Level 3 Lead Examiner Report 2001

January 2020

L3 Qualification in Construction

Unit 1 – Construction Principles

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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

Construction Principles

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	**11**	**23**	**36**	**49**

Introduction

This was the fourth series for the Unit 1 Construction Principles examination, with the examination being in the same format as both previous examinations, which is a traditional paper-based examination with a number of different styles of question. There was a slight increase in the number of learners taking the examination in January 2020 compared to the previous series in June 2019.

The question paper followed the format identified in both sets of sample assessment materials and also the past examinations. The focus of the paper being on a range of questions that assess construction materials, the application of mathematics and human comfort. The range of questions will change each examination series with the aim of covering all of the topics listed within the specification. It is important for centres to remember that, due to nature of the specification, they will need to ensure that learners are given the opportunity to become familiar with the processes of producing written explanations, the approaches to adopt when answering extended writing questions and skills needed to address questions involving calculations.

The paper had 5 questions. Each question was based on construction related scenarios, with each question having multiple parts. Learners were required to demonstrate knowledge and understanding of a range of specification topics and to apply this knowledge to the specific question scenario. The intention was to offer as broad a coverage as possible for all areas of the unit content. Questions had varying weightings attached to them, with 1 to 4 marks for the lower demand questions and up to 12 marks for questions where an extended response was required, such as questions where information needed to be interpreted and knowledge drawn from multiple areas of the specification.

Each of the questions that involved calculations was marked using both method (M) marks and accuracy (A) marks, as shown in the mark scheme. The short written response questions were point marked against mark schemes with linked responses being required for explain questions, whilst longer questions were assessed using a levels-based mark scheme. One question was multiple choice for which learners had to select the correct answer from four alternative options.

Introduction to the Overall Performance of the Unit

Learner performance was generally consistent across the paper, although when answering the longer open questions, learners performed slightly less well as a result of their synoptic nature. Overall, performance showed a slight improvement on the Summer 2019 series and was similar to that in January 2019. Potentially this is due to the number of learners that are new to the qualification. There was evidence of learners having been taught well across the significant parts of unit content, with most learners attempting all of the questions; it was however recognised that questions related to subjects that had not been included in the Sample Assessment Materials or previous series tended to perform less well. It was positive to see that there were examples of full marks being awarded for the majority of the shorter response questions, whilst in general learners answered the longer questions with answers that were somewhat contextualised.
It is important that learners are given the opportunity to practice responding to shorter and/or lower demand questions as well as the applied calculation questions that relate to aspects of human comfort as exemplified in Learning Aim C. When completing calculations it is important to show working as this allows access to 'method marks' should the solution be incorrect.

Learners responded well and provided clear responses to many of the questions in the examination with many being able to achieve marks allocated for identification for written 'explain' questions even where the lead point was not justified or expanded upon.
It is important that learners are prepared fully for the examination and have the opportunity to practice questions of the various types that were used in this paper and other examination papers that are available.

Individual Questions

Question 1

This question was in five parts and was related to a civil engineering context, specifically an urban railway line. Learners performed with mixed success across the four parts of the question.

1(a)

This question was generally answered well by learners, with the majority being able to identify that hardness was the property of steel that made it suitable for the application of a railway track that needs to resist abrasion. This was a multiple choice question and learners were able to make an appropriate choice from the four options available to them, although ductility was a common incorrect answer.

1(b)

Learners performed with some success on this part of the question. Many learners seemed to be able to recognise that the question related to the lowest amount of light that is required. Where learners achieved lower marks they tended to make reference to concepts that were not directly relevant, such as glare or daylight factors.

This response gained 2 marks.

(b) The railway line will have stations for passengers to get on and off a train. At each station a minimum level of illuminance is required.

Describe what is meant by the term minimum level of illuminance.

(2)

A minimum level of lighting required to so that people can see their surroundings

This response is representative of many answers that are of a 'mix and match' form. The learner has identified that there is a minimum level of lighting required, and then expanded on this by stating that this allows people to see their surroundings. Alternative expansions also made reference to safety and security. Such 'mix and match' responses are acceptable provided there is a clear link between the two factors.

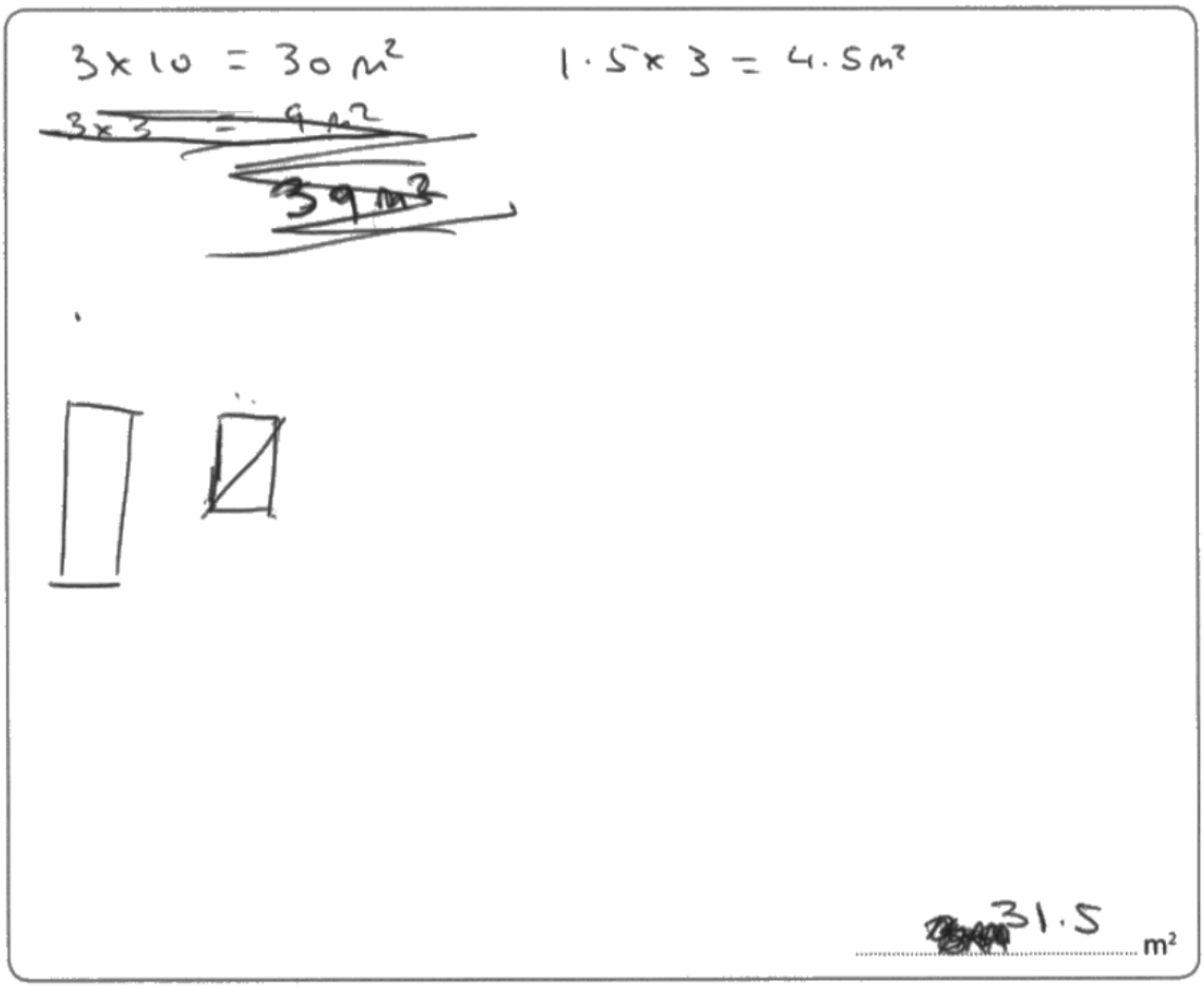
1(c)

