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# Examiners' Report/ Lead Examiner Feedback

March 2018

NQF BTEC Level 1/Level 2 Firsts in Applied  
Science

Unit 8: Scientific Skills (20474E)

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## Grade Boundaries

### What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade (Distinction, Merit, Pass and Level 1 fallback). The grade awarded for each unit contributes proportionately to the overall qualification grade and each unit should always be viewed in the context of its impact on the whole qualification.

### Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark should be for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

### Variations in external assessments

Each test we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each test, because then it would not take into account that a test might be slightly easier or more difficult than any other.

Grade boundaries for this, and all other papers, are on the website via this link: [qualifications.pearson.com/gradeboundaries](https://qualifications.pearson.com/gradeboundaries)

### Unit 8: Scientific Skills (20474E)

Grade	Unclassified	Level 1 Pass	Level 2		
			Pass	Merit	Distinction
Boundary Mark	0	12	20	28	37

## **General comments**

Learners performed well across many questions in this paper. Learners were able to demonstrate effectively many of the skills that were tested in the paper. They were able to; identify items of equipment and their use, risks, plan an experiment, tabulate data with appropriate headings, draw a bar chart, read values from a graph, describe trends in data from a graph and tables of data, identify anomalies, calculate averages and make simple inferences based on data provided.

The graph in this examination was a bar chart, and this was well answered by learners of all abilities. The calculation that followed on from the graph was more challenging, however many learners were able to score some marks, with a greater number than in previous examination series scoring all the marks. The first six mark question on the paper asked learners to produce a plan based on information given. The plan related to an exercise bike. Some learners produced plans that related to running up steps, running or other exercises, these did score some marks, however the responses indicated that not all learners fully use the information given at the start of the question. The final question related to improving an experiment on reflection of light in a mirror. Learners find this challenging. The command line asked learners to explain improvements. In many cases appropriate improvements were identified, but these were not explained and this limited the marks awarded.

The calculations were better answered than in previous series. Learners were in many cases able to evaluate their answers, although this is not strictly required, it did indicate that there were many more learners using calculators in this series. Learners in most cases showed working and so gained partial credit in situations where they had made an error in the later stages of a calculation. The question relating to averaging a set of data was particularly well answered by learners of all abilities.

As in previous series all questions were set in a context, in many cases it was evident that learners were able to make use of the data in the context and relate their answer to it. In questions where a trend between variables is being looked for, this is particularly important.

Learners were asked to take data off a graph in some questions, it is evident that learners are more confident in using graphical data to aid their answers, learners quoted information from the graph to support the points they were making.

One question asked learners to indicate on a diagram the position of a ray of light of a specific colour. Learners answered this well. Questions asking for diagrams to be added to or completed are answered well overall by all learners.

## Feedback on specific questions

Q1

The first question on the paper related to equipment and aspects of risks and hazards. This question was answered well overall; however there remain number of learners that do not know the uses of basic laboratory equipment. In Q1ai some learners answered by writing 'measuring jug' rather than 'measuring cylinder'. The question is about appropriate scientific equipment and not general household items.

The final part of the question, 1cii, asked learners to explain a precaution to reduce a risk. This was a two-mark item and a good example scoring two marks is given here.

(2)

R As hydrochloric acid is irritant Raj should wear gloves and lab coat for to protect his skin also goggles to protect his eyes.

In this answer the learner has given the precaution, ('wear gloves') and then stated a reason, ('to protect his skin'). The learner has given both answers on the mark scheme, relating to both gloves and glasses. Only two marks can be awarded.

This example is gained one mark.

(2)

He should wear Gloves for Protection when handling hydrochloric Acid and he should wear Safety Goggles.

There are two precautions stated, but no justification, so only one mark is scored. Some learners do find that giving a reason or justifying a choice difficult. Many learners scored just mark for this part of the question.

Q2

This question related to determining the dependent variable in a hypothesis and then producing a plan to test the hypothesis.

The first part 2a, has been asked many times before and learners are expected to use the stem of the question to answer it. Learners found this item particularly difficult in this examination. A correct answer is given here.

(a) State the dependent variable in this hypothesis. (1)

The ~~outcome~~<sup>change</sup> in heart rate.

Learners should be advised to use the information in the stem of the question, to help them answer in the correct context. Knowing the difference between dependent and independent and control variables is a key set of ideas in this examination.

The second part of the question, 2b, was worth six marks and required learners to produce a plan. Learners were given some guidance in the stem of the question as to what should be included. This question was answered better than similar questions in previous series. Learners were able to identify a brief method and mention appropriate controls. Some learners appeared not to have read the stem of the question and wrote a plan about a different experiment, such as climbing stairs, running or cycling on a track. Some learners listed equipment or gave a risk analysis or went on to consider the processing of data. None of these things were required to answer this question. Learners would have been better served had they devoted more time to answering the question in terms of the guidance given in the question.

