Examiner's Report/
Lead Examiner Feedback

March 2015

NQF BTEC Level 1/Level 2 Firsts in Applied Science

Unit 8: Scientific Skills (20474E)

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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

This is the fourth time the paper has been sat.

Learners appeared to be well prepared in answering many aspects of the paper. In particular learners have been able to identify appropriate items to make measurements, and are aware of variables and how these can be controlled. They can order data appropriately in tables. Learners have shown that they can produce bar charts which are correctly labelled and scaled and plotted accurately, they were also able to perform straightforward calculations confidently. They struggled with calculations that required algebraic transposition of the terms. Learners struggled with producing a hypothesis; this was tested for the first time in this paper. Learners still find the analysis of data and formulating detailed improvements to an experimental method a challenge.

Learners should note that the language used in responses limited marks. In a number of cases learners wrote generally about taking measurements, for example in Q3b, 'collecting sweat' is not the same as 'measuring the amount of sweat'. Learners need to be clear as to what they are going to do with quantities they are recording. It was clear in a number of cases that learners were not able to distinguish the difference between 'find' or 'collect' or 'record' and 'measure'.

Learners should be reminded of the levels of demand in the command words used in the paper. In many cases very simple descriptions were given in questions that asked for an explanation. Learners should know the difference in what is needed for a question that starts 'Explain' as compared to one that starts 'Describe'. Learners should also be aware that lengthy explanations for questions that include the words 'List' or 'State' are not necessary.

In calculations, many learners do not show their working which can lead to marks being lost due to errors in the manipulation of the numbers. Where intermediate steps were shown in the learner's calculations, it was usual to score at least a mark. Learners were not penalised if they gave a correct answer without showing their working, but they ran the risk of gaining no mark if they had made an arithmetical error in their final answer.

It was encouraging to see that learners were using information in the stem of questions to help them form an answer. It should be noted that no credit is gained for simply repeating what is written in the question. Weaker learners gave quite full answers to the longer questions, such as Q3b and 8, but only repeated what they had already been told and so no mark was scored.

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	17	25	33	41

Feedback on Specific Questions

Q1b

The correct answer for this was the idea of change in pulse or heart rate. A good number of learners provided this answer, however it was clear that the term 'dependent variable' was not understood by some learners who gave answers relating to aspects that were controlled.

Q2

This was the first time this aspect of the specification was tested in the paper. Learners found this quite a challenge. To gain the three marks awarded learners needed to consider that the ball was slowing down, that the average speed of the ball deduced as the distance increased and finally that this was representative of non-linear motion. The last of these ideas was rarely seen in responses.

A typical two mark response is shown below:

Write a quantitative hypothesis for how the distance travelled by the bowling ball affects its average speed.

(3)

As the Bowling ball travels further the average speed drops. This tells us that once you let go of the bowling ball, that is when the bowling ball is at its high speed and once it gets further away from you, it intends to toss further because its slowing down.

The learner states that the ball is slowing down and secondly that the average speed drops with distance. The final marking point relating to the rate of decrease is not in the answer. Learners should note that they need to explain fully what such graphs show. In many cases there was a description rather than a hypothesis made. It should be noted that a number of learners thought that the graph showed that the average speed increased with distance and formulated a hypothesis on that basis.

Q3a

This question scored at least one mark, however two marks was less often seen. A good two mark answer gave the idea of weighing the tissue and then the detail of before and after.

(a) Describe a method that Claire and Toby could use to measure the mass of sweat collected on the paper tissues.

(2)

They could do this by ~~Pt~~ Weighing the paper tissues before they got used to see how heavy they are then weigh ~~them~~ the paper tissue after therefore you will find out the out of sweat on the tissue.

Many learners only gave the idea that the tissue was weighed. In quite a number of responses the amount of sweat was measured in terms of volume. This was not creditworthy and scored 0.

(a) Describe a method that Claire and Toby could use to measure the mass of sweat collected on the paper tissues.

(2)

they could measure the amount of sweat using a measuring clynder.

Q3b

This question was open ended and related to planning a task. Learners generally gave responses that failed at give detail. Learners were able to give a range and to repeat the test, but in many cases there was little else. Learners needed to go on to consider that they needed to explain the key variables to be controlled and then how the hypothesis would be tested. This final aspect was rarely seen.

This response gained five marks:

(b) Write a plan for Claire and Toby to find out how the angle of the treadmill affects the amount of sweat produced by an athlete.

(6)

Include in your plan:

- The number of angles they should test.
- The number of experiments they should carry out.
- An explanation of why this would test the hypothesis.

