spelling was given on the page.

(a) Identify the piece of equipment they will use to measure the light intensity.

(1)

light mette

Q 1b

Most learners were able to give at least one variable to be controlled - the light source being a popular choice.

(b) Chloe and Britney keep the length of the fibre optic cable the same.

Identify **two** other variables that will need to be controlled for this experiment.

(2)

1 light source

2 light meter

Many learners were able to give two appropriate controls.

(b) Chloe and Britney keep the length of the fibre optic cable the same.

Identify **two** other variables that will need to be controlled for this experiment.

(2)

1 Voltage of Power supply

2 Light Source used

A few learners gave vague answers about fair testing and it should be noted that learners would always be expected to qualify what is mean by a fair test, rather than just stating that something is fair.

(b) Chloe and Britney keep the length of the fibre optic cable the same.

Identify **two** other variables that will need to be controlled for this experiment.

(2)

1 So it is a fair test

2 So they how it works

Q1c

Most learners were able to name a risk associated with the experiment, however, few were able to link the risk with the appropriate hazard. Many learners tried to link the wrong hazard.

Although most learners identified electric shock or electrocution as a main health hazard they were unsure of the cause. A common misconception was that it is possible to get an electric shock from the optical cable e.g. "getting shock from the optical cable". The danger from using water near electrical equipment was also a frequent answer.

(c) It is important to be safe when carrying out an experiment.

Describe a health risk with this experiment.

(2)

You could get an electric shock off the fibre optic cable.

Some learners gave the precautions that you should take rather than identify the risks and hazards e.g. "wear goggles" "gloves" "hair up", "it is important to be safe by wearing goggles to protect your eyes"

1 mark

electric Shock

2 marks

The light intensity may be too bright for your eyes and could damage them or give you a migraine.

2 marks

With this experiment one health risk is possibly electercuation from the power supply.

0 marks

This might cause heat so you will need gloves. (2)

Q2

Learners generally performed well in this question, most identifying that the length of cable was the independent variable and that repeats were required to secure reliability. Many learners seem well prepared and understood the difference between the variable. However learners often did not say which control variables they would use and very few learners saying that they would draw a conclusion.

A lot of learners said plot a graph but they did not mention that they have to have enough results to draw the graph.

Common misconceptions in the question relate to some learners confusion about the independent variable- a number of responses talk about changing voltage rather than length of the cable. Many learners commented on repeating the test, though many did not explain why this was important.

The most common mark was 3, for identifying the independent variable was length, measuring the light intensity and then either saying repeats or plot a graph.

2 The aim of Chloe and Britney's next experiment is to find out whether the length of the fibre optic cable will affect the light intensity.

Write a suitable plan for this experiment that will give a full set of results.

In your answer you should include:

- a range and number of measurements that will test the aim of the experiment
- an explanation of why the range and number of measurements were chosen.

(6)

3 marks

collect a equiptment
.Low voltage powersupply
.Light source
.Light meter
5cm long Fibre optic cable
10 cm Long Fibre optic cable
15 cm Long Fibre optic cable
hook up the the Light Sorce to the power supple and keep it a 1.00 volt through-out the whole experiment, then place the diffirid leneths of cable , collect results from the Light meter and plot on a greath.

4 marks

Using the same low voltage power supply, light ~~sauce~~ source and light meter, get ~~a length~~ different lengths of fibre optic cables. Maybe starting at 5 inches and working at an inch at a time, till you get to 12 inches (1 ~~meter~~). go back and do the same measurements of cable 3 times ~~so you have a secure outcome~~. and work out the average light intensity. by adding up each result with that length and deviding it by how many results you got.

3a (ii)

Most learners were able to identify an appropriate piece of equipment to measure temperature, such as thermometer or data logger. There were however, a number of learners who could not correctly identify the piece of equipment needed

(ii) Name **one** piece of equipment used to measure the temperature of the water.

(1)

Thermometer

(ii) Name **one** piece of equipment used to measure the temperature of the water.

(1)

Conical Flask

(ii) Name **one** piece of equipment used to measure the temperature of the water.

(1)

~~Or Test Tube~~ Measuring Jug

Q3b

It was encouraging to see so many learners attempt to answer this question, although lots struggled to get the 2 marks, they were showing working and got credit for this e.g. 71-21, 50.

Many learners did the wrong calculations or were not dividing by 5 and some even dividing by 300 as there are 300 seconds in 5 minutes.

The most common misconception was to take the largest number and divide by smallest i.e. 71/21.

71 ÷ 21 = 3.4

3 °C per minute

It was evident that many learners did not have a calculator despite this being a must have on the paper. Commonly learners were therefore trying to work out the answer using a variety of methods.

In this example the learner has obviously put some time and effort into calculating the difference between 71 and 21 without the aid of a calculator.

Calculate the temperature change **per minute** for **propanol**. (2)

Start = 21
1 min = 31
2 min = 41
3 min = 51
4 min = 61
5 min = 71

50

= 50

50 °C per minute

1 mark

Calculate the temperature change **per minute** for **propanol**. (2)

~~50~~
~~21~~
~~31~~ – ~~ethanol~~

71
−21
51 – propanol

51 ÷ 5 = 10.2

10.2 per minute

The learner incorrectly calculates temperature difference as 51. The learner has then divided this by 5 and is given 1 mark for this.

The correct method:

2 marks

Propanol : 71 - 21 = 50 in 5 minutes

50 ÷ 5 = 10

Propanol = 10°c per minute.

10 °C per minute

3c

This graph question was generally done well. Learners demonstrated some good graph skills. They drew the line of best fit and plotted almost all points correctly.

The biggest error was a result of not drawing the scale on the y axis correctly to 55/60 or not putting units on the axis. A small number of learners made the mistake of drawing a bar graph, or put the dependent variables along the y axis as the numbers from the table. There were some cases where they plotted the temperature values from the table on the Y axis. However, learners were not penalised if the plotted the axes reversed.

(c) James and Gary repeated the experiment for ethanol and measured the temperature of the water every minute for **five** minutes.

The results are shown in the table.

