Examiner's Report/
Lead Examiner Feedback

November 2015

NQF BTEC Level 1/Level 2 Firsts in Applied Science

Unit 8: Scientific Skills (20474E)

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November 2015
Publications Code BF042814

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.

Overall comments

Learners were well prepared for answering some aspects of this paper. It was evident that learners were aware of what was required to answer the shorter questions. Learners were able to read data from graphs and tables with confidence and also to read scales. They continue to be able to order data into tables with little difficulty in most cases. Learners remain confident in calculating averages and identifying anomalous data. They were able to give the factors that should be controlled in planning an experiment and the measurements that should be recorded. In this series learners struggled with drawing good curves of best fit to points on a graph. They also found calculations involving area under graphs a challenge as well as calculations involving algebraic transposition and substitution. In many cases learners do not show the working that was used to arrive at an answer. Question 4 provided most of the calculations in the paper and the examples given in this report all model the approach that learners should adopt in answering calculation questions. Learners continue to find analysis of data a challenge. Learners are not clear as to the difference between a risk and a hazard.

Learners are still uncertain as to the difference between a description and an explanation. This has limited the marks that learners have been able to access for several series and is a matter that centres need to address. The term 'Explain' requires the learner to provide a justification of a point and the answer must contain some reasoning as an explanation. In this examination all of the questions where an explanation was required were poorly answered by learners. Centres are advised that in preparing learners for the examination that practice should be given of this type of question, so that the learner is aware of what is required for a full mark answer.
It was evident that some learners had not read the question set prior to answering and thus gave an incorrect or inappropriate response. In other cases learners drifted off the point of the question and gave unnecessary details. Often learners did not use the mark allocation that is identified in the question to guide their answer. In many cases where two marks and more were available, very simple single mark answers were given. Centres could assist learners in drawing to learner's attention the mark allocations during preparation for the examination.

This examination is based on practical activities that are part of the specification. In some cases it was clear that learners were unaware of some of the tasks. This was particularly the case in Q8, where many learner answers were based on the idea that the thermistor was supplying heat to the water and that the multimeter was a power supply. A full variety of practical activities that give learners opportunities to devise experimental plans, use a variety of equipment and techniques and then devise conclusions based on the evidence collected is an ideal way to prepare for this examination.

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	13	21	29	38

Feedback on Specific Questions

Q1ai

This first question on the paper was designed to be a straightforward start to the paper, yet it proved a challenge to many learners. The learners were given a diagram of a measuring cylinder and asked to name the item, this example scores the mark , however, a significant number were unable to answer the question and others gave answers such as 'measuring beaker' or other equipment such as 'test tube' and even 'thermometer'.

(a) (i) Identify the apparatus shown in the diagram.

(1)

Measuring cilinder

Q1bi

In this question learners were asked to identify a hazard. The stem of the question stated that Bacteria were a hazard and the question asked for an additional hazard. Many learners gave the answer 'Bacteria' for this despite it being made clear in the stem of the question that an additional hazard was required. A correct response is given below that scored the mark.

(i) Identify **one** other possible hazard when carrying out this experiment.

(1)

Working with acid is very Dangrous

Some learners gave a hazard and a risk and hence scored no mark as the response below shows.

(i) Identify **one** other possible hazard when carrying out this experiment.

(1)

The acidic paper dishs could go on your skin a burn or irritate you.

The inclusion of the idea that the acidic paper discs burn or irritate is a risk. The learner therefore gave both a hazard, (the acidic discs) and the consequent risk; it was therefore unclear as to whether the learner understood the difference between the terms. The learner had not followed the instruction in the question, which was to give a hazard.

Q1bii

This question asked for the risk involved in the experiment. Risks relate to the effect on a person, in this case from the hazard of being exposed to the bacteria. The risk would therefore be 'illness' or 'disease' or 'infection' or an equivalent idea. In many cases learners were able to give this kind of response.

(ii) State a risk of using bacteria. (1)

If it gets into your body then it can cause infection.

Q1c

Learners were generally able to give at least one of the control variables. The answer below gives two that were often seen. The example scored 2 marks.

State **two** variables that she will need to control. (2)

1 Same values of ph (1, 4, 7, 14)

2 Same amount of bacteria in the agar plate

Q2a

Many learners were able to identify that the mass was the dependent variable. Some learners considered the mass hanger as the answer, but this was a control variable. It is the masses added to the hanger that is the dependent quantity. A significant minority considered the thread as the answer.