Learners took a wide range of approaches to answering this question, with a number considering a large cuboid with the two side sections removed, or a rectangle with two triangular additions. In a small number of cases learners calculated the area of a rectangle and then a trapezium at the top. It was positive to see learners showing their working in full, which allowed method marks to be awarded for partial solutions or solutions where errors have been made at various stages of the calculation. Where learners failed to achieve higher marks they either omitted one of the sections, or they made arithmetic errors in their working.

This response gained 3 marks

(c) Calculate the cross sectional area of the reinforced concrete pier.

(4)



One mark can be awarded for the correct answer for area of the rectangle. A method mark can also be awarded for the correct population of the formula for the triangular sections and one mark for the area of a triangle.

The final mark is not awarded as the learner has not added the constituent parts together correctly.

1(d)

This was an example of a 'describe' question. The focus was on how airborne sound can affect residents of housing near to the railway line. To achieve marks, learners were required to recognise that the railway line is likely to be the source of large amounts of noise which can pass through the structure of buildings and cause disturbance to the residents.

This response gained 2 marks

The railway line will pass through a number of areas of housing.

(d) Describe how airborne sound from passing trains may affect residents of the housing.

(2)

Airborne Sounds may disturb residents by vibrating windows and distancing them in life. They may find it hard to sleep with the noise.

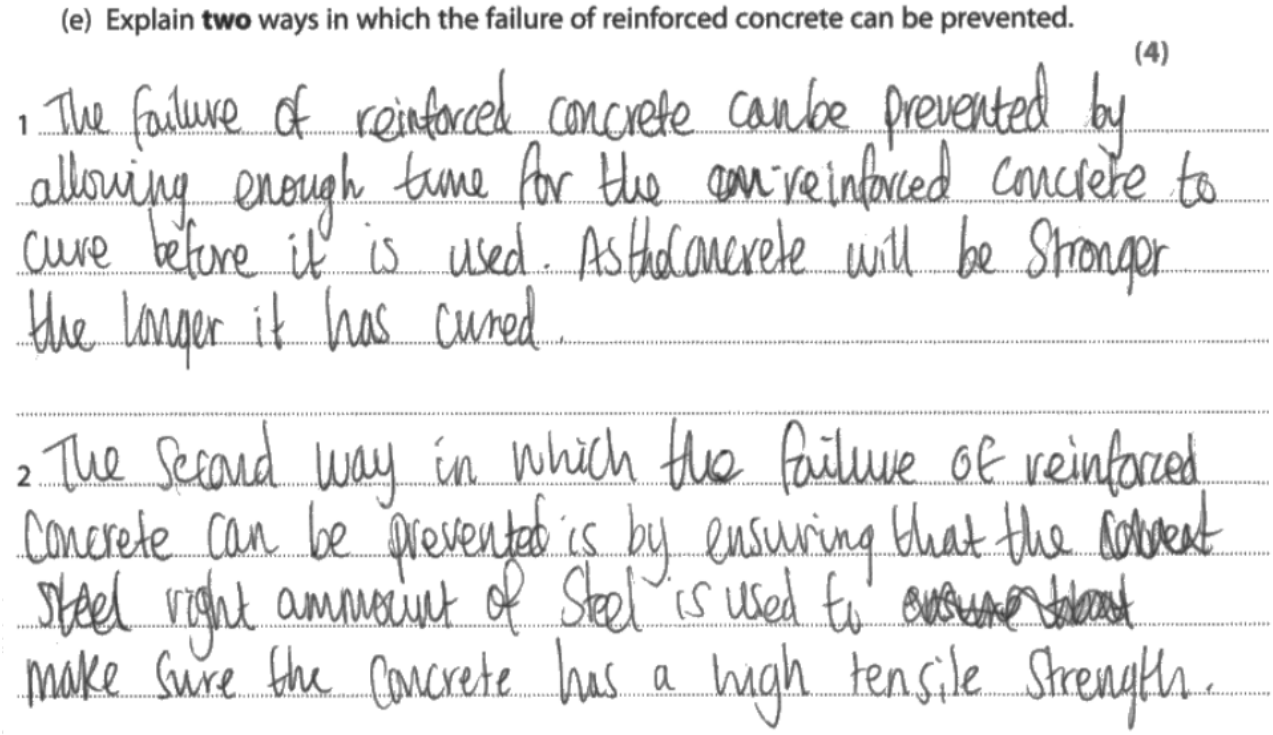
The learner has recognised that airborne noise created by trains can cause the fabric of the building to vibrate as a result of the sound waves. This is linked to a realistic type of disturbance for residents, specifically related to sleeping. This is another example of a 'mix and match' type response which links two responses in the mark scheme to provide a logical answer and can be awarded both of the available marks.