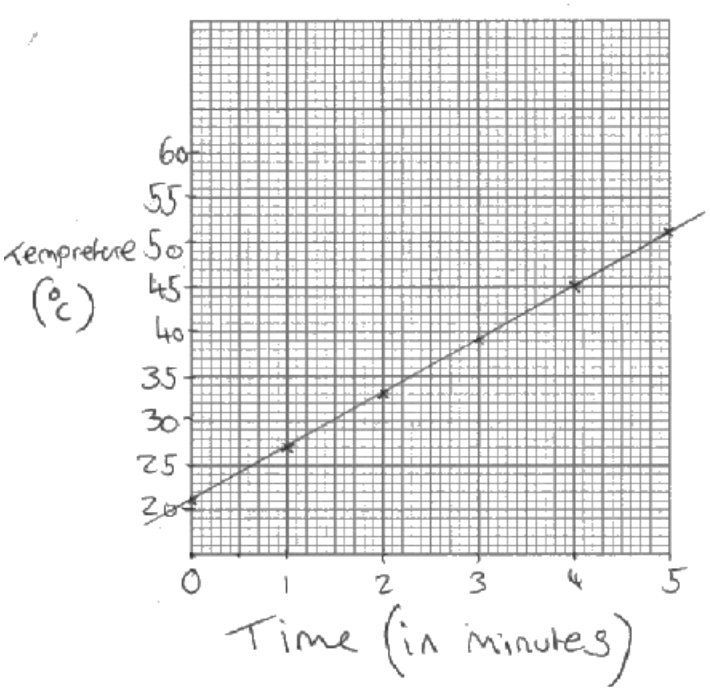
Time in minutes	0	1	2	3	4	5
Temperature (°C)	21	27	33	39	45	51

Plot a line graph of these results.

Use the graph paper below.

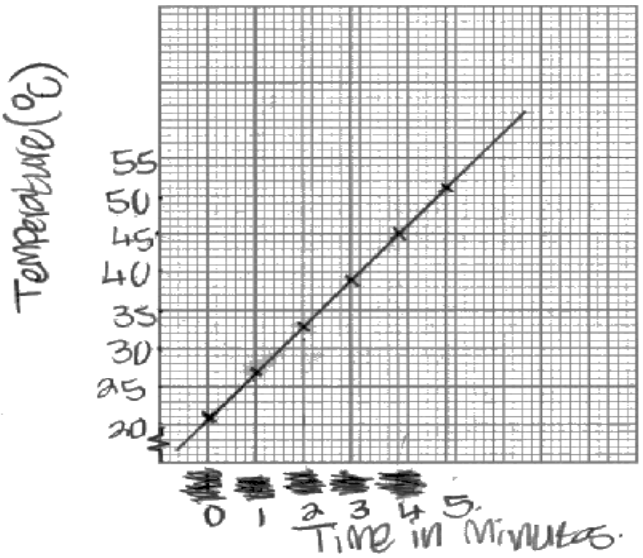
(6)

6 marks. All correct – although the y axis doesn't start at 0, this is appropriate in this case and the learner was not penalised.

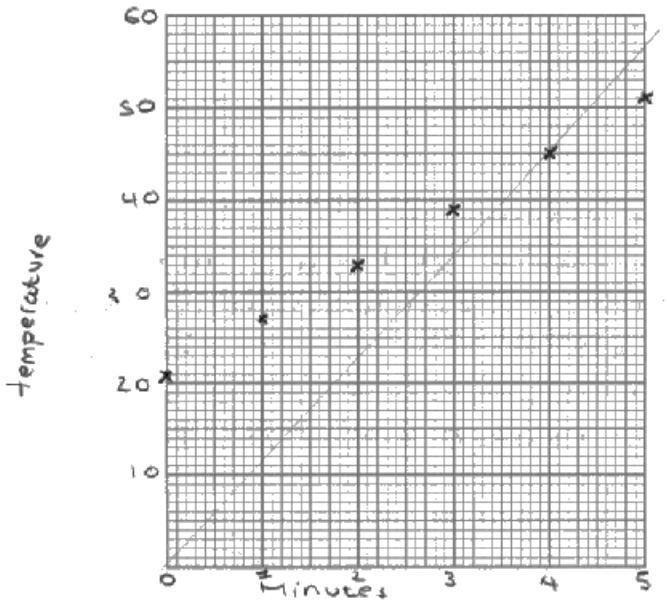


The most easily lost mark was not using an appropriate size for the axes; the axes should have covered more than half the available space along each axes or incorrect labelling of the axes. Another most common mistake was not having 0 in correct place i.e. starting half a square in from the corner.

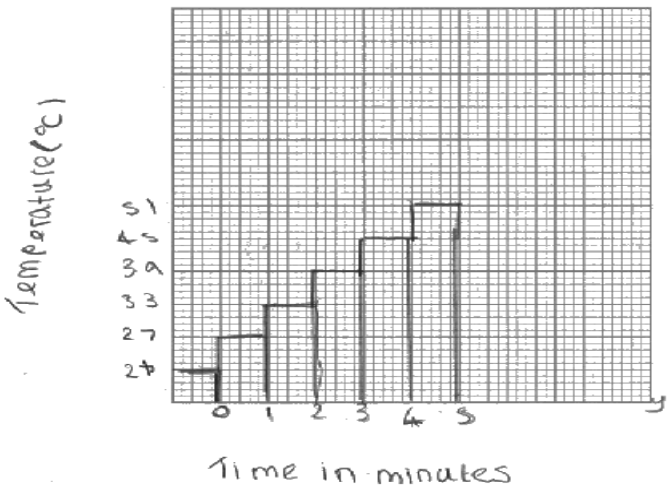
5marks. A mark was deducted for scale not being appropriate The graph should cover more than half of the paper. This graph appears to do this but because the learner has chosen to place the zero one square in, the actual plotted graph covers only half of the paper. Therefore the mark available for scaling was not awarded.



4 marks – learner does not score axes labelling mark or line of best fit mark.