Starting of with the treadmill at an angle of 20°c and timing up to 10 minutes of the ~~athl~~ athlete running. Collect the sweat produced by the athlete. Using two other angles of 30°c and 40°c and wite all the results into a table. This would mean three experiments to carry out and then repeat the experiments three times to give an accurate result. This would test the hypothesis because the angle of the treadmill will affect the amount of sweat produced by the athlete. ~~There~~ There will be different results for each angle because ~~if~~ the athlete would have to use more muscle in the legs. Keeping the controlled variables the same; person, treadmill, speed of the treadmill, same temperature of the room so ~~the athlete~~ it doesn't not affect the athlete's sweat.

The learner gave a range of angles (the poor notation after the angles was ignored), they have mentioned that the experiment should be repeated, they have then explained how it would test the hypothesis and finally have gone on to give a control for the athlete and the treadmill. The learner very nearly scored a sixth mark, however the comment about collecting sweat was not enough to gain the mark for measuring the amount of sweat produced.

Q4bi

This question was generally answered correctly. A good two mark response is shown below.

Diameter of hole (mm)	Speed of oil (cm/s)			
	1	2	3	Average
2	0.35	0.36	0.37	0.36
4	0.40	0.39	0.41	0.40
6	0.51	0.50	0.52	0.51
8	0.64	0.66	0.65	0.65
10	0.86	0.85	0.81	0.84

(i) Calculate an average of the results for the **2 mm** diameter hole.

(2)

$\frac{0.39 + 0.36 + 0.37}{3}$

0.36 cm/s

In this case the learner has shown the working out and given the answer. In many cases there was no working out shown and an incorrect answer so no marks could be awarded. If the working out had been shown then a mark for the addition of the numbers or dividing by three could have been awarded even if the final answer was incorrect.

Q4bii

In this question learners were expected to identify a relationship between hole size and speed of oil flow for one mark and then state that a larger diameter gave a greater speed of flow.

This was a two mark response.

(ii) Describe what the information in the table shows.

(2)

The information in the table shows that the increase of the diameter of the hole in (mm), increases the speed of oil to flow in (cm/s)

This was a one mark response

(ii) Describe what the information in the table shows.

(2)

It shows the speed of oil changing as the diameter of hole increases.

(ii) Describe what the information in the table shows.

(2)

The tables shows us the diameter of hole (mm) and the speed of oil (cm/s) and how many tube go's they had and the average score

Q5bii

This was a good discriminator of ability. Learners of greater ability were able to find the gradient and give the answer correctly. This gained both marks.

(ii) What is the temperature fall per minute for this mass of ammonium chloride?

(2)

°C -3 per min ÷2 = -1.5

-1.5 °C/min

Weaker learners were able to calculate the temperature drop and not go any further, so scored one mark.

Q6ai

This two mark item gave learners some difficulty in scoring the second mark. Most were able to identify the anomaly and either circled it or mentioned it in some clear way in their answer. The explanation as to why it was an anomaly was less often seen correctly. Learners gave very general answers such that it was the smallest time in the table, or that it had the greatest difference. Learners did not specify clearly enough the anomaly relative to the row or column. A clear example of what was expected is shown below.

Drop height (m)	Time (s)			
	1	2	3	4
1	2.15	2.17	2.19	2.16
2	3.44	3.45	3.42	3.41
3	4.31	2.05	4.28	4.31
4	5.25	5.20	5.22	5.21

(a) (i) Gregor and Dimitri realise one of the results is anomalous.

Explain which result is anomalous.

(2)

Anomalus is on drop height(m) 3. because in 1st, 3rd and 4th repeat are more that 4(s). but in secont time dropt 2.05(s) 2.05, are anomalous.

In this response the learner identifies the anomaly in the table and explains it in terms of the other values in the row.

Explain which result is anomalous.

(2)

2.05 in 3m is anomalous because it is more than 1 second away from the other times on the table.

This response scored one mark for identifying the anomaly, but the explanation is not clear in terms of the other data around the anomaly.

Q6aii

Many learners gave a correct statement for this question however some gave an answer that would have resulted in the time being greater rather than less than those on each side of the anomaly.

For example this response scored no marks.

(ii) State what may have caused the anomaly to occur.

(1)

This has happed as it may of come down slow

This would have resulted in a time greater than the others around it.

Q6b

Learners found this question a challenge. In many cases the answers given were very general. An example is given below. This scored no marks.

Explain why this is not an appropriate average from the results they collected.