An example of a six-mark answer is given here.

All of the student should eat the same food before the experiment.  
~~They~~ They should pedall for 10 minutes constantly without any break. Their heartbeat will be measured before and after the exercise and will be noted.  
They all should wear the same clothes and pedall on the same speed level because it affect on their heartbeat.  
Then the change in all the students heart rate will be calculated.  
They also should use the same type of bike to pedall because ~~it~~ it might be more difficult on one than the other one.  
Their heart rate should be measure with the same tool as it might display different on different machines.

The learner has stated that the heartbeat, (heartrate) should be measured before and after exercise, this is two marking points. The following gain one mark each. The learner gives a specified time of exercise. The learner goes on to state that they should use the same speed level which is a further mark. The learner then goes on to state that the change in heart rate is to be found. In the final section there is a statement that the same bike has to be used. It was good to see a greater number of learners gaining higher marks for this question, responses in previous series have been poorer.

The response below is a three mark answer, which identifies the three most common points scored.

Equipment :

Stopwatch, Weight measure, pedaling  
exercise  
bike.

1) Measure the students weight  
(different sizes

2) Measure the heart rate at the beginning  
(if the heart rate is ~~be~~ a low rate but  
increases rapidly at the end of the  
exercise

3) Initiate the exercise and  
stop after a minute

4) calculate the rate <sup>of the students,</sup> afterwards.

Alex needs to evaluate if this occurs to  
student whose rate has a rapid or slow  
change.

The heart rate before and after exercise is awarded two marks and the time of exercise. Learners should be aware that there are six marks and so should write six clear points that relate to the task.



Q3

This question related to tabulating data and using data in a calculation.

Q3a has been asked in various ways in most series. This question scored very well, learners are clearly able to label the headings correctly in a table and put the data in the correct columns in a sensible order. The standard of answer for this question is much improved. This response gained all three marks.

(a) Complete the table for these results.

(3)

Temperature	Height of bounce
25°C	20 cm
40°C	30 cm
60°C	40 cm
80°C	45 cm
100°C	50 cm

The learner had correctly labelled the headings, and then put the data in the right column in a sensible order. Some learners did not score the table heading mark as they used the units as the headings, others identified the word, 'bounce' as the height. It appeared that some learners were shortening the headings to such an extent that the words used no longer conveyed the meaning of the quantity measured.

Q3b was a calculation. Many learners were able to gain a mark for finding the difference in height. Marks were awarded for finding the height difference, converting it to meters and then substitution and rearrangement of the equation. The actual steps could be done in any order. More learners than in previous series were able to gain full marks for this kind of question.

This answer scored all four marks.

acceleration due to gravity =  $10 \text{ m/s}^2$

Show your working.

(4)

$200 - 20 = 180 \text{ cm}$

$180 = 1.8 \text{ m}$

$\frac{3.6}{10 \times 1.8} = 0.02$

mass of ball =  $0.02 \text{ kg}$

2

GPE  
ag x height

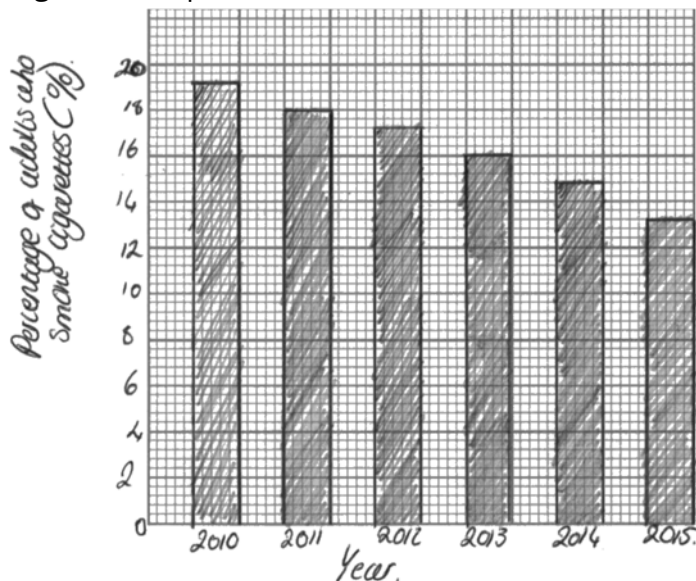
GPE  
m x ag x h

The learner has evaluated this answer incorrectly. There is no mark for evaluation.

The learner has found the difference in height (1), they have then converted it into the correct unit (1). Finally, they have substituted into and rearranged the equation correctly, (2). Learners should be made aware that the process gains the marks and that there is no evaluation mark identified specifically in the mark scheme.