1 mark - The learner has unfortunately plotted a bar chart, despite the question instructing learners to plot a line graph. The learner has also plotted temperatures values from the results table directly onto the y axis. Also the scales do not cover over half of the axes. It does appear that they have in the first instance, but if you measure between the 0 and 5 on the x axis you can see that in fact the scale does not cover half of the available space on either axes. The learner only gains the axes labelling mark



3 (d)

Most learners scored 1 on this question for commenting on the 10 degree difference at the end of the test or for a similar numerical comparison. When learners scored 0 is was usually because no comparison was made between the two substances during the answer. This question was answered by most with the data repeated from the table and many just repeated the stem of the question and did not add any further detail.

(d) James and Gary then repeated the experiment for methanol, which is another fuel.

Both sets of results are shown in the table.

Time (minutes)	Temperature (°C)	
	methanol	ethanol
0	21	21
1	25	27
2	29	33
3	33	39
4	37	45
5	41	51

Describe **two** features of the data that show ethanol gives off more heat energy than methanol.

(2)

The learner has described how methanol and ethanol temperatures change meeting the first alternative marking point. 1 mark

~~After~~ Both Methanol and Ethanol start at 21°c at 0 minutes, ~~then~~ after 5 minutes Methanol is on 41°c and Ethanol is on 51°c and straight away after 1 minute ethanol is on 27°c and Methanol is only 25°c.

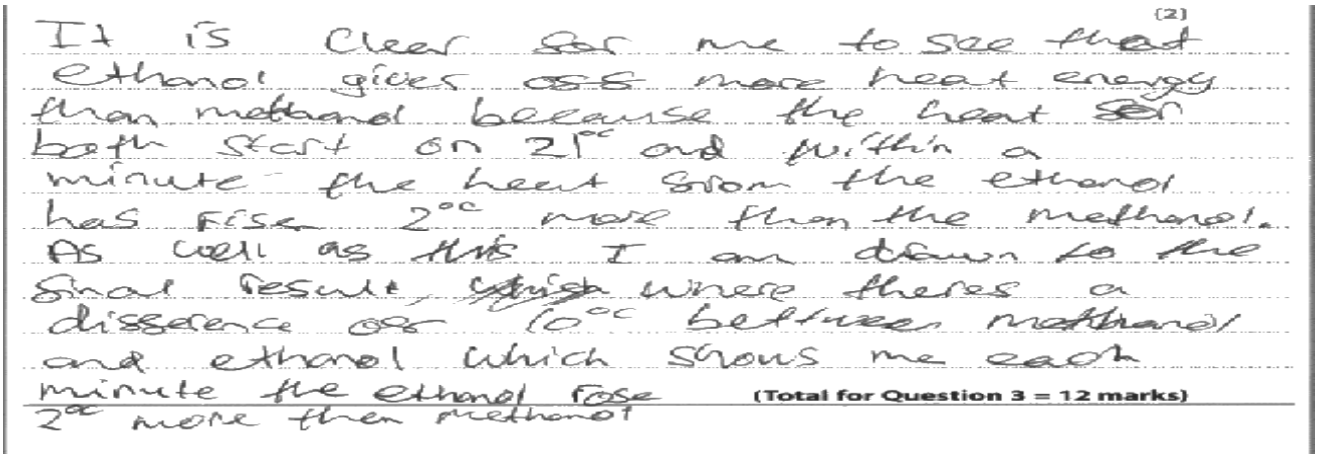
1 mark. The learner has said that ethanol gives off more heat energy than methanol every time meeting the first marking point.

two features that ethanol gives off more heat energy than methanol is that in every minute going up the heat of ~~Ethanol~~ is higher everytime compared to the results of heat coming off methanol, also the speed of heating up is much faster than the speed of methanol heating up

0 marks

methanol is a higher fuel then ethanol because it has lower Celsius than ethanol. (2)

2 marks - The learner has correctly identified that the temperature of ethanol rises faster than methanol and also the difference in temperature after 5 minutes.


It is clear for me to see that ethanol gives off more heat energy than methanol because the heat set both start on 21°c and within a minute the heat from the ethanol has risen 2°c more than the methanol. As well as this I am drawn to the final result, which where theres a dissidence of 10°c between methanol and ethanol which shows me each minute the ethanol rose 2°c more then methanol

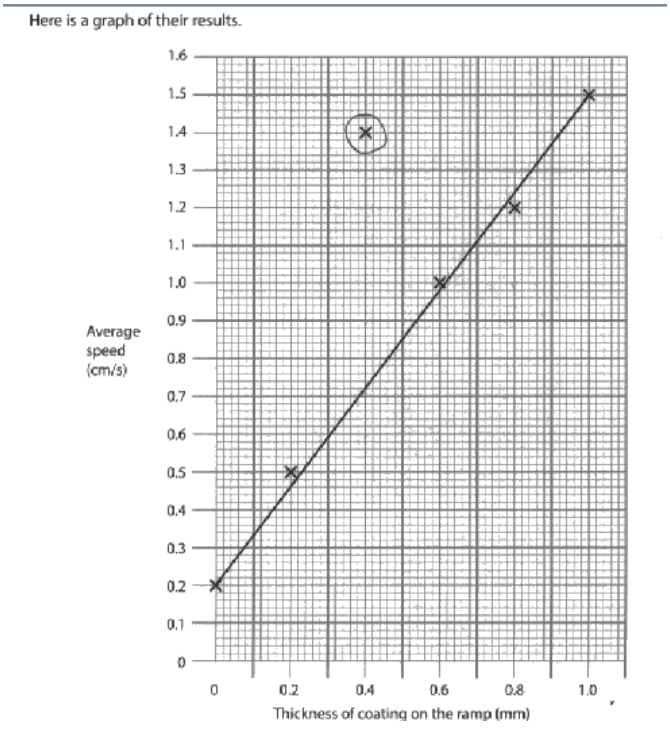
(2)

(Total for Question 3 = 12 marks)

4a (i)

Most learners were able to identify the anomaly and circle it correctly. A few learners circled the point at 0.6 as they were perhaps confused between a variation in the data and an anomaly.

1 mark



4 a (ii)

Many learners did well on this question with many gaining at least one mark. The most common answer was inaccurate measuring or recording of results or thickness of coating.

Where the learner lost marks this was because some learners misunderstood the question and explained what an anomalous result is "because one of them is not on the line it's far away from the others"

There were quite a few general responses not specific to this experiment – "may not have done the experiment the same", "used faulty equipment", "not following the method", "done the experiment wrong".

