BTEC

Examiners' Report/
Lead Examiner Feedback

November 2016

NQF BTEC Level 1/Level 2 Firsts in
Applied Science

Unit 8: Scientific Skills (20474E)

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Overall comments

Students were able to demonstrate effectively some of the skills that were tested in the paper. They were able to; identify items of equipment and their use, risks, tabulate data with appropriate headings, read values from a graph, describe simple trends in data from a graph, identify anomalies, calculate averages and make simple inferences based on data provided. In these aspects Students maintained the pattern of previous examination series of showing improving performance.

Students found the graph drawing question more challenging than in previous series. In this examination the question was based around drawing a scatter graph with a line of best fit. This gave a wider distribution of marks in comparison with the previous series, where the graph question was less challenging. The calculation of temperature change was found to be particularly challenging. The question not only expected Students to find the value of temperature change, but for the full four marks give the value to two significant figures. Many Students found the rearrangement of the equation challenging as well as the conversion of the mass to kilogram from grams. As a result very few gave the correct answer, and even fewer were able to then give a correct value to two significant figures for the full four marks. Simple algebraic manipulation and decimal conversions remain an issue for centres that needs to be considered in preparing Students for this examination. In this paper Students were asked to plan an experiment relating to a light dependant resistor, Q3bii, it appeared that many Students had little idea of this task and as a result gave answers that were not relevant to the question. The final question, Q7b, was also challenging. The question tested an understanding of how results support/do not support a hypothesis based on given data; this was very challenging, with many Students repeating the contents of the table, so although they appeared to have written a good deal, they had not answered the question. Both these question were awarded 6 marks, however Students rarely scored more than one or two marks as they did not give the detail needed to score marks. Students must be given opportunities to practise answering these questions. For Q3bii it was evident that some Students had been prepared to some degree as they had a clear generic plan, however mentioning control variables and independent variables, without being specific to the task will not score marks. Students must read the question carefully before attempting it and they should be aware that a plan has a context and asks for some information to be given on the variables, the range and controls, and then means of ensuring reliability in the experiment.

In the June 2016 report I noted the following:

'In previous reports it has been made clear that this examination is based on practical activities. It is still apparent that many Students have a lack of some of the skills that are developed in the Unit 8 specification. Students will greatly benefit from being exposed to as wide a range of practical scenarios and activities so that they can develop the necessary skills to answer the questions set in this examination.'

This remains a major issue for many Students. Students will find it difficult to access much of the paper if they are not exposed to a wide range of practical skills and given the opportunity to make hypotheses, draw graphs, make conclusions and evaluate data that they have gained. In addition Students need to have opportunity to practice the mathematical skills needed for this paper.

Feedback on Specific Questions

Question 1

Proved to be a good start to the paper with many Students gaining both marks to identify the use of a ruler and a measuring cylinder. It is evident that many, but not all Students are aware of the appropriate uses for common pieces of laboratory equipment.

Question 2

Q2a was answered correctly by most Students. The idea of a risk and its meaning in terms of an effect on a person is understood. Some Students used general terms such as 'it is harmful' which does not score a mark. A few Students misunderstood the question and considered the risk to the woodlice.

Q2b was found to be challenging too many Students. Many wrote an answer that was related to the previous question which was about bacteria. This question was about looking at what is a suitable range.
A two mark answer is given here.

If there was only four woodlice it would have been possible that each lices would goin all of them but with five you can determin if the lices would like the area more were 2 lices are.

In the last sentence of the answer the Student states that where two woodlice are found they would like it more, which is acceptable for the mark relating to being in the best conditions as well as stating the marking point relating to where two woodlice are found. Students found it difficult to express themselves in answers to questions such as this.

This response gave what was acceptable for the first marking point, but has made no indication about why they would go to one chamber in terms of the conditions.

Five wood lice would be a suitable range because there would be two wood lice in one chamber;

Many Students considered that the fifth woodlouse was a spare which was available if one died, this answer scored no marks.

Question 3

Q3ai was a standard experiment drawn from the unit content in the specification on electric circuits. Many Students appeared to be unfamiliar with this practical or indeed any electrical practical. In many cases answers were taken from one of the instruments seen in the diagram, rather than answering the question, which was about identifying the independent variable – the current. There are key terms in the specification which Students are expected to be able to know and understand, these do include the terms, dependent and independent variable.

