L2 Lead Examiner Report 2002

February 2020

L2 Qualification 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, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external 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 is 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 external assessment 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 assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:

http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

Unit 8: Scientific Skills (20474E)

Grade	Unclassified	Level 1 Pass	Level 2		
			Pass	Merit	Distinction
Boundary Mark	0	13	22	31	40

Introduction to the Overall Performance of the Unit

Performance across the paper was very good, with learners scoring well in some of the longer questions as well as in some calculations and graphical work. Learners were able to gain credit across many areas of the specification covered in the paper. Learners were able to; identify items of equipment and risks, identify precautions and attempt a plan of an experiment, comment on errors in a table, draw a bar graph, describe trends in data, identify anomalies, calculate averages, perform calculations, improve an experiment and discuss conclusions based on data presented.

The graph that learners were asked to draw in this paper was a bar chart and this was a very well answered question. Learners clearly can deal with showing data in this form. The first six-mark question on the paper asked learners to produce a plan based on information given. Learners were able to gain marks more confidently than in the previous series. The scenario appeared to be one that learners could relate to and produce a reasonable answer, in many cases. The final question related to discussing two conclusions based on data in the form of a graph. Learners were able to answer this question rather better than in previous series.

The calculation of an average is now a very well answered question and many learners were able to do this confidently. The calculation relating to finding the time light can travel a given distance was attempted by many learners, but poor algebra gave some problems as well as the use of significant figures in the final answer. 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.

Learners were asked to take data off a graph in a number of questions and in different contexts, it is evident that learners are more confident in using graph data to aid their answers, quoting values from the graph to support the points they were making. Where learners were asked to comment on trends in data or analyse what a graph was showing answers remain weak. Answers lacked detail and gave a general comment, rather than using the data from the graph to answer the question.

It was evident in many responses that learners were generally well prepared and had been able to draw on a wide range of practical activities to develop the skills tested in this paper. It remains the case that the best prepared learners are in centres which provide a wide range of practical tasks to ensure that learners have the required experience.

Individual Questions

Question 1 considered equipment, risks and control variables.

Q1a was a multiple choice question, which was very well answered with nearly 90% of learners giving the correct answer.

Q1bi most learners recognised the potential for burns/scalds. The question scored well. Other answers were not specific enough and referred to general harm or damage to skin or eyes without qualification. Some commented on possible effects on breathing and impaired vision through steamed up glasses.

Q1bii a well answered question with many learners suggesting the use of goggles and gloves, this was followed by using a face mask and lab coat.

Q1ci this question was not so well answered. Learners struggled to gain one mark; two marks was seen quite rarely. Many recognised that the flaming killed bacteria on the loop. The necessity to avoid contamination was less frequently addressed. Several thought that the heat melted the bacteria so they would spread more easily – make them reproduce faster – or make them more visible so they can be clearly seen.

Q1cii learners scored well on this item. A wide range of alternative answers were on the mark scheme, so learners generally scored well. Common answers were, time for incubation, size/volume of the agar plate and quantity of bacteria were seen. Some were confused by temperature and gave this as the control, when this was one of the variables. Others would have scored more highly if they had qualified their answers with appropriate detail. Same plate or same agar was frequently seen.

Q2 asked learners to produce a method for a plan for an experiment.
The question discriminated well and gave some learners the opportunity to outline a plan and give controls. Weaker learners were usually able to identify a control and/or give the start of the plan usually by stating that known masses of hydrogel were needed. More able learners were able to give more of the steps of the plan and usually one control. Many learners wrote answers that related to nappies rather than hydrogel and seemed unaware that the hydrogel could be removed. Many answers that were creditworthy went down the first of the two routes outlined in the mark scheme, where known quantities of hydrogel were

measured out and water added. Learners who followed this route tended to score more marks compared to the other approach. The stem of the question pointed quite clearly to water being added in the experiment, rather than urine. Adding urine was not penalised, however learners seemed to be unaware of the greater difficulty to control the experiment if urine was used. A significant number of learners spent a good deal of time in writing a risk assessment. This question was scaffolded and indicated areas where credit would be gained. Risk assessments were tested in Q1 for the most part. Learners could have devoted more time at looking at the method and controls, rather than risks.

Q3 considered the presentation of data in a suitably headed table of results, line of best fit drawing, plotting a bar chart and performing a calculation using significant figures.