(2)

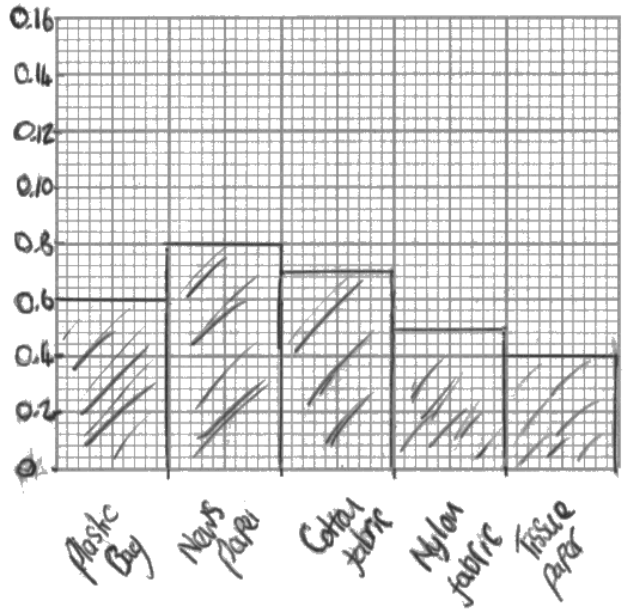
Because they need to get a rounded up result for the table.

To score one mark the learner needed to state that the timer measured to two decimal places. The second mark was rarely seen and the learner would have needed to say that the number quoted was to a greater accuracy than the timer could measure.

Q6c

The graph question was generally very well answered by all learners. There are some points worth considering for the future.

In this case the y axis is non-linear, so the point for scaling cannot be given, similarly if the learner had started at 0 and then jumped to 0.4 and then proceeded in 0.2 increments beyond 0.4 then the mark would not have been given.



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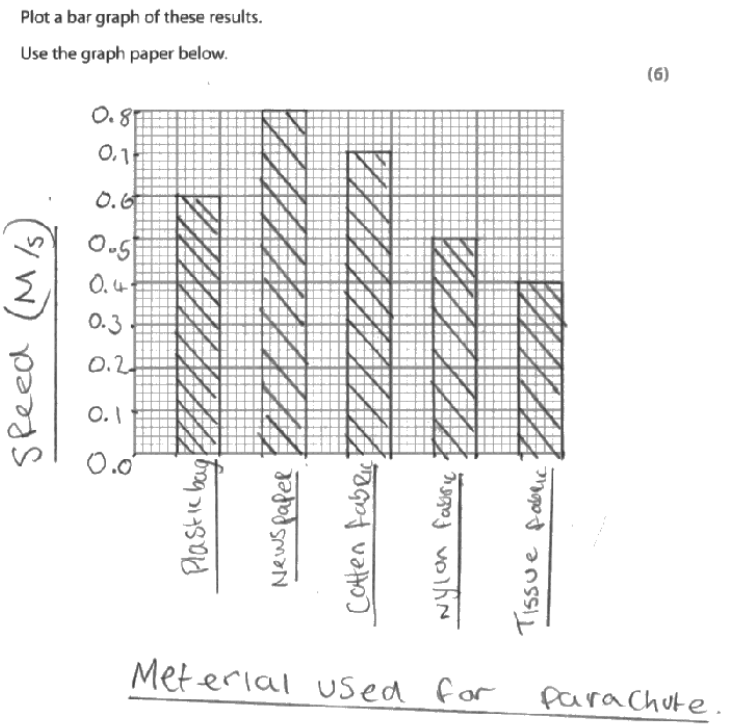
This graph illustrated a second point that learners need to be made aware of. The spread of data is limited. Just two full squares separate the 0.4 and the 0.8 values. At least half the graph paper should be used.

The graph below exemplifies a six mark answer, where both scaling marks are given.



Q6d

This question appeared to confuse learners. The question asked which parachute took the longest to reach the ground. Learners in large numbers gave the answer 'newspaper' on the basis that it was the largest number in the table. Learners did not make the connection between a high speed and therefore less time needed to fall to the ground.

Q6e

Few learners score both marks for this calculation. The most usual reason was forgetting to square the velocity in the equation.

A well set out answer with working is shown below

(e) Calculate the kinetic energy of the parachute.

(2)

$\frac{1}{2} \times 0.03 \times 0.8^2 = 0.0096$

0.0096 J

More typically one mark was scored for a partial answer. The answer below scored one mark.

(e) Calculate the kinetic energy of the parachute.

(2)

$0.03\,kg \times 0.8\,m/s = 0.024$

$0.024 \div 2 = 0.012$

0.012 J

Q7

Learners struggled to gain three marks with this question. Learners needed to consider both sides of the evidence and give a balanced response for full marks.

In general one mark was scored for linking the loss of water for the plant to windy conditions. In some cases learners mentioned that the experiment was repeated, but did not give the reason why this was done. In this question aimed at more able learners, there was the expectation that learners would state that it was to check the reliability of the results.

Marks could be gained for stating the case that the evidence would not support the conclusion as well. In this case learners needed to consider the number and types of plants tested and the different fan levels. Learners usually gained one of the first two marks, but seldom considered the fan levels.