Q2b

This six mark question was found to be a challenge for many learners, as it was in the previous series in June. Learners were able to score marks for identifying ranges and for recording the variables appropriately. The other marks allocated in the mark scheme were more problematic. There were some good responses, such as the one below.

once you have all the equipment you must carefully place the thread onto the aparatus. once securely fasened, a mass hanger must be added to a mass. starting with one weight added to the hanger, you must then carefull place that onto the thread, write down on paper how large the mass was and also write the thickness of the thread. keep Repeating by changing/Increasing The weight in which the thread can hold. once the thread snaps write down the final weight. Repeat the whole process 3 times with 3 different threads and gradualy Increas the mass added to the threads

(Total for Question 2 = 7 marks)

This scores marks for adding masses to the mass hanger. Then for carefully placing the masses, and then for recording the mass to break the thread. Finally for using a range of threads. Many learners gave an answer such as this. In many cases learners started with a description of the equipment and how it was put together with hazards and risks identified. There were no marks for these points. This is a good example of where learners can stray off the point of the question and include details that are not creditworthy.

Q3a

Learners scored well in this question. Most were able to identify that the energy given out resulted in a temperature increase. A typical creditworthy response is given below.

(a) State how the results show that energy is given out in this experiment.

(1)

The temperature went up by 11 °C, this shows that energy is given out.

Weaker learners repeated back the information in the table without saying anything about the temperature increasing.

Q3b

This item scored well. Learners are now well practised in tabulating date that is given in a variety of forms. In this case the data had to be given in ascending order of value of temperature. Many learners did this; however some did not, and placed the temperatures in the order given in the question. In some cases learners did not give appropriate headings to the columns. Some learners used units as the column headings which was not creditworthy.

Q3c

This two mark question was a challenge for some learners. Many were able to score the mark relating to an increase in energy with an increase in mass, but few were able to quantify this. The response below was worth two marks.

Describe the pattern shown in these results.

(2)

As the mass goes up in 0.1g the energy transferd in water goes up in 480 J

Many learners did not add the last part. This is a good example of a situation where learners gave a one mark answer in a situation where a few more words would have given two.

Q4aii

This calculation worth two marks required learners to read data from the graph, and perform a subtraction. Many learners could do this. An example of a good two mark answer is given. The learner has identified the two values from the graph and has then performed the subtraction. If the answer 5 was given alone this was also credited.

(ii) Use the graph to calculate the change in speed of the electric car between 65 and 90 seconds.

Show your working.

(2)

24 − 19

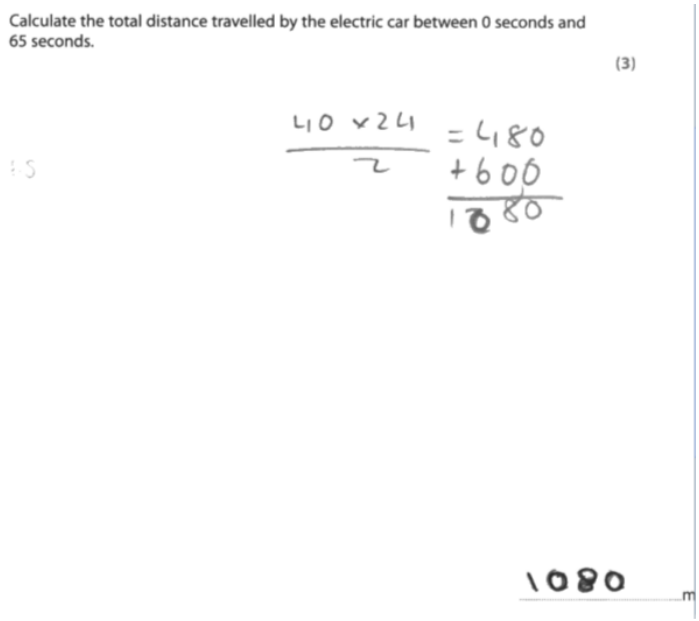
24
19
05

It changes by 5 m/s

5 m/s

Q4b

Learners found this three mark calculation challenging. Learners were given the relevant relationship for finding the area of a triangle. Many learners found difficulty in using the relationship. In order to gain full marks the learner had to add the area of the triangle to another area that was given. Most learners were not able to go through these steps and obtain the correct answer. A correct three mark answer with working is shown.