Q3a, this question scored well, with 90% of learners scoring at least 1 mark and 60% scoring full marks. Data was almost universally placed in the correct columns. However, some simply listed the data in the order that the appeared in figure 3. A minority listed the planets in the order of their distance from the Sun, although most simply listed in order of temperature. A minority created two columns based on high and low temperatures, with, of course, an arbitrary cut off point between the two. In terms of headings, the majority that lost a mark gave the unit 'Kelvin' rather than the quantity 'temperature'.

Q3b asked learners to draw a curve of best fit through a series of points. This was a well answered question with nearly two thirds of learners scoring the mark. The smoothness of some curves was just about acceptable, with wobbles and tramlining mainly ignored. If lines were more than one small square away from a point, or if the line at any place was thicker than one small square, the point was not scored. Most learners followed the command and drew a curve, those that did not, and drew a dot to dot line, did not score.

Q3c was a 6 mark graph question. This was very well answered by most learners. The weakest learners scored at least 1 mark for labelling the planet axis with the planets. Other marks were harder to gain, but still easier than in previous series. The labelling of the distance axis was more challenging than expected and many learners forgot the unit that was required as well as the label. This affected the whole ability range, and learners who scored 5/6 generally missed this mark. Scaling and plotting were done accurately for the most part and gave little difficulty to most learners. There remained a significant minority that were unable to scale the distance axis, taking the numbers directly from the table. Others had

a linear scale but made the increments too large and were unable to plot the final bar on the graph. Others used scales that went up in 8's 16's and other non-helpful numbers. In many cases when these were used, some plotting errors were made. Some learners would have benefitted from having a ruler available to draw the bars. In some instances, the bars and tops were drawn freehand, this introduced plotting errors that could have been avoided. Many in this position barely scraped a plotting mark because of the +/-1 small square rule.

Q3d was a calculation requiring a substitution rearrangement with an evaluation to 2 significant figures. Many learners confused 2 significant figures with 2 decimal places. Many answers scored 2 marks for an answer that gave more than 2s.f. Some learners gave a correct evaluation with an answer of 486.99, or 487, but then thought that 2s.f meant that it was just the two first numbers correctly rounded that needed to be given, so writing the number 49. These learners therefore wrote 487 = 49 but could not see the problem with leaving the answer in this way. Such learners scored the 2 marks available for the calculation but did not score the mark for significant figures. One of the values in the question was given in standard form, and this was a problem for some learners. Some learners were unable to rearrange the formula and multiplied the numbers rather than divide them. The skills of algebraic rearrangement and use of standard form are skills that many learners need to develop and practice before undertaking this paper. The question discriminated well, with a very small number of learners gaining all three marks.

Q4 asked learners to read data from a graph and then describe a trend.

Q4a was very well answered, with nearly 85% of learnings gaining the mark. Nearly every learner identified that the volume of alkali was 35cm3. Some learners, incorrectly, gave the answer 5. In this case they had read the pH scale and selected the middle of the straight part of the line. This emphasised the need to read questions carefully and do what the question asks, which was about the volume of alkali not the pH.

Q4b was not well answered by the learners overall. The question asked learners to describe the pattern in the graph. Many weaker answers described the shape of the line and not the trend in the variables. To answer this question correctly, learners do need to use the pH and volume of alkali and describe what happens to the pH as more alkali is added. The question was worth three marks, with a mark allocated to describing the trend in the first, middle and final part of the graph. Many learners simply stated that as more alkali is added the pH increases,

which was worth one mark as compensation to not giving a full description of the trend. To score all the marks learners should have described each part. Centres should guide learners to look at the mark allocation for a question in order to determine what is to be written as an answer.

Q5 asked learners to consider a 'rates' experiment to find an average, deal with anomalies and then explain why the anomaly had occurred, based on the information given at the start of the question.

Q5a asked learners to find an average from data in a table. Very large numbers of learners were able to do this and gained full marks. Some learners made transcription errors in transferring data from the table to the calculation, however, if they showed working a mark could be scored by showing the correct division by 4. Learners are allowed calculators in this examination; it is evident that some learners either do not use them or do not have them available. Whenever a calculation is done, learners should check their working out and answer to ensure they have not made avoidable mistakes. It should also be noted that the correct answer alone on the answer line does score full marks, however if any error is made in writing this down, then no marks are scored. It is always advised that learners show all working.

Q5bi was a well answered question with over 85% of learners scoring at least a mark, and nearly half the cohort scoring both marks. Learners are now clearly able to identify what should be done with anomalies if found in data. Some learners gave the same answer twice, but written in different ways, for example by stating 'ignore it' and then going on to state, 'by leaving out of the calculation'. Learners should take care to ensure that they are not repeating themselves in answers that require two different means of dealing with a situation.