1(e)

This was the first 'explain' question on the exam paper. The focus was on approaches that can be taken to prevent the reinforced concrete in a railway bridge from failure. Learners were asked to explain two approaches that could be taken, therefore both of the responses needed to be different and not variations on the same approach. A proportion of learners answered with generic responses related to issues that would be considered at the design stage, for example the design of the concrete mix, or answers that were inappropriate, such as the provision of further reinforcements. Where learners did achieve marks they often made reference to ensuring that the concrete was not damaged or allowed water through to the reinforcement bars, or that there should be a routine

maintenance programme. A number made reference to using reinforcements that would not corrode.

This response gained four marks.



(e) Explain **two** ways in which the failure of reinforced concrete can be prevented. (4)

1 The failure of reinforced concrete can be prevented by allowing enough time for the reinforced concrete to cure before it is used. As the concrete will be stronger the longer it has cured.

2 The second way in which the failure of reinforced concrete can be prevented is by ensuring that the correct steel right amount of steel is used to ~~ensure that~~ make sure the concrete has a high tensile strength.

4 marks awarded

first response is linked to BP11

the second response is linked to BP5

This answer has two distinct approaches to reducing failure, one being linked to ensuring that the concrete has cured fully before allowing loads to be applied. The second response is an interpretation of making sure that the reinforcements are correctly specified for the application. Although tensile failure is not specifically named it is implied in the reference to 'high tensile strength' for the reinforced concrete overall.

Question 2

This question had was related more closely to general construction and the built environment activities. The focus was a refurbishment project for an existing block of flats.

2(a)

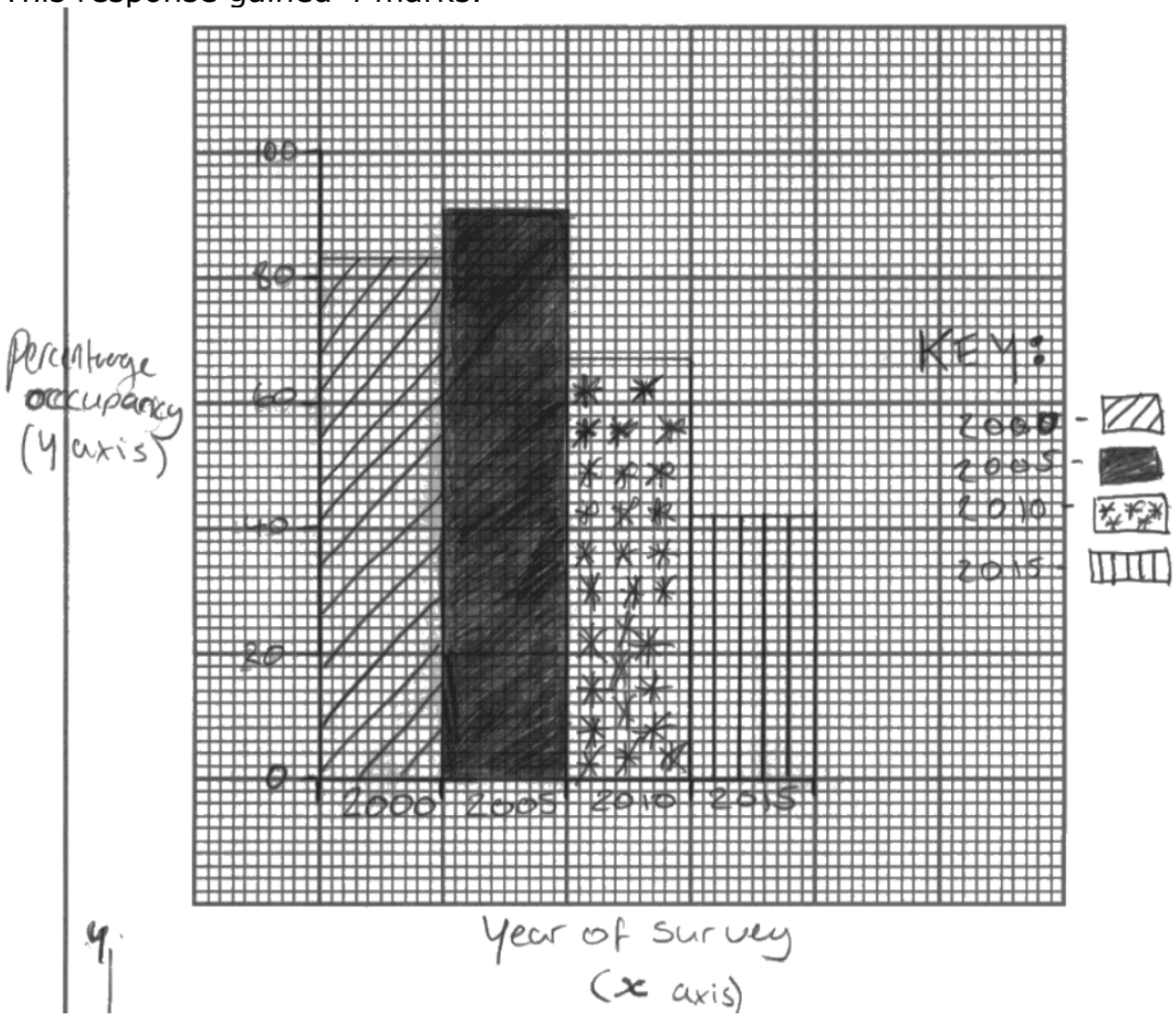
This question was generally answered well by learners, with most learners being able to state one form of natural degradation for construction materials. Where learners did not achieve the mark available this was often

due to stating answers that were vague, for example 'rot' or that the answer was inaccurate. The majority of learners achieved one mark for this question.

2(b)

Learners performed well for this question. In most cases they selected a scale for the graph that allowed them to plot the values to an appropriate degree of accuracy. Some higher achieving learners used a scale starting at 40 for the percentages and therefore were able to plot values to a higher degree of precision.
Where learners did not achieve full marks this was due to incorrectly plotting values or using an inappropriate scale.