Calculate the total distance travelled by the electric car between 0 seconds and 65 seconds.

(3)

$\frac{40 \times 24}{2} = 480$

$+600$

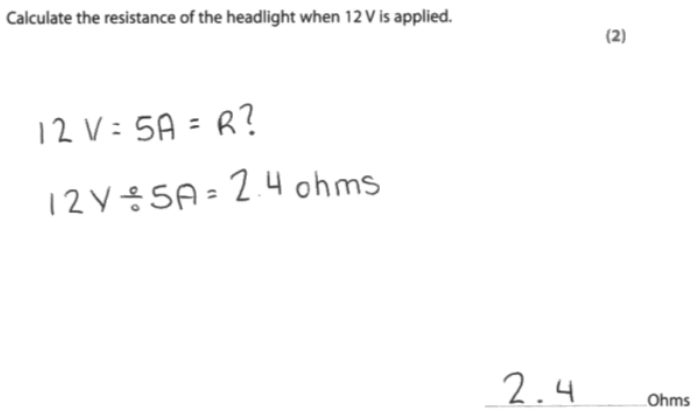
1080

1080 m

Learners on occasion gave an answer on the answer line without working out being shown. In cases where the answer was wrong some learners may well have missed out on a working out mark. Learners should always show their working.

Q4c

This calculation required learners to transpose an equation and then substitute in values. Some learners did this and got the correct answer, however there were many who found the rearrangement difficult and therefore gave an incorrect answer with no working. A correct answer with working is shown below. This scored two marks.


Calculate the resistance of the headlight when 12 V is applied.

(2)

12 V = 5A = R?

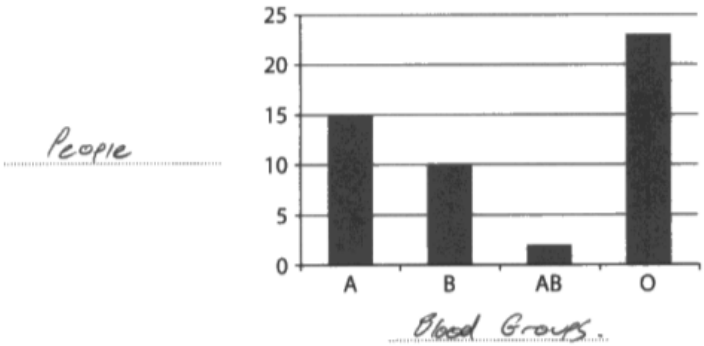
12 V ÷ 5A = 2.4 ohms

2.4 Ohms

In many cases learners multiplied the numbers to obtain 60. Such answers scored no marks.

Q5ai

Learners were required to label the axes of a graph. Many learners were able to do this, but a significant number did not do this correctly. Some learners labelled the axes 'x and y' and missed the point of the stem of the question. It was evident that some learners went straight to the question command line without reading the stem of the question which named the variables being graphed. A correct response is shown below worth both marks.



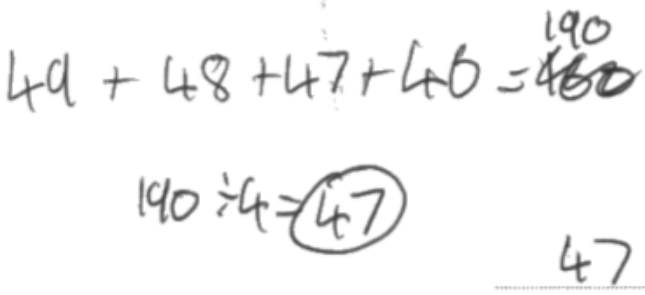
Q5b

This is the first time that learners have had a pie chart to complete. Learners answered the question well. Many learners scored both marks by being able to correctly partition the segments and then label them correctly. It was evident that weaker learners found this a challenge and were unable to divide the segments correctly.

Q6a

The final calculation on the paper was well answered. This required learners to calculate an average and this was done confidently by nearly all learners. An example is given below.