Q5bii was a challenging question. Many learners were unable to give an answer to this question which asked for an explanation of why the anomaly occurred. Many learners gave general answers, such as the timing was incorrect, or the wrong volume of solutions was used. These kinds of answers did not score. In order to gain marks learners needed to relate their answer to the time anomaly in the table. This time was far longer than for the other trials. Answers therefore had to indicate that the stopwatch was started too early, or stopped to late, or that the longer time was due to a weaker solution of sodium thiosulfate being used. In other words, the answer had to identify why the anomaly was a longer time and suggest a reason for this.

Answers such as losing concentration, not looking properly, writing down the wrong time, not using the right equipment, etc, scored no marks, as these were generalisations and did not deal directly with the anomaly in the data.
Where learners did identify a reason for the anomaly, they did not explain it very often, thereby losing the second mark for each linked pair. Four marks was seldom seen, however more learners were able to gain two marks for identifying two unexplained reasons.

Q6 asked about ways an experiment could be improved and then based on information given, make an inference as to the effect of making a change to the way the equipment was set up.

Q6a was a challenging question. It required learners to explain two improvements to an experiment that some details had been given for. In this type of question, the information provided to learners at the start of the question is limited. This is to provide learners with opportunities to give extra details as to how the method could be improved. Repeating information already given did not score marks, nor did answers off the point. For example, some learners suggested undertaking a risk assessment as an improvement, however the question made clear that it was improvements to the method that were required. The mark scheme for this question indicates the types of answer that were expected. For example, the given method indicated that a toy car was placed on the ramp. It was expected that learners would identify that this was not very clear, and may therefore have suggested, that the toy car was always placed in the same position on the ramp each time, with the reason being that the starting distance was therefore always the same. This answer would have scored two points. The first part of this example was seen from a number of learners, it was very few that then followed it up by saying why. Many learners suggested trying different surfaces, or larger/smaller cars. These were not improvements to the experiment, but extensions. This did not score marks. It was the case that many learners were not clear as to the difference between an improvement and an extension to an experiment. Extensions to an experiment were tested in a previous series.
Some learners gave generalised answers relating to fair testing, this again did not score marks as these were general comments. The idea of repeating the experiment at each height did score a mark, and the reason for it had to be detailed, i.e. to check for anomalies or to average the results.
This question required learners to give specific details, not generalisations and this is where many learners found the difficulty.

Q6b was a very well answered question where more than 75% of learners were able to suggest a higher average speed than the one given. As the command word was suggest, there was no exact answer being looked for, the correct response was any number bigger than the one given.

Q7 was a levelled 6 mark question that asked learners to discuss whether or not the two conclusions given were supported by the data in the graph.
The question was well answered in comparison to previous 6 mark levelled questions in previous series. Learners were expected to discuss the two conclusions and using the data from the graph support their discussion. Many learners did so successfully for both conclusions and so were able to gain a mark in the Merit band, however the lack of detail in many responses meant that the Distinction band was less frequently achieved. Many learners gave a very simple response or were not clear as to which conclusion they were referring to. If there was a sensible general discussion or a discussion of only one conclusion, then the answer was limited to the Pass level. Most learners that looked at just one conclusion, generally looked at why men smoked more than women, rather than looking at the data. Some learners used this question as an opportunity to warn of the perils of smoking or suggested that things were different in the 'olden days' as smoking was accepted more than now. It appeared that for some learners that the data was too obvious to discuss and comments such as 'well it is obvious from the graph that the both the learner's conclusions are correct were seen, which did not really answer the question.
What was required was a discussion of the data given, not a critique of it or how it was obtained.

Summary

Learners should:

- have opportunities to engage in a wide range of different practical activities to ensure that they have used a range of equipment, considered risks and means of avoiding them.
- read the questions set carefully and ensure that they are providing an answer to the question set, in some cases learners spent a good deal of time in giving details of risk assessments or equipment lists, when these were not asked for
- when drawing a graph ensure that axes are correctly and fully labelled with the label and unit.
- make sure that when asked to explain an idea that there is a statement and a justification.
- when answering a describe question give a logical sequence.
- when asked to comment on a trend on a graph, to consider the variables and use them in the answer, rather than describe the shape of the line.
- Learn how to round values to the correct number of significant figures and be aware of the difference between, for example, 2 s.f. and 2 d.p.