This is an example of a three mark response

Discuss how well the evidence Susie collected supports the conclusion she made.

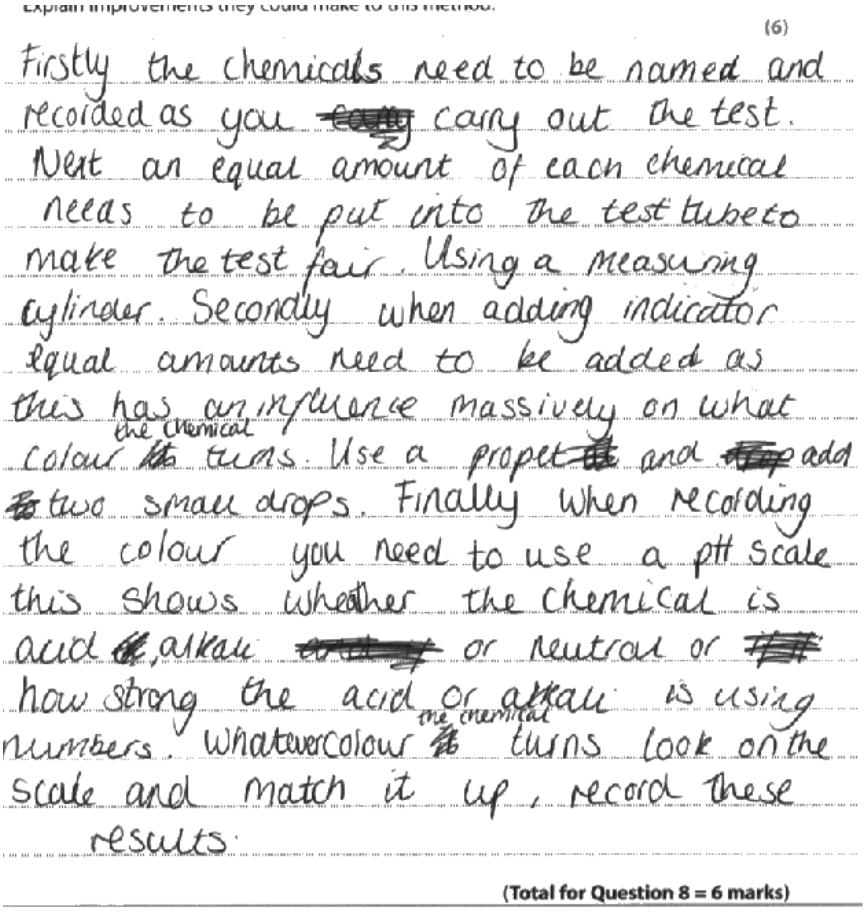
(3)

Not very well because she only tested one plant and decided that all plants react the same, even though the plant ~~in~~ in the windy air bubble moved further than still air. She should have tried the experiment on other plants as well to show if her conclusion is correct.

Q8

In this question learners were expected to consider a number of factors in deciding how to improve an experiment. Learners were able to gain a few marks for this but it was rare to see more than four marks awarded.

This response scores four marks


Explain improvements they could make to this method.

(6)

Firstly the chemicals need to be named and recorded as you ~~carry~~ carry out the test. Next an equal amount of each chemical needs to be put into the test tube to make the test fair. Using a measuring cylinder. Secondly when adding indicator equal amounts need to be added as this has an influence massively on what colour the chemical turns. Use a proper ~~pipette~~ and ~~drop~~ add two small drops. Finally when recording the colour you need to use a ph scale this shows whether the chemical is acid, alkali ~~or neutral~~ or neutral or ~~how~~ how strong the acid or alkali the chemical is using numbers. Whatever colour ~~it~~ the chemical turns look on the scale and match it up, record these results.

(Total for Question 8 = 6 marks)

The learner has given three improvements and has explained one of them. This explanation relates to the amount of indicator as this affects the colour of the chemical. This is a merit level response.

This response scored two marks and was typical of most responses seen for this question.

① use Allomonium chloride, Amonium nitrate, sulfur dioxide.

② ~~put 10cm³~~ using a 10cm³ measuring cylinder add 10cm³ of each chemical to ~~test~~ seperate test tubes

③ Add a drop of indicator Liquid using a pipette ~~to~~ for each chemical

④ Record what colour the chemical turns and measure it against a PH Scale.

⑤ Repeat the experiment 3 times

⑥ work out an average.

(Total for Question 8 = 6 marks)

The learner has named three different types of chemicals, they have stated the amount of chemical, and they have written the same amount of indicator. There are no explanations, so although there are several improvements the mark is limited to two marks and hence is a pass level answer.

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