Q3aii gave better responses with many Students identifying at least one control variable in the task. Students struggled to identify two controls.

Q3bi was a question relating to producing a hypothesis based on some information. Many Students gained one mark for stating that as the lamp became brighter the resistance of the light dependent resistor would quantitative way.

The response below indicates an attempt at the second mark.

> The brighter the lamp is, the lower the LDR's resistance.
> As the lamp gets brighter, the quicker the resistance of LDR decreas.

The Student clearly gains the first mark, however the idea of 'quicker' cannot be given credit as the graph is not time related. To score the second mark the Student needs to say either that the line is not proportional or that the line is steeper at first to convey that a change in resistance will not be expected to be linear.

Q3bii was a six mark planning question. Students performed poorly in this question. The question asked Students to write a plan to test how lamp brightness affected the resistance of a light dependent resistor. Many Students gave a generic plan which stated that there needed to be control variables and that there had to be a range of readings, but gave no details related to the actual situation. Other Students gave answers which were a description of the diagram given in the stem of the question.

This response gained 5 marks.

To test how the lamp brightness affects the resistance of the LDR. You should start with the power box switched off & take a reading of the LDR's resistance in a completely dark room. Then switch on the power pack, & take a reading of LDR's resistance at 10 different lamp brightness levels. Test the resistance every 1 amp until you reach 10 amps.

As you do this experiment, keep the circuit the same all the way through testing - keep the same bulb, power pack, length of wires & amp reader. Perform the experiment 3 times for each amp level to make sure you can get an average & cancel out any anomalys.

The Student starts by stating that the resistance of the light dependent resistor is measured in a dark room, this gains two marks from the mark scheme. The Student then goes on to add that the current is changed and that readings are taken at one amp intervals up to ten amps. This is a further two marks. In the final paragraph the Student suggests a range of aspects of the experiment that should be controlled, for the fifth marking point. It should be noted that although there are a range of controls, they are all the same marking point. This level of response was rarely seen. It should also be noted that the Student mentions repeating the experiment three times, this is not creditworthy. The Student also states that different light brightness levels are measured in the first section. This is a repeat of the stem of the question and hence scores no marks. Many Students stated that the brightness of the lamp should be changed, but did not go on to say how that was done, for example by changing the current in the circuit. Few Students scored more than two marks for this question.

Question 4

Q4a is a question that asks Students to complete a table of results with appropriate headings and with data presented in ascending or descending order. This question was not as well answered as in previous series, mainly due to Students being unaware of the difference between the unit for heat capacity and the unit J/K. Many Students headed a column with just the unit which lost the mark for headings.

The results table shown below scored all three marks. The headings are correct, the numbers and names are in separate columns and the order of the numbers is in ascending order.

Substance	Heat Capacity (J/k)
Sand	0.290
Copper	0.385
Steel	0.450
Concrete	0.880
Water	4.182

Where lower marks were scored, Students usually gave the wrong headings or gave the numbers in a random order. Nearly every Student scored one mark, with many scoring two, but rather fewer than in past series scored all three.