Some referred to repeat results "because they only did the experiment once". There were also some vague answers referring to "it" such as "chance of it sticking".

Also comments such as "could have rolled the marble faster" meant that it was unclear whether they are commenting on the anomalous result or if marble was pushed with more force.

1 mark – for 'they didn't calculate the average correctly'.

(ii) Give **two** possible reasons why the anomalous result occurred.

(2)

Calculate the average

they didn't ~~do~~ it correctly

the experiment went wrong

2 marks - 1 mark for inaccurate timing and 1 mark for the ramp has moved which is an acceptable alternative to the height of the ramp has changed.

(ii) Give **two** possible reasons why the anomalous result occurred.

(2)

They may have not timed it right and the ramp could have moved.

2 marks - Less sticky coating was added is acceptable for the thickness of the coating is not even/not correctly applied and the marble is a different size is acceptable for changing the marble.

(ii) Give **two** possible reasons why the anomalous result occurred.

(2)

less sticky coating was added

different size of a marble.

2 marks

(ii) Give **two** possible reasons why the anomalous result occurred.

(2)

- Didn't have the same amount of non-stick coating.
- wasn't set off at the same place as the other.

4 b (i)

Learners wrote fairly long answers to this question although a simple "increase" would have sufficed.

Some common misconceptions for this question was that the increased thickness would increase friction and therefore slow down marble, showing that they had not correctly read the result from the graph but were forming their own opinion based on their own knowledge e.g. "friction becomes greater and slows the marble down" Also some had assumed that the graph showed the time taken rather than speed so believed that the marble slowed down as it took longer to get down the ramp e.g. "the thicker the coating the longer it took for the marble to roll down". Some learners didn't refer to speed e.g. "becomes more slippery"

Despite the fact that "increased" is stated in the question there were some interesting spellings given "incressed", "incrised", "increeses". Learner should be encouraged to ensure that they are spelling key words correctly. In this context poor spelling was accepted as there was no other similar word that it could be mistaken for. However, learners may lose marks if the marker cannot determine if the learner is clearly given the correct answer.

0 marks

(b) (i) State what happens to the speed of the marble as the thickness of the non-stick coating increases.

(1)

The speed of the marble slows down because the stick surface gives no fiction to force the marble fast.

1 mark

(b) (i) State what happens to the speed of the marble as the thickness of the non-stick coating increases.

(1)

The marble goes quicker

(b) (i) State what happens to the speed of the marble as the thickness of the time, non-stick coating increases.

(1)

As the thickness of the non-stick coating increases so does the marbles speed in cm/s.

(b) (i) State what happens to the speed of the marble as the thickness of the non-stick coating increases.

(1)

As the thickness of the non stick coating increases the average speed of the marble also increases.

4 b (ii)

The majority of learners were able to calculate the correct answer. The common mistake was to input the values into the equation given without re-arranging, resulting in a value of 0.06. A lot of learners got the answer 6 but showed no working out. There were no major issues with this question other than a few learners who got the incorrect answer, although the concept of substitution was correct. A few learners just tried lots of combinations on the numbers and not deciding on the correct answer.

Again some learners were hampered by not having a calculator.

2 marks

Calculate the distance the marble travels in 10 seconds.

(2)

$0.6 = \frac{?}{10s}$

$10 \times 0.6 = 6$

$0.6cm/s \quad \frac{6cm}{10s}$

6 cm

Calculate the distance the marble travels in 10 seconds.

(2)

D / S T

$0.6 \times 10 = 6.$

$S \times t = 0.6 \times 10.$

6 cm

1 mark

Calculate the distance the marble travels in 10 seconds.

(2)

$0.6cm/s = \frac{}{10}$

$0.6 - 10 = 9.4cm$

9.4 cm

0 marks

$\frac{0.6}{10} = 0.06$

0.06 cm

Q5a

A large number of learners scored the full 3 marks with some just losing out on 1 mark, as they failed to put the correct headings "concentration" and "time", although given in the question. Alternatively they did not put numbers in ascending or descending order e.g. 1.0, 0.2, 0.4, 0.6, 0.8 was a common order given.

Common misconceptions included assuming the M stood for metres of magnesium, or minutes.

0 marks

minutes	seconds
10	10
~~4~~	0
5	20
6	50
8	30

1 mark

(a) Complete the table for these results.

Concentration	Time

2 marks - The learner has the column headings correct and has place the data in the correct columns. However they have not put the numbers in ascending or descending order.

concentrations of hydrochloric acid (.)	time taken (seconds)
1.0 M	10 s
0.2 M	120 s
0.4 M	80 s
0.6 M	50 s
0.8 M	30 s

3 marks

(a) Complete the table for these results.

Concentration(m)	Time(s)
0.2m	120s
0.4m	80s
0.6m	50s
0.8m	30s
1.0m	10s

5 (b)

Few learners scored more than 2 for this question. They could normally state two ways to deal with the anomalous results, but did not expand on these points.

Some learners misinterpreted the question and described possible causes of the error, not ways to resolve it. Learners frequently scored the first point of the linked pairs, but learners rarely achieved the second linked marking point. The third linked pair – 'plot the line of pest fit' was the least frequently awarded.

Common misconceptions involved learners suggesting that you should guess or make up the incorrect value. Most learners said that experiment 2 should be ignored, although some did not specify anything about the mean or average. Many learners said "redo the experiment".

0 marks - They could leave experiment 2 out and just use 1 and 3 is not enough to award a mark as they have not referred to calculating a mean or an average

The result for experiment 2 at 30°C is anomalous.

Explain **two** ways Samantha and Luke can deal with the anomaly at 30°C.

(4)

1 They could leave experiment 2 out and just use Experiment 1 and 3

2

0 marks

Nothing creditworthy here.