This response gained 4 marks.



The learner has been awarded 1 mark for both of the axes being drawn and labelled with appropriate values. 3 marks have then been awarded for the plotting of all four bars which are drawn to the correct height.

2(c)

Learners performed well on this question, with a large proportion able to identify at least one way that the use of electronic control systems could improve comfort levels for residents of the refurbished flats. This is a growing technology and it is encouraging that learners have awareness of the benefits of such technology. Where learners did not achieve marks this tended to be the result of giving answers which would be generic to any heating system, for example explaining the function of a thermostat. Other common errors were due to learners misinterpreting the question and thinking the focus was an electrical heating system and therefore made comparisons with gas-fired heating systems or similar.

This example gained 2 marks.

(c) There is a need to upgrade the central heating systems in the flats by installing electronic control systems.

Explain **two** ways in which the use of electronic control systems could improve comfort levels for residents.

(4)

1 It is easy to use and is very Compatcable which won't get the ~~tyed~~ resident stressed.

2 They can controle it on their phones for when ~~that~~ they're comming home or set a time in the morning so it is warm when they wake up.

The learner has stated that an electronic control system is easier to use, which gains no marks as this is somewhat subjective and is also often not the case when compared to a traditional thermostat and timer.
The second response is however valid, with reference to being able to control the heating system from their phones, and an expansion of this related to being able to do this on their way home from work to make the rooms warm.

2(d)

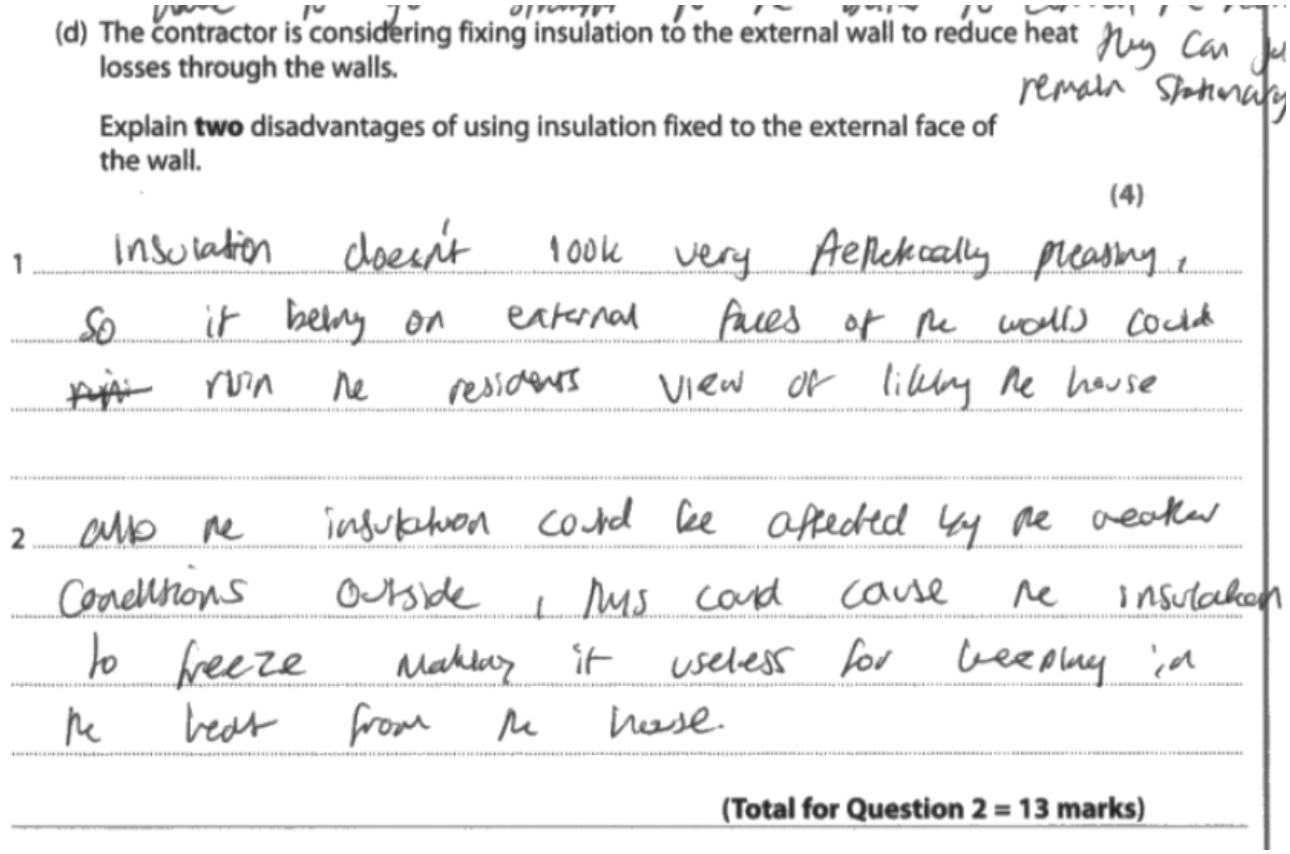
This question addressed a topic area which has not been specifically assessed in previous series. Learners were asked to explain two disadvantages of external cladding, which in the main was answered well with many learners being able to achieve 2 marks.
Many learners were able to identify that external cladding is more prone to damage, or that it can be unsightly. These points were often expanded upon to a greater or lesser extent. Where learners did not achieve marks this was often due to misconceptions, such as external insulation would not be effective as it would allow heat out of the building.

This example gained 3 marks.

3 marks awarded

first response is linked to BP9

second response is 1 mark from BP5



(d) The contractor is considering fixing insulation to the external wall to reduce heat losses through the walls.

Explain **two** disadvantages of using insulation fixed to the external face of the wall.

(4)

1 Insulation doesn't look very Aethetically pleasing, so it being on external faces of the walls could ~~ruin~~ ruin the residents view of liking the house

2 AND the insulation could be affected by the weather conditions outside, this could cause the insulation to freeze making it useless for keeping in the heat from the house.