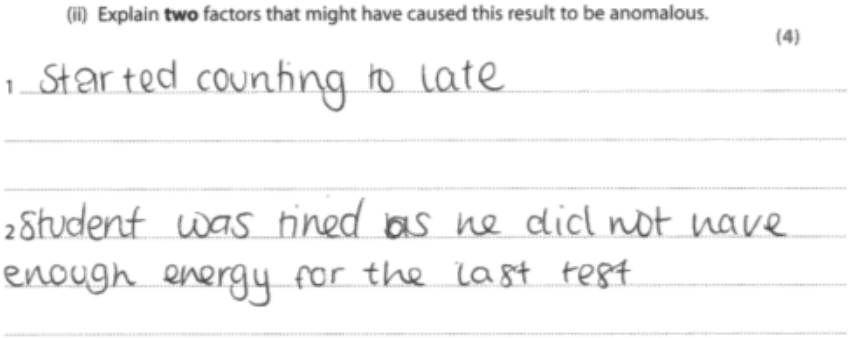
(a) Calculate the average number of step-ups per minute completed by student 1.



In this case the learner scored both marks as the marks were allocated for the addition to 190 and the division by 4. The learner has incorrectly rounded the answer to 47, because working had been shown both marks are scored. In some cases learners gave an answer of 47 on the answer line without working and in this circumstance no marks were scored. The answer in the mark scheme was 47.5 and an answer of 48 was accepted as this is correct rounding. Centres should give learners opportunities to correctly practise rounding in preparation for this paper.

Q6bii

This four mark question was very challenging to the learners. The command word used in the question was 'explain'. Learners therefore had to give a reason for the factor chosen that caused the anomaly. In the vast majority of cases one and sometimes two factors were identified, but they were not explained. This limited most learners to a maximum of two marks. The response below gained three marks. The first factor is not explained so scored one mark, and the second factor identified is explained and hence it scored two marks.

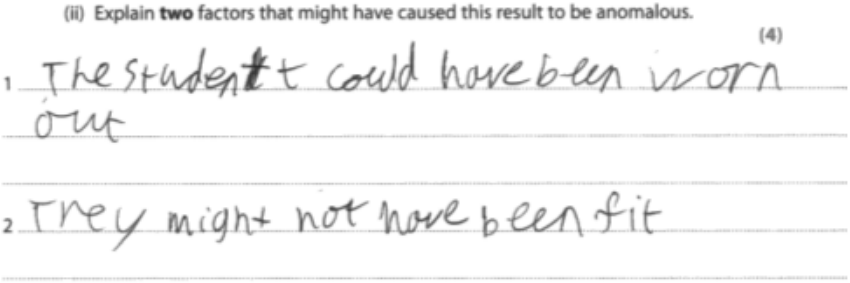

(ii) Explain **two** factors that might have caused this result to be anomalous.

(4)

1 Started counting to late

2 Student was tired as he did not have enough energy for the last test

Some learners gave two responses that were from the same marking point, without an explanation and hence scored one mark. See below.


(ii) Explain **two** factors that might have caused this result to be anomalous.

(4)

1 The Student could have been worn out

2 They might not have been fit

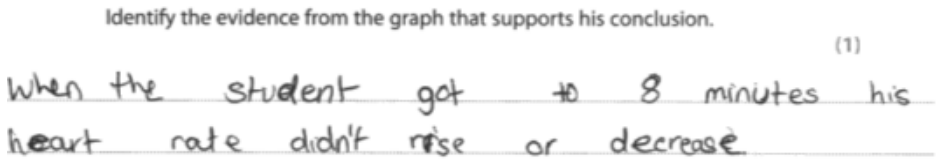
Learners continue to find questions relating to this aspect of the specification difficult to answer. Similar questions have been set on previous papers and there is still little difference in the level of response seen from learners. Preparation for the examination should concentrate on this aspect.

Q6ci

Weaker learners found drawing a curve of best fit difficult. Many missed the first point on the y axis. In other cases a straight line was joined to a curve or the line was drawn dot to dot.

Q6cii

Learners were able to suggest a reason for the graph supporting the conclusion. A typical response is shown below that scored the mark.


Identify the evidence from the graph that supports his conclusion.