The result at 30°C being an anomalous result is a repeat of the stem of the question and therefore not creditworthy

Going over the test to see where they went wrong is insufficient for the idea of repeating the experiment at 30°C or not using this result when calculating the mean

1 Because 30°c is anomalous maybe go over that test and see where they went wrong as its to random to make sense.

2 Samantha and [redacted] Luke could think back to when the done the experient and think of ways it went wrong.

2 marks - They can do the test again is sufficient for repeat the test at 30°C and they have the linked mark to this as they have said to calculate an average. If the links are clear it does not matter where they put it on the page

Explain **two** ways Samantha and Luke can deal with the anomaly at 30°C.

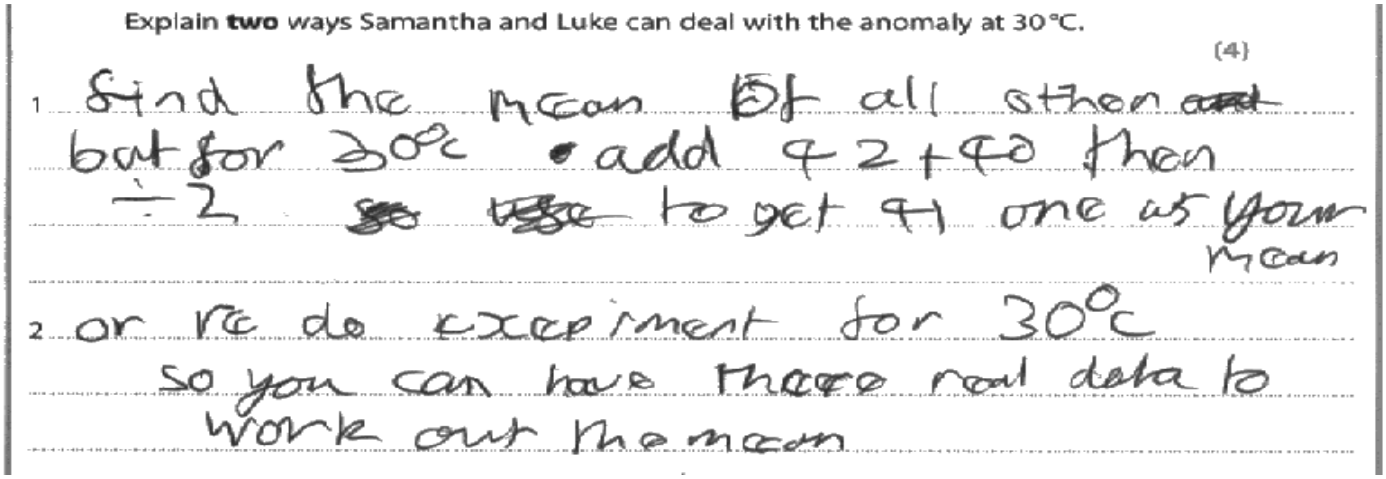
(4)

1 They can do the test again to correct it

2 They can find out the adverage of the numbers.

3 marks - For 30°C add 42 and 40 and then divide by 2 is an explanation of the method to calculate the mean without using the result from experiment 2 for 1 mark

To redo the experiment at 30°C is also creditworthy for 1 mark and they have then mentioned calculating the mean for a further linked mark


Explain **two** ways Samantha and Luke can deal with the anomaly at 30°C.

(4)

1 find the mean of all sthen ~~and~~ but for 30°c add 42+40 then ÷2 ~~to~~ to get 41 one as your mean

2 or re do experiment for 30°c so you can have more real data to work out the mean

Q6a

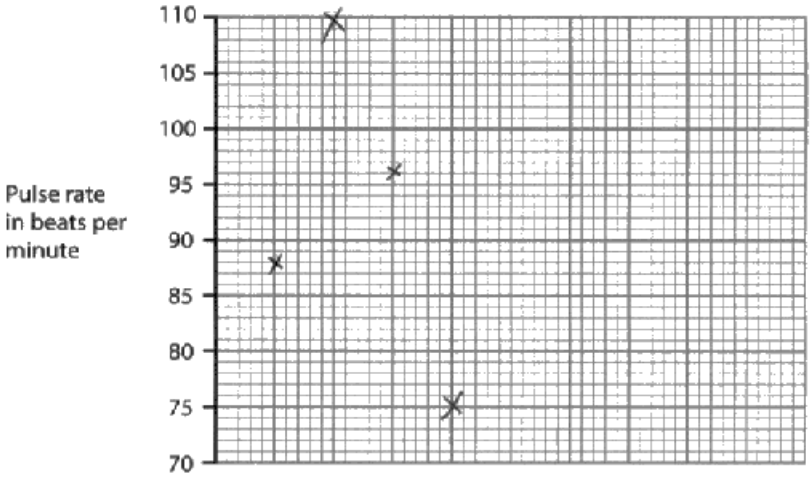
Most learners were able to gain at least 1 mark for this question, with most learners understanding that measuring the initial resting pulse rate was needed. Fewer learners understood that resting between each exercise was needed to ensure a fair comparison could be made.

6 b (ii)

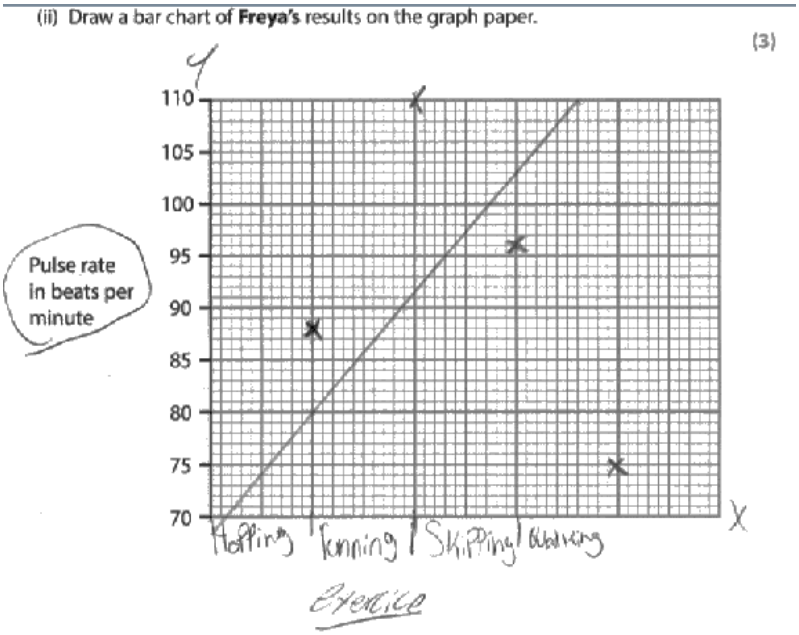
Most learners were able to plot the bar chart correctly. However, some learner's plotted X's instead of bars and were then often trying to join the points up. Some learners were hampered by apparently not having a ruler, this lost some learners marks as they were not precise enough in plotting the bars.