(Total for Question 2 = 13 marks)

The first answer is awarded 2 marks for a suitable linked answer which can be directly linked to the mark scheme. One mark is awarded for the second answer as the learner has recognised that external insulation could be affected by the weather. This has been expanded on with further information about the weather rather than how it affects the insulation. As a result no further mark can be awarded.

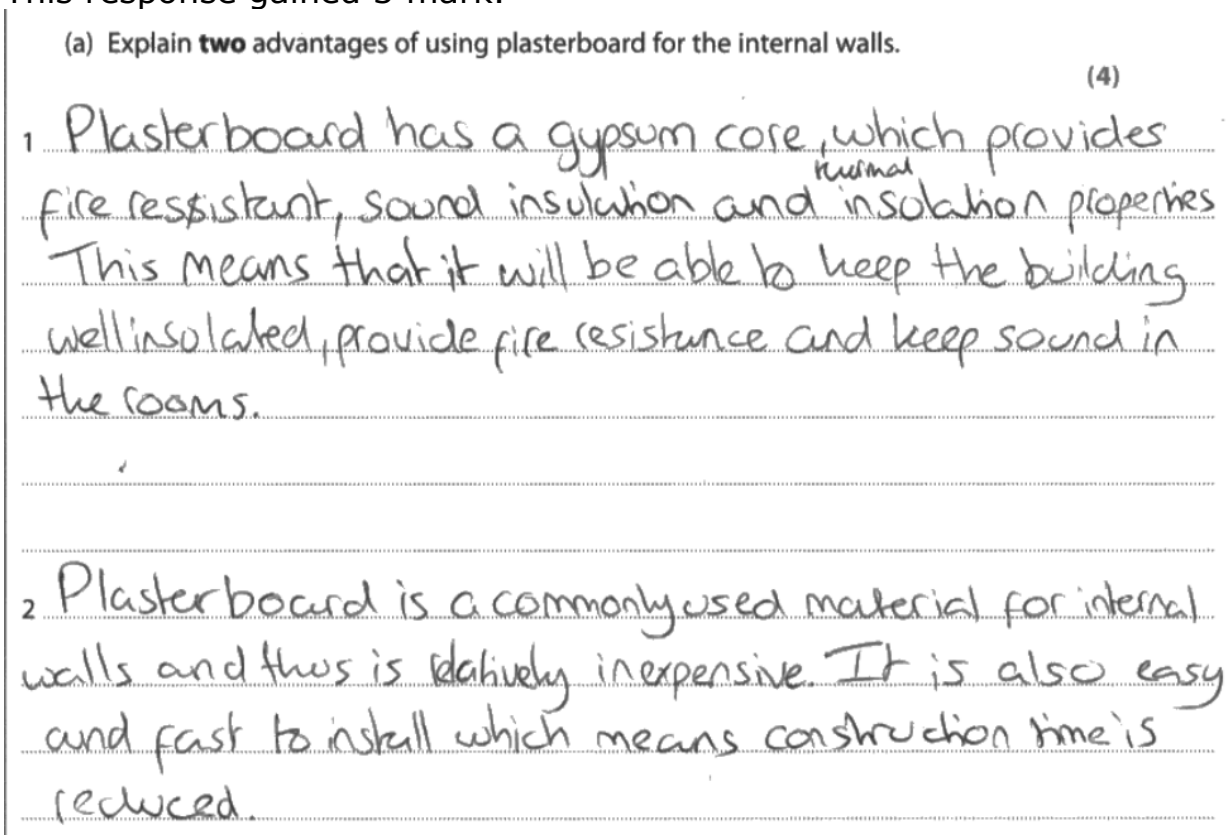
Question 3

This question was focussed on the construction of a new teaching block for an academy trust. The new building is to be of steel frame form with partition walls and concrete slab floors.

3(a)

This question was answered with some success by learners, with most learners being able to recognise properties of plasterboard that make it suitable for internal walls. Where learners did not achieve the marks available they tended to provided answers which were generic and lacked the required focus on the internal wall aspect of the question, for example thermal insulation. Many learners did however recognise that plasterboard offers an efficient solution that is easy to install for a number of different reasons, that it has fire resistance properties and that it can insulate sound. Answers to this question were often of the 'mix and match' type

This response gained 3 mark.



(a) Explain **two** advantages of using plasterboard for the internal walls.

(4)

1 Plasterboard has a gypsum core, which provides fire resistant, sound insulation and thermal insulation properties This means that it will be able to keep the building well insulated, provide fire resistance and keep sound in the rooms.

2 Plasterboard is a commonly used material for internal walls and thus is relatively inexpensive. It is also easy and fast to install which means construction time is reduced.

The first response is a 'mix and match' type answer that links the sound insulation properties of plasterboard with keeping noise in classrooms. The second response links it being easy to install with reduced construction time. Note that there are multiple 'identifications' of advantages, however only 2 can be credited.

3(b)

Learners were less familiar with the approach to answer this question about stress and strain in a concrete slab under compression. They needed to calculate the strain and then use this, along with the given stress, to calculate the modulus of elasticity of the concrete slab.
In a large number of cases, learners did not know how to populate the formula for stress, despite the values needed being in the question. This suggests a topic area that has not been covered in as much detail as some of the other concepts in the specification - it is important learners know the meaning of the various symbols used in formulae in the information booklet. Than they had been for other maths-based questions on the paper. Other common errors included populating the formulae 'upside down' or converting units when it was not necessary.

This example gained 4 marks.