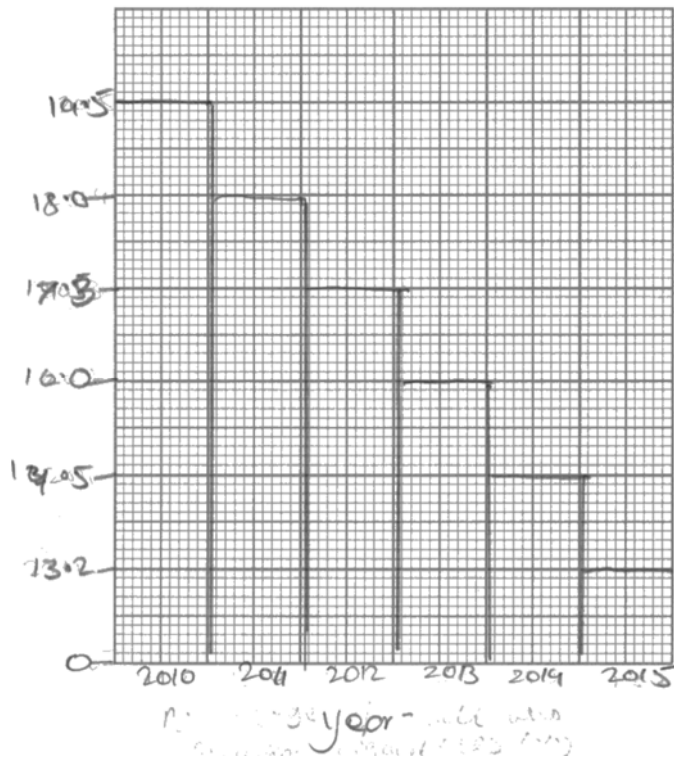
Question 4 related to presenting data and making conclusions.

The first part of the question, 4a, scored well, with many learners being able to draw the bar graph correctly using appropriate labels, scaling and plotting bars accurately. This is a good example of a six mark answer.



All mark points have been scored, there were two for labelling the axes, two for scaling and using the graph paper fully, and finally two for plotting.

The next graph scored just one mark. Some learners find scaling the axes difficult. In this case the y axis is the data straight from the table and is not linear.



The only mark that could be scored was for the labelling of the x axis as 'year'.

Q4b was the second part of the question and asked learners to write a conclusion based on some data in a table. This gave some good answers, however in some cases learners quoted numbers rather than trends or failed to notice that to answer the question fully that there was a need to consider what happened before and after the smoking ban of 2007 and both women and men.

This answer scored two marks. It identifies that smoking for men and women decreased and that there was a dramatic decrease in the past few years. The past few years was taken to mean at around the time of the smoking ban.

More men smoked than women. Both men and women stopped smoking which shows a dramatic decrease over the past few years.

In many cases learners gave one or two points in their answer, so failed to score higher marks. To answer this fully learners should have made three separate points in their conclusion.

Question 5 related to the processing of data from a table and a graph and identifying reasons for anomalies.

Q5ai was answered very well, learners clearly understand what needs to be done if an anomaly is identified.

Q5aii was a harder question. Learners were asked to explain reasons for the anomaly. Many learners scored less than two marks, because they were not precise in the language used in answering the question.

The example below is an example of a four mark answer.

(ii) Explain **two** reasons that might have caused this anomaly. (4)

Reason 1 Used of different concentration of glucose solution. The concentration used might be too low which caused a result of low volume of carbon dioxide.

Reason 2 The conical flask might have not been covered with a bung which caused the gas to be all released and few will go to the delivery tube.

The learner gives two separate reasons and then written about the consequence. In the case of the first reason, the learner states that the glucose solution was too low so producing a lower volume of carbon dioxide. The learner stated it was lower, and that is what was being looked for. Many learners were not specific enough, stating that the concertation was different, or wrong. There had to be a clear link in terms of lower concentration of glucose/less yeast used and the consequence in terms of the gas produced.

In some cases, learners only gave the reason and no consequence, so the mark was limited as this was an explain question. The example below shows this.

(ii) Explain **two** reasons that might have caused this anomaly.

(4)

Reason 1 She put ~~too~~ less yeast in.

Reason 2 Some carbon dioxide might have escaped.

This answer scored two marks as there are reasons, but no mention on the effect on the amount of gas produced.

Q5b asked learners to find an average. This was a very well answered question. Many scoring both marks for the calculation.

$$2.0 + 2.4 + 2.6 \div 3 =$$

$$\text{average volume} = 2.53 \text{ cm}^3$$

This answer scored both the marks. The learner has added up the numbers and divided by three. The final answer is incorrect, but if working is shown, then the marks can be awarded.

Show your working.