0 marks

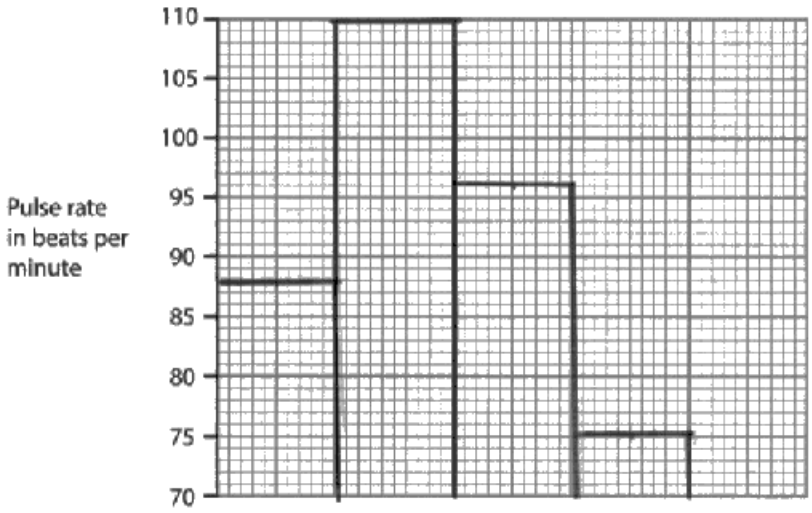
(ii) Draw a bar chart of **Freya's** results on the graph paper. (3)



1 mark - This learner correctly plots the points. However, the question specifically asks for a bar chart. The mark scheme requires bars correctly plotted. As there are no bars these marking points cannot be scored. The learner is awarded a mark for correctly linking the points to the activity.

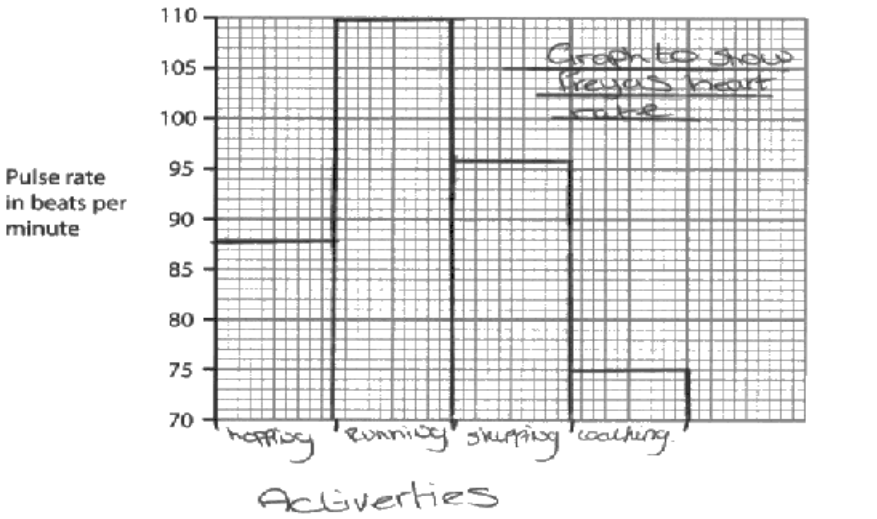


2 marks – no bar labels, but plotting is correct



3 marks

(ii) Draw a bar chart of **Freya's** results on the graph paper. (3)



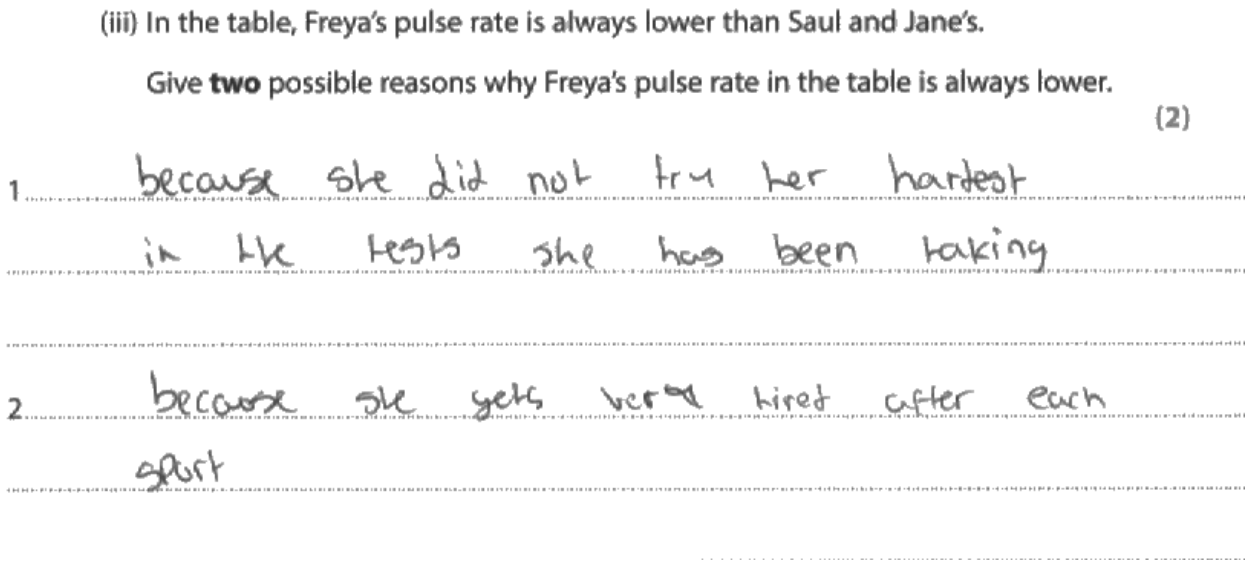
6b (iii)

This question was generally well answered. The majority of learners scored at least 1 mark. However, the most common error was in saying more than one way the girl could be fitter than the others which only counted for 1 marking point.