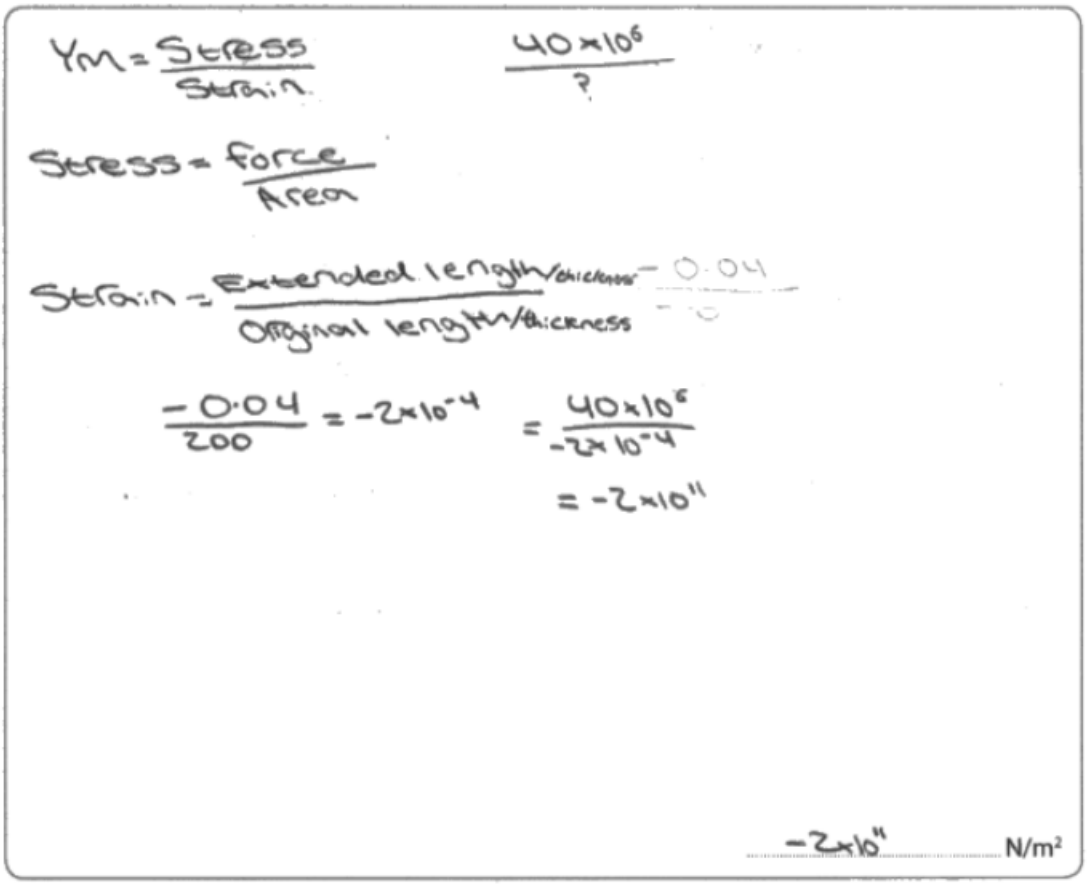
The contractor has carried out tests on the concrete that has been used for the floor.

The original thickness of the concrete floor slab was 200 mm. During a test, a load applied to the concrete compressed it by 0.04 mm.

The stress in the concrete has been measured as 40×10^6 N/m².

(b) Calculate the modulus of elasticity of the concrete.

(4)



The value of stress has been calculated as $-2x10^{-4}$ using a negative value for dL. (the length of the extension, or in this instance compression) has been interpreted as a negative value, which is acceptable.

The correct process has been used to determine the modulus of elasticity (positive or negative). Each of the values in the formulae have been used correctly and the answer is numerically correct. All method and accuracy marks can be awarded.

3(c)

A wide range of responses where provided by learners, with a significant proportion achieving marks at the higher end of band two or into band three. To reach this mark band answers needed to link together a range of considerations not only of the steel frame form but also the context of the school building and specific requirements such a building would have. The higher scoring responses considered each aspect in detail, and suggested logical reasons why a steel framed building is popular for educational buildings. These were often supported by good technical knowledge that was applied to the situation, for example being able to have long clear spans to allow versatility of layout and flexibility to make internal changes without making changes to the structure of the building. Some learners achieved marks at the lower end of the mark range by giving generic answers that gave advantages of steel frames, such as them being able to be prefabricated.

This is an extract from a response that achieved 7 marks from mark band 3.

(c) Discuss the reasons why a steel framed structure is a popular form of construction for buildings of this type.

(9)

A Steel Frame structure is strong and can bear a heavy weight load, required for a large building. As it does not need internal solid walls to support the structure, it provides a large open floor space, which can be separated by partial walls. This makes the space very versatile, can be used in different ways and alternated if a change of use is required.

A framed structure is also quicker to construct, which will help meet deadlines by a faster build process. The foam can be manufactured off site. Then put into place onsite, minimising time on site and disrubtion school.

The candidate demonstrates a developed understanding of the use of steel framed construction.

Some good points have been raised and explained in depth and are each related to the school. All sides of the case are considered and the answer is well-balanced, giving weight to all viewpoints including those during the construction phase and also in-use. The points made are relevant and there is a clear link to the school building in the question.

When answering questions where a number of factors need to be considered, it is important that all are included in order to achieve their higher mark bands.

The focus of question 4 is an industrial development where a number of units are being constructed that will have workshop areas and offices. There were three parts to the question, including the final calculation on the examination.

4(a)

Learners generally found this part of the question difficult, with only a small number selecting and using the appropriate formula from the information booklet. In many cases learners added the values in the question and divided by three instead of recognising that they needed to calculate the weighted mean taking in to account the areas of the various parts of the loading bay and the overall surface area. This was an area of the specification that had not been previously assessed, although a significant number of learners were able to access marks at the earlier stages of the calculation.