Q4b was a graph question that gave a greater level of difficulty than some in recent series. Over the lifetime of the specification the papers have to test all types of graphical representation mentioned in the specification. In this examination it was a line graph and Students do appear to find these a greater challenge. Some Students were able to gain all six marks, but many scored one or zero, as a result of taking the numbers directly from the table to produce a graph scale that was not linear. In that case the maximum mark scored was one, and only if both the x and y axis were correctly labelled including the unit. In many cases Students were able to produce a sensible linear scale on both axes. Students used the graph paper fully, and compared to some previous series, Students used most of the graph paper. The Student who produced this graph was awarded full marks.
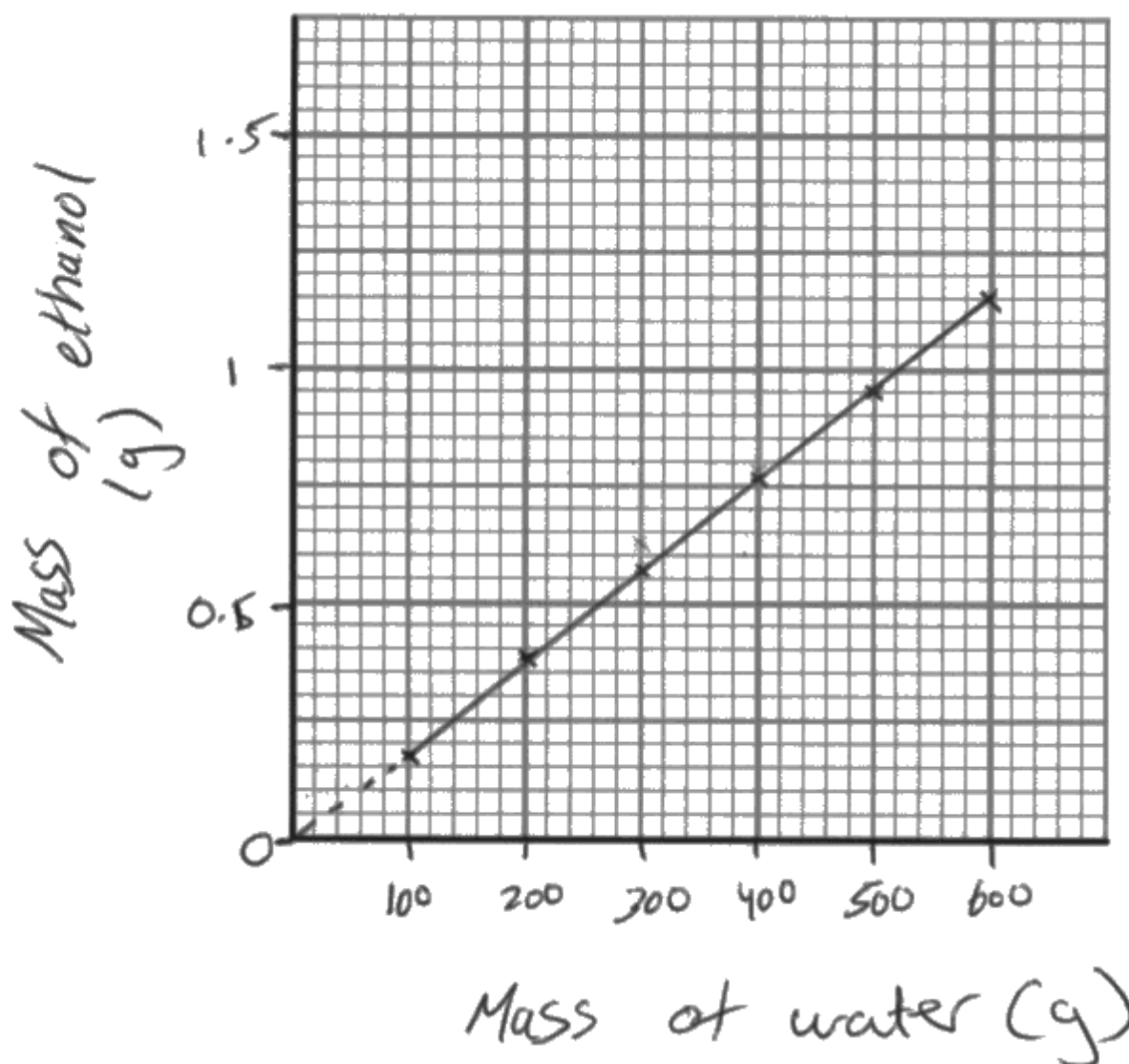
Both x and y axis are fully labelled. The y axis goes up in 0.25g per large square, which is a sensible amount and in a linear way and the x axis scale is also linear. The graph takes up most of the paper. Plotting is accurate to +/- one small square and the line of best fit is straight. It should be noted that the line only needs to be drawn between the first and last points, any extension either side is ignored. The scale on the y axis was commonly one that went up in 0.2 per large square which was also acceptable. Scales going up in three's or other odd numbers should be avoided. In a few cases Students made errors with the graph and were then given an additional piece of graph paper to redraw the graph. Centres should be aware that the graph drawn has to be a comparable size to the one that would be drawn in the examination paper. In this case a graph square which is seven times seven large squares.

Q4c was a calculation that was designed to test the top end of the ability range. The item proved very hard for many Students and it was evident that mathematical skills were the main reason for this. The specification requires Students to be able to substitute and rearrange given formulae and

give answers to a number of significant figures. The response below gained all four marks.

$$260 = 0.02 \times 4200 \times k$$

$$260 = 84 \times k$$

$$k = \frac{260}{84}$$

$$= 3.095238$$

$$= 3.1 \ (2sf).$$

1 kg = 1000 g

So 20g = $\frac{20}{1000}$

= 0.02 kg.