A large number of learners focused on the health related points rather than methodological issues. A number tried to do this for both of the points.

Common misconceptions included stating that Freya was fitter for 1st marking point, and then saying the others were less fit for the 2nd marking point not realising that they were just giving the reverse argument, which would get them no further credit. Some learners also mentioned that she did not try her hardest. Only a few said that her resting pulse was lower or that she miscalculated her pulse rate.

1 mark – learner gives the same marking point.



(iii) In the table, Freya's pulse rate is always lower than Saul and Jane's.

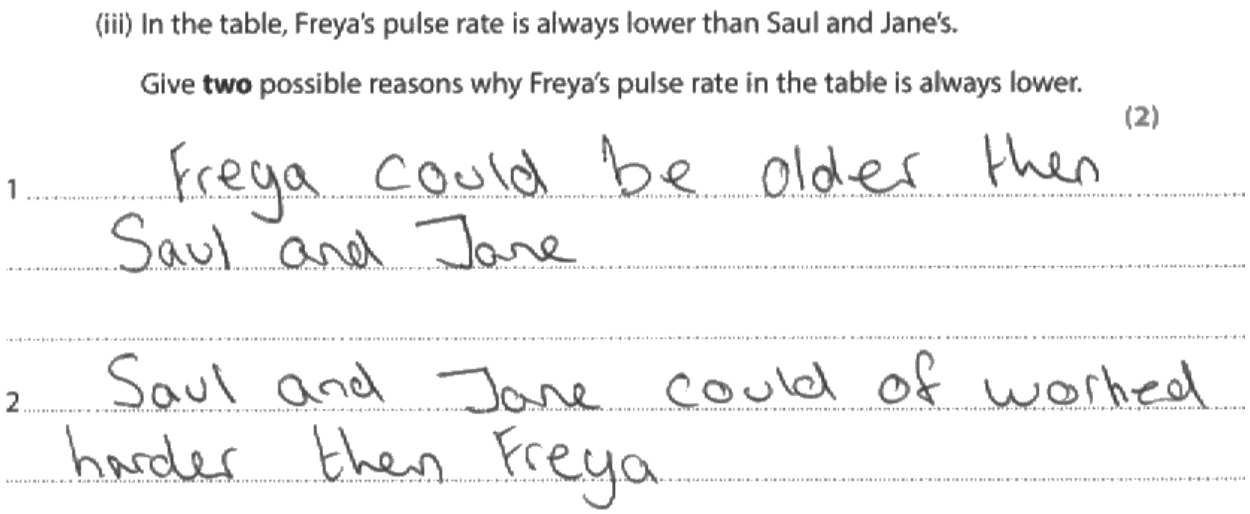
Give **two** possible reasons why Freya's pulse rate in the table is always lower.

(2)

1 because she did not try her hardest in the tests she has been taking

2 because she gets very tired after each sprint

1 mark – for second point. A common misconception amongst learners was to discuss the age, weight or race of the learners.



(iii) In the table, Freya's pulse rate is always lower than Saul and Jane's.

Give **two** possible reasons why Freya's pulse rate in the table is always lower.

(2)

1 Freya could be older then Saul and Jane

2 Saul and Jane could of worked harder then Freya

2 marks

(iii) In the table, Freya's pulse rate is always lower than Saul and Jane's.

Give **two** possible reasons why Freya's pulse rate in the table is always lower.

(2)

1 She could be fitter than Saul and Jane.

2 She might not of worked as hard as Saul and Jane.

2 marks

(iii) In the table, Freya's pulse rate is always lower than Saul and Jane's.

Give **two** possible reasons why Freya's pulse rate in the table is always lower.

(2)

1 Her pulse rate could be lower than their's before they started the exercise's.

2 Freya might not have put so much effort in as the other two did.

Q7

Most learners got 1 or 2 marks for this question by describing the pattern of results and linking it into pulse rate increasing with exercise. A few learners were able to make a more detailed account of how accurate the hypothesis was.

Generally the most common answers were from an analysis of the data, with comments relating to the positive correlation and describing that heart rate increased with exercise. Many attempted to support their conclusions with data from the graph or table. However, it was clear that many learners struggled to organise their ideas and to write a coherent piece of extended writing.

A common misconception was to support Jane's hypothesis. Many here said that the hypothesis is strong although they could not justify why. Some said it was weak but did not give a strong reason. Only a few said there was a positive correlation but they did not explain any further. Learners were able to gain marks for some simple statements about the data or were able to explain a simple point. Few learners were able to link their analysis of the data back to the idea of the hypothesis being vague or to draw correct conclusions.

0 marks The learner has said the hypothesis is true, but has used no evidence to support this.

Jane made a hypothesis for this experiment.

Hypothesis:

'I think the more you exercise the more it will affect your heart'

Freya thinks Jane's hypothesis is weak. Analyse Jane's hypothesis.

- You may wish to describe any trends or patterns in the data in your answer.
- You should include a conclusion.
- Use the evidence in the tables and graph to support your answer.

(6)

Her Hypothesis is true it might actually affect your heart if you do too much exercise it might but it depends on how much exercise you do in a week to be honest.

0 marks

Janes point is valid because janes fitness is much higher than freyas and as you can see on the graph. Saus Jane done the exersize more with greater speed because her heart rate is 118 and freyas and saus are 114 (saul) and 11 (freya) the proves that janes hypothesis is correct.

1 mark - The learner identifies that Freya's pulse is lower, but thinks this is because she is less fit. The learner does attempt to link the pulse rate to exercise, but does not link correctly to the hypothesis.

The learner has said that both Jane and Saul's pulse are faster than Freya, however this is just the reverse argument for 'Freya's pulse rate is lower'.

From the data they have collected you can see Freyas ~~heart~~ the pulse is lower and I think it is because she is less fit than Jane and Saul. I would say that Janes Hypothesis is correct as both Jane and Sauls pulse are faster than Freya and Freya also had the lower pulse because She wasn't doing as much exersize as Jane and Saul.