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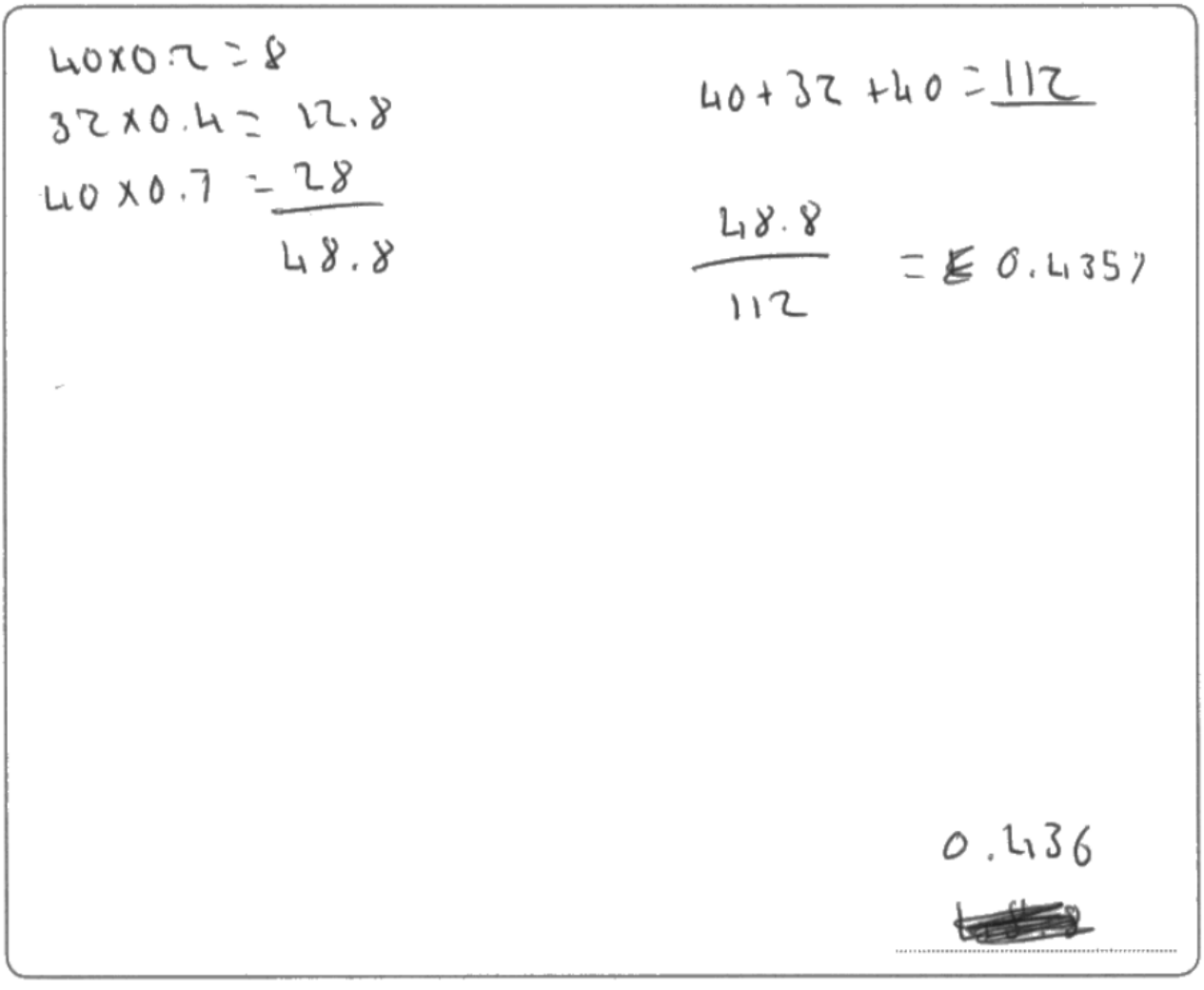
(a) Calculate the mean sound absorption coefficient for the loading bay.

(4)

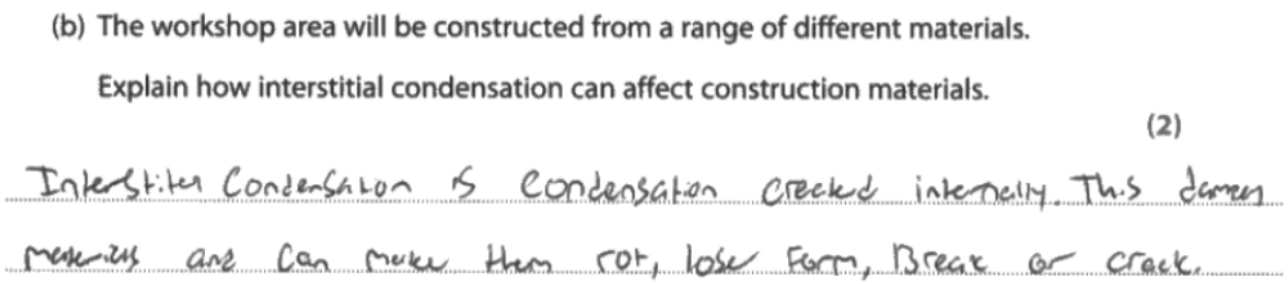


In this example, the learner has completed all stages of the calculation. They have calculated the weighted values for each of the surfaces, added surface areas to find the total surface area and then calculated the mean value with accuracy.

4(b)

Question 4b tested learners understanding of interstitial condensation. A small proportion of learners were able to recognise the effects of interstitial condensation, such as causing rot or decay within a material. Often the key aspect of interstitial condensation was omitted, namely that it forms within the material. Where learners did achieve marks this was often due to giving answers that were generic or related to surface condensation.

In this example, the learner achieved 2 marks.



(b) The workshop area will be constructed from a range of different materials.

Explain how interstitial condensation can affect construction materials.

(2)

Interstitial Condensation is condensation created internally. This damages materials and can make them rot, lose form, break or crack.

This example recognises that interstitial condensation is created internally. This is expanded upon with reference to making materials rot or loose form - either of these could be accepted for the second mark, which despite being brief, has some elements of accuracy.

4(c)

Many learners achieved high marks on this question. The question related to the benefits of using natural light in the offices of the new buildings. A large number of learners recognised that there would be less need for artificial light and therefore energy usage would be reduced, whilst others considered the health benefits as opposed to artificial lights. Some learners stated no artificial light would be required which was incorrect. Such answers did not achieve any marks; it is important that learners fully understand the focus of individual questions when giving their answers.

This response achieved 4 marks.

(c) The construction company plans to incorporate natural lighting into the new industrial unit.

Explain **two** benefits that natural lighting would provide.

(4)

1 Reduce need for artifical lighting which will reduce the cost of lightening the building. By reduce use of fuel is more sustainable and kinder to the enviroment.

2 Comfort of those using the building, natural light is beneficial health wise for people and improves mood, so improves productivity. Natural light from the sun will also heat the building so increased thermal comfort for users.

(Total for Question 4 = 10 marks)

The learner has recognised two benefits of using natural light, with each being expanded on with a justification. Each response can thus be awarded 2 marks.