(2)

$$\text{average volume} = 2.4 \text{ cm}^3$$

This response scores no marks, there is no working and the answer on the answer line is incorrect. Had the learner shown their working they might well have gained two marks.

Q5cii well answered by many learners. The question asked for a description in the pattern of the graph. In previous series learners have not done well on this type of question, with answers describing the way the line on the graph went, rather than the trend. It was pleasing to see learners using the labels on the axes and the values on the graph to support their answer. An example of a two mark answer is given here.

The trend shows that the more concentration of sucrose solution (%) we add the more volume of  $\text{CO}_2$  is produced. From 10% to 50% (sucrose) the  $\text{CO}_2$  is increasing from 2-8  $\text{cm}^3$ . From 60% the  $\text{CO}_2$  volume of  $\text{CO}_2$  stays the same 8  $\text{cm}^3$ . The trend graph is positive correlated.

This answer identifies the trend as increasing. The learner uses information from the graph to do this. The learner then goes on to state that from a given value the volume stays the same.

Q6 asked about conclusions and evidence used to support conclusions. Learners have found these questions challenging in previous series, this was also true for this series. The question started with an easy introduction, which many learners were able to access. Learners were able to take the information and use it in the drawing that followed. The second part of the question was challenging. This is an example of a three mark answer.

At the beginning of the graph the percentage of light leaving the optical fibre ~~and~~ increasing wave length of light would support Jessica's conclusion but after 550 nm wavelength the graph doesn't support her conclusion because the ~~wavelength~~ <sup>(so) light leaving</sup> is going to be straight (sitted and) it's not proportional to the wave length.

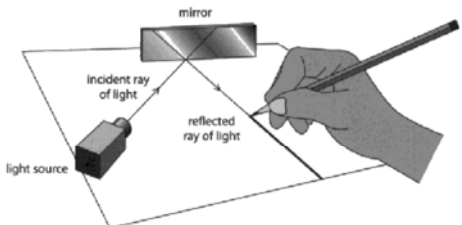
(Total for Question 6 = 4 marks)

The learner has identified that the conclusion is partially justified at the start and then goes on to explain why it is not at the end.

The final item in the paper was a six mark levelled question about improving an experiment. This type of question has been asked in previous series and has been a challenge for many learners. A wide range of practical experiences helps learners think of what suitable improvements to the method could be made. In many cases improvements that were identified related to the processing of data, and health and safety matters. The question asks how the method could be improved, so answers must relate to the use of the apparatus. In many cases answers were generic and referred to types of variable and how they could be controlled, this was not specific enough. The question asked learners to explain improvements, so they had to be identified and then some comment was needed on how this would improve the experiment.

The response below gained 6 marks.

7 Frank investigates the relationship between the angle of incidence and the angle of reflection for light reflecting from a flat mirror. He shines a ray of light onto the mirror. He uses the equipment shown.



Here is his method.

1. Place a mirror onto a sheet of paper.
2. Shine a ray of light onto the mirror.
3. Measure the angle that the ray reflects from the mirror.

Frank thinks that his method can be improved. Explain the improvements he could make to the method. (6)

To improve his method, he could draw around the mirror on his piece of paper so that if it moves, he will know where it needs to be to carry on with his experiment. Drawing a normal line at a perpendicular angle to the mirror and then shining the light source onto the point where the normal line meets the mirror could produce him a more accurate result. Marking off the incident ray and reflected ray of light on his paper and then removing the equipment to match these lines up may help him to produce a more accurate diagram. Repeating the experiment ~~at~~ where he shines the light source (the incident ray) at different angles to the normal line on the mirror will produce him ~~the~~ different angles of reflection. This will prove to him that the angle of reflection is always equal to the angle of incidence. Turning the lights off in the room he is doing the experiment in may also give him more accurate results as he can then clearly see the light source and where it is being reflected.

(Total for Question 7 = 6 marks)

TOTAL FOR PAPER = 50 MARKS

The learner has identified three aspects from the indicative content that could be improved in this experiment. These are related to ensuring the mirror remains in the same place, drawing angles accurately, using a normal and using low level light conditions. Each of these has a comment on how the experiment would be improved. In addition, there is a comment measuring a range of angles. This response met the level 3 distinction criteria in the mark scheme.

This response gained two marks as there are some improvements but all of them are unexplained. This limited the mark that could be awarded to level 1.

CV - keep the position of the mirror  
and use the same equipment for  
the light source and the distance  
between the light source and mirror the same

IV - Shine a ray of light at ~~the~~  
mirror from 3 different angles.  
for example at  $20^\circ$ ,  $40^\circ$  and  
 $60^\circ$

DV - measure what angles the light  
reflects from the mirror in your  
data.

Measuring from multiple angles  
gives a range of results.