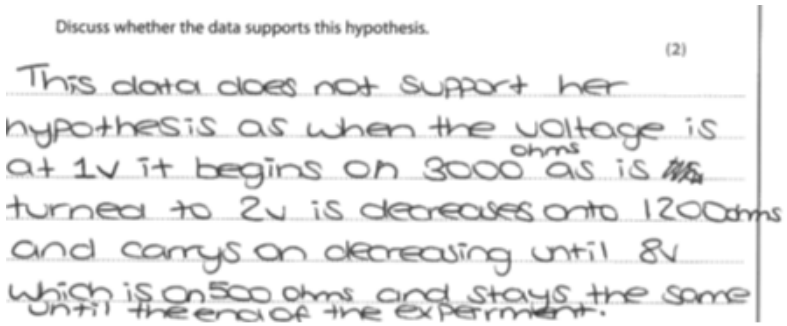
(1)

When the student got to 8 minutes his heart rate didn't rise or decrease

Some learners attempted to answer the question by describing the whole graph.

Q7b

This two mark question was a challenge to learners. Stronger candidates were able to provide two ideas, and the weaker ones struggled to give any answer. This question lacked some of the scaffolding of other two and four mark questions and so was a little more of a challenge, the mark allocation should have provided a guide as to what was needed in the answer together with the command word. Weaker learners described the shape of the line. An example of a good two mark answer is given below.


Discuss whether the data supports this hypothesis.

(2)

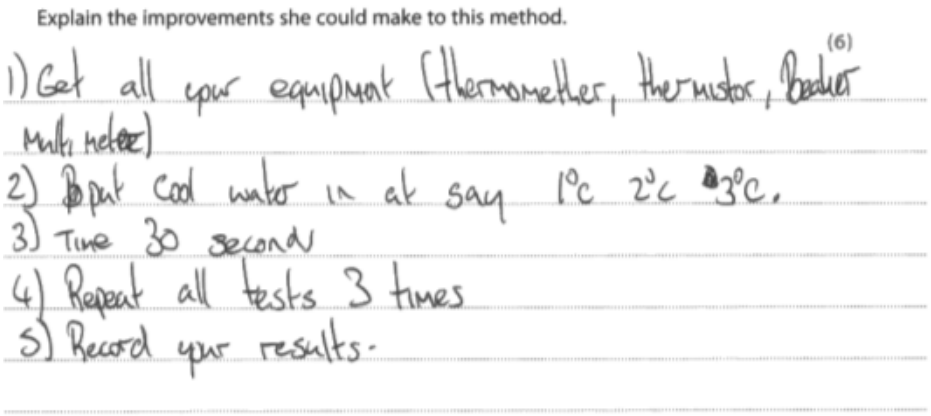
This data does not support her hypothesis as when the voltage is at 1v it begins on 3000 ohms as is turned to 2v is decreases onto 1200ohms and carrys on decreasing until 8v which is on 500 ohms and stays the same until the end of the experiment.

The learner has identified the relationship between the resistance and the voltage, worth one mark, and has explained that the resistance stays the same beyond a certain voltage, worth another mark.

Q8

Learners found this final levelled question the most difficult on the paper. Learners have been given similar questions asking for an explanation to improvements to a method. In this case the scenario was an electrical experiment that is drawn from the specification. Many learners misunderstood the purpose of the equipment and considered that the thermistor was some form of immersion heater and that the multimeter was a power supply. A description then followed of an experiment where water was heated and the temperature was recorded over a given time. The fact that no timing instrument was suggested in the stem of the question seems to have been missed by those learners. It was clear that some learners had not had experience of using this kind of arrangement and this then led to issues of how to improve what had been presented.

In many cases learners repeated the points in the stem of the question and suggested nothing more. Others described how the various items were connected or suggested risk assessments and means of control. These were dealt with elsewhere in the paper.


Explain the improvements she could make to this method.

(6)

1) Get all your equipment (thermometer, thermistor, beaker multimeter)
2) Put cold water in at say 1°c 2°c 3°c.
3) Time 30 seconds
4) Repeat all tests 3 times
5) Record your results.

This answer was awarded a pass mark of 1 as a range of temperatures is suggested.
In order to score above a pass mark learners needed to have explained the improvement and this was in nearly every case missing. Hence the mark was restricted to the pass level. The command word in this question is ‘explain’ and this was not apparent in the answers seen.

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Publication Code BF042814 November 2015

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