Question 5

The final question on the paper is based around a scenario where a range of information is provided to learners. This includes information about construction details of a building and climatic information for two locations where buildings of the same design are to be located.

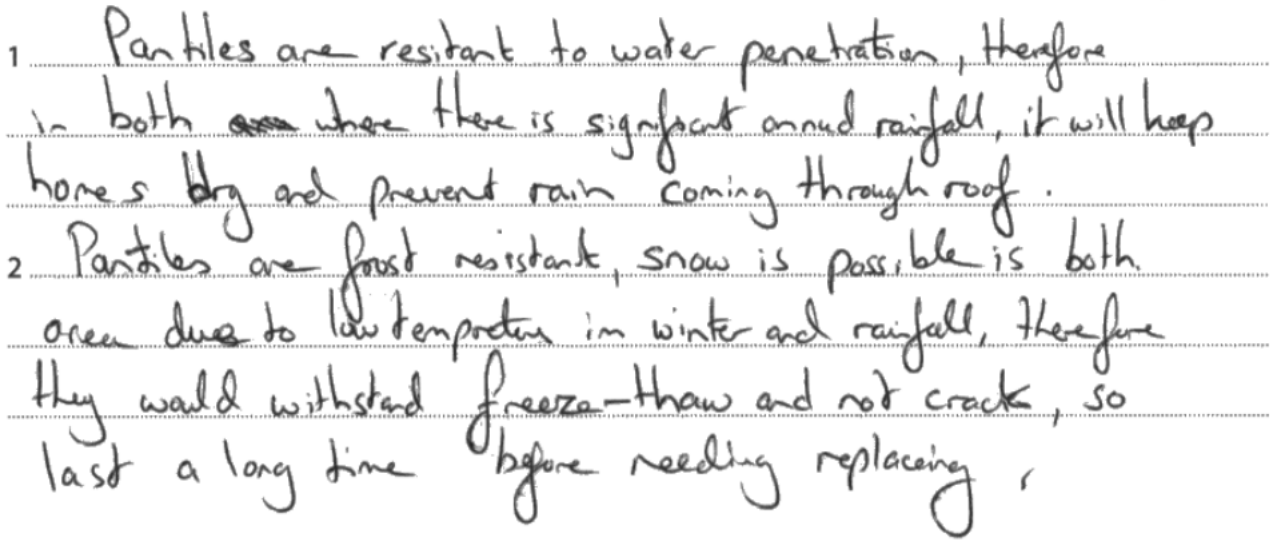
5(a)

The first part of the question relates to performance characteristics of pantile as a roofing material that would be used for the houses in the two given locations. Many learners were able to identify one performance characteristic of pantile, although in many cases these lacked expansion. Where learners did not achieve marks this was often as a result of lacking understanding of the specific properties of pantiles, for example stating they are thermally insulating. In the majority of cases learners were able to identify at least one pertinent point.

This response achieved 4 marks

(a) Explain **two** performance characteristics of pantiles as roofing materials for use in these locations.

(4)



The learner has identified two properties of pantiles, namely resistance to water penetration and frost resistance. They have explained why these properties are appropriate for the two locations, making reference to the climatic information in the information booklet. The two points are developed and show a good understanding of the context.

5(b)

Learners were asked to explain three advantages of using low emissivity glass for the windows of the new houses.
Common responses made reference to the energy saving benefit of low emissivity glass, such as its ability to reflect heat to either keep the building warm or cool depending on the time of year. Other typical responses included the ability of low emissivity glass to prevent UV radiation from passing through, or that condensation does not form upon it. Each of these was often explained to some extent to achieve the second mark available for each point.

This example was awarded 6 marks.

(b) The construction company intends to install triple glazing with low emissivity glass.

Explain **three** advantages of using low emissivity glass.

(6)

1 It dosent allow uv raidiation to enter through , this means materials on the inside of the buildings cant be damaged by these rays.
2 low e glass dosent allow out of the heat ~~this~~ energy into the building, meaning the building will stay cooler in the summer.
3 It dosent allow all of the heat energy back through the glass, meaning it will stay warmer in the winter.

In this example the learner has identified three distinct advantage of using low emissivity glass for the triple-glazed windows. Each response has an appropriate expansion point, with no repetition between these expansions. As such, each response can be awarded 2 marks, and 6 marks overall for the answer.

5(c)

This is the final question on the paper. The question needs learners to draw together aspects of information about the construction of the buildings and the local climate to provide an evaluation of the materials and processes used and their suitability for the two locations in the question.

To achieve higher marks learners need to make suitable links between the information they have been provided with to justify the material used with respect to their properties and working characteristics. To achieve higher marks each material and building element that has been included in the information booklet must be considered in combination, with an answer that draws on the related underpinning knowledge from the unit content.

This is an extract from a response that gained 10 marks from band 3

The mineral wool will insulate the buildings and stop any heat escaping through the walls. This is very benefical as the mean temp in both locations is between 8°C and 11°C which isn't that warm. The facing brickwork is important as it is weather resistant. As shown in figure 2, rainfall in location A can be greater than 600mm which can cause potential damage to a building. As the facing bricks are waterproof they can resist damage. They are also important to protect the building from wind. Location B has a higher monthly wind speed than A which is why the brickwork is required for both. It is also ~~to be~~ aesthetically pleasing.

In this response the majority of points made are relevant and there is a clear link to the situation in the question, including reference to the climatic information provided in the information booklet. Although not shown in the extract, each of the materials used for the construction have been covered both individually and also how their combined use provides a suitable form of construction for the given locations.

Summary

Based on their performance on this paper, learners should:

- Attempt all questions on the paper as marks are often awarded for partial answers providing pertinent points are made.
- Show working in full for calculation as this allows access to method marks. If arithmetic errors are made then marks can still be awarded
- Avoid excessive, or inaccurate, rounding when completing calculation questions.
- Provide linked responses for 'explain' questions. An initial lead point should always be expanded upon with either an expansion or a justification to achieve the second mark available.
- Develop answers for the longer open response questions, making use of the information provided in the scenario and the information booklet.
- Question papers are designed with sufficient space to provide answers that will achieve maximum marks; there should be no need to add additional pages to the answer booklet.

Centres are reminded that learners must not submit the information booklet with their answer booklets.

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