The Student has converted 20g to 0.02kg and then substituted and rearranged the formula correctly to give the correct answer. The Student has finally given the value to the correct number of significant figures. This Student showed all the working so if an error had been made at some point some marks would have been gained for intermediate steps. It still remains the case that Students do put down an answer without working and in the process lose all the marks if that answer is incorrect. In many cases the answer of 3.095 was seen, this scored three marks as the significant figure mark could not be awarded.

Question 5

Q5b. In this question Students were expected to give a description of how the number of zebra changed over time. It required Students to identify that there was a regular increase and decrease, that this was repeated every fifteen to twenty years or that numbers of zebra never fell to zero, or did not exceed a certain number. Many Students gave the regular increase/decrease answer, but then did not give further detail.
Q6aii gave poorer responses than expected, many Students failed to score a mark.

Small error on the computer or maybe she was not paying attention

An answer relating to why there was a difference was expected and in this case a lack of attention /distraction was a suitable answer.

Question 6

Q6b was generally answered well; however some Students missed out on marks because they did not show working. The Student in this example has shown working so even though they have put the incorrect answer on the

answer line they have divided 2.11 by 5 which is the correct calculation and scored both marks.

Show your working.

(2)

This Student has given the same answer on the answer line

Show your working.

(2)

0.43   s

There is no working to show how this answer was arrived at and so no marks were scored.

Q6ci was a challenge for many Students. The question asks for Students to make an analysis of the evidence. Many Students gave a description of the graph. The two examples given here highlight the differences.

When he drank the cola, his reaction time stayed the same for 5 minutes. It then dropped ~~co solded~~ ~~it got to 36 minutes.~~ After that ~~this reaction~~ ~~time~~ from 0.38 to 0.26 in 31 minutes. Then in the next 25 minutes it increased from 0.26 till 0.35.

In this example the Student states that the reaction time stays the same for five minutes, and this gains a mark. The Student then goes on to state that

'it', (the reaction time) dropped in 31 minutes (indicating until 36 minutes) and then increases again, which gains a second mark.

> well at the start it was level then it dropped down to 0.26s then rushed straight back up to 0.35s so as the time increased after drinking dot cola his reaction got better because of the sugar but then after a while it got slower

The Student has described the numbers and shape of the graph and so scores no marks. Most Students did this.

Q6cii was also found to be difficult for most Students. The first marking point was for stating that the amount of caffeine in the cola needed to be found prior to extending the experiment. No Students seemed aware that this was necessary, before going on to make comparisons to other drinks containing caffeine, be they other types of cola or other types of drink. A good two mark answer is given here.

> He could drink cola which has caffeine and then drink the cola which doesn't have caffeine and then test if caffeine affects your reaction time or not.

The Student suggests different samples of cola, with or without caffeine, which gives the first mark and then they go on to explain that this will test if it is the caffeine or not, for the second mark.

Many Students gave an answer such as the one below.

> The amount of caffeine consumed the better your reaction time will become.

This is a conclusion, and is not an answer to the question given.

Question 7

Q7b was the levelled six mark question on the paper and as with previous series, proved to be challenging. Few Students gained more than a pass level mark, and extremely rarely more than a merit level mark. The example here gained a merit level mark.

Katie's results do not support her hypothesis. Because
Firstly Because iron, plastic, and stone all have the same fall time for 1kg and 3kg, which is 1.7 seconds

Secondly her hypothesis states the heavier the mass the quicker it will fall, this is not true, Because the feather took 4.2 seconds longer when it was heavier.

Thirdly, The diameter of the ball, does not affect it in any way the iron, stone and plastic all have two diameters and the fall time remains the same.

The Student has given an explanation as to why the data for iron, plastic and stone do not support the hypothesis for mass. They have gone on to discuss why the feather ball is not supporting the mass hypothesis because its time is longer rather than shorter.

The Student has also given an explanation as to why iron, plastic and stone do not support the hypothesis for diameter, but they have not considered the feather ball.

The Student has given a full explanation for the mass and a partial explanation for the diameter.

For a distinction mark the Student would have needed in addition to have considered an experimental detail such as there being more than one variable, or the experiment was not repeated.

Many Students simply quoted the data from the table without reference to the hypotheses. Some looked at the data incorrectly and suggested that the data did support the hypotheses.

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