1 mark - The learner has said that the hypothesis is weak, but this is a repeat of the stem. The learner does identify that Saul and Freya's heart rate are always lower than Janes', but does not give a plausible reason to explain this. The learner does say exercising helps your heart, but not how.

Janes hypothesis is weak because you need to excercise to pump your blood around your body and to keep a good pulse rate. Excercising helps your heart, Saul and freya's heart rates are always lower than Janes this might mean that she checked her pulse rate wrong.

You should always excercise because it helps with your heart rate and also helps your body a lot!

2 marks - The learner has said the more you exercise the more your pulse increases which is a simple point. The learner has recognised that the hypothesis is vague and has explained this.

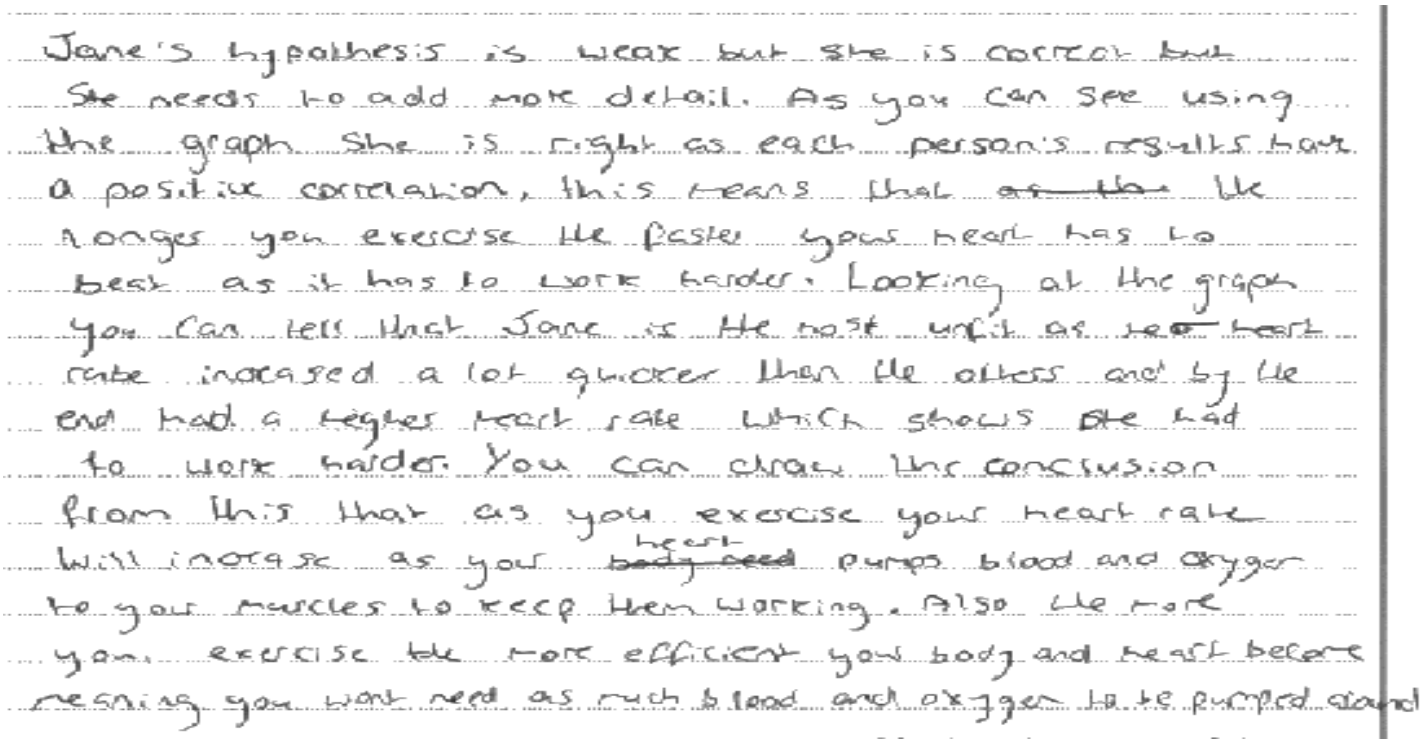
her hypothesis is right due to the results in the table and on the graph as when they do more excerise there puse gets faster, but janes hypothesis could be more detailed- for example 'the more excersie you do the more likely it is for your pulse rate to be faster'

3 marks - The learner has attempted to improve the hypothesis by attempting to explain how it affects the heart and has attempted to link it to the trend on the graph which is inaccurate. The learner has then written a conclusion (that the time spent walking increased the pulse rate increased) and used data to support their answer. This has enough detail for a merit level answer however due to some inaccurate science only 3 marks are awarded.

A better hypothesis for this experiement would be "increasing the time will increase the heart rate, doubling the time will double the heart rate"

To conclude,
The graph shows that time spent walking increased, the pulse rate also increased. It shows that Jane had a higher Pulse rate because at 6mins Janes pulse rate was at 105 beats per minute whereas Saul was at 101 and Freya was at 98 beats per minute. Jane had a higher pulse rate, was due to her respiration, She breathed in more oxygen in order to pump it around the body and for the muscels to function more properly. Changing the intensity of excercise will increase the heat rate as it will be faster.
The trend on the graph is directly proportional as both the time and pulse rate increased.

5 marks - This learner has identified that the hypothesis needs more detail, but has not expanded on why this is. The learner has used supporting data trends and used this to correctly identify that Jane is likely to be less fit than the others.



Jane's hypothesis is weak but she is correct but She needs to add more detail. As you can see using the graph She is right as each person's results have a positive correlation, this means that as the the longer you exercise the faster your heart has to beat as it has to work harder. Looking at the graph you can tell that Jane is the most unfit as her heart rate increased a lot quicker then the others and by the end had a higher heart rate which shows she had to work harder. You can draw the conclusion from this that as you exercise your heart rate will increase as your ~~body need~~ heart pumps blood and oxygen to your muscles to keep them working. Also the more you exercise the more efficient your body and heart become meaning you won't need as much blood and oxygen to be pumped around

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