



# Mark Scheme (Results)

January 2021

Pearson BTEC Nationals  
In Construction and the Built Environment

(20075K)

Unit 1: Construction Principles

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## General marking guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Mark grids should be applied positively. Learners must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark grid, not according to their perception of where the grade boundaries may lie.
- All marks on the mark grid should be used appropriately.
- All the marks on the mark grid are designed to be awarded. Examiners should always award full marks if deserved. Examiners should also be prepared to award zero marks, if the learner's response is not rewardable according to the mark grid.
- Where judgement is required, a mark grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the mark grid to a learner's response, a senior examiner should be consulted.

## Specific marking guidance

The mark grids have been designed to assess learners' work holistically.

Rows in the grids identify the assessment focus/outcome being targeted. When using a mark grid, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner's response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band depending on how they have evidenced each of the descriptor bullet points.

Question Number	Answer	Mark
1(a)	C - Hygrometer	1

Question Number	Answer	Mark
1(b)	<p>Award <b>one</b> mark for each appropriate comment.</p> <ul style="list-style-type: none"> <li>• Moist air cannot escape from the apartment (1) because of lack of / inadequate ventilation (1)</li> <li>• If there is high humidity there is a lot of moisture in the air (1) and the air is warmer than surfaces such as windows and walls (1)</li> <li>• As air cools it loses its ability to retain moisture (1) so the vapour turns back to a liquid / forms condensation when it meets a cold surface (1)</li> <li>• Water vapour can pass through the fabric of the building (1) condensing to form damp when the temperature within the material is below the dew point (1)</li> </ul>	2

Question number	Working	Answer	Notes	Mark
1(c)	<p><b>Determine perimeter of the building:</b></p> <p>Perimeter = 2500 + 12500 + 10000 + 3000 + 7000 + 5000 + 10000 + 10000 + 3000 + 7000 + 3000 = 76000 mm or 76 m</p> <p>Perimeter = 76000 mm / 76 m</p> <p>External corner requirements: Length = 300 × 8 = 2400 mm (2.40 m)</p> <p>Internal corner requirements: Length = 300 × 4 = 1200 mm (1.2 m)</p> <p>Length of soffit required = perimeter + external corners - internal corners</p> <p>Length = 76000 + 2400 - 1200 Length = 77 200 mm</p> <p>SC Accept 77.2m</p>	<p><u>Length =</u> <u>77200 (mm)</u></p>	<p>M1 for calculating the perimeter of the building.</p> <p>A1 for correct calculation of the perimeter</p> <p>M1 for calculating the external or internal corner requirements.</p> <p>M1 correct method to calculate centre line (ft)</p> <p>A1 for correct value of centre line length (cao).</p>	5

Question Number	Answer	Mark
1(e)	<p>Award <b>one</b> mark for identification and <b>one</b> additional mark for an appropriate expansion up to a maximum of <b>two</b> marks.</p> <ul style="list-style-type: none"> <li>• The sky component of the DF varies due to the distance away from the windows (1) because the further away from the window the light level will reduce (1)</li> <li>• Different parts of the room may have different surface colours / finishes (1) therefore the amount of light reflected of these surfaces / internal reflected component will be varied (1)</li> <li>• Some parts of the room might be obstructed by furniture (1) which would lead to shadows/darker areas (1)</li> <li>• Externally reflected component may be obstructed by other nearby buildings/trees (1) which would reduce the level of light that is able to enter the room (1)</li> </ul> <p>Do not accept answers related to the location or orientation of the room as the focus of the question is daylight factors within a room.</p>	2

Question Number	Answer	Mark
1(d)	<p>Award <b>one</b> mark for identification and <b>one</b> additional mark for an appropriate expansion up to a maximum of <b>two</b> marks.</p> <ul style="list-style-type: none"> <li>• uPVC is water resistant/waterproof (1) so the soffits will not degrade with rot/mould/when exposed to rainfall (1)</li> <li>• uPVC is rot / corrosion / insect resistant (1) so extends the life span of the soffit (1)</li> <li>• uPVC is frost resistant (1) which reduces the impact of freeze and thaw cycles/air frost on the soffit boards (1)</li> <li>• uPVC has a decorative finish (1) and therefore requires less maintenance (1)</li> </ul>	2

Question Number	Answer	Mark
2(a)	<p>Award <b>one</b> mark for any of the following:</p> <ul style="list-style-type: none"> <li>• Common bricks come in different materials (1)</li> <li>• Can be used above/below the DPC (1)</li> <li>• Will be hidden by the render so appearance is not important (1)</li> <li>• Lower cost than facing bricks (1)</li> </ul> <p>Accept any other appropriate response. Do not accept answers related to aesthetics or weatherproof.</p>	1

Question Number	Answer	Mark
2(b)	<p>Award <b>one</b> mark for identification and <b>one</b> additional mark for an appropriate expansion up to a maximum of <b>two</b> marks.</p> <ul style="list-style-type: none"> <li>• High density concrete blocks have good compressive strength (1) so can support the weight of the upper floor/roof (1)</li> <li>• High density concrete blocks have good sound insulation properties (1) therefore will reduce noise from external sources. (1)</li> <li>• High density concrete blocks have good fire resistance properties (1) which would allow the structure to remain stable if there was a fire (1)</li> </ul>	2

Question Number	Answer	Mark
2(c)	<p>Award <b>one</b> mark for identification and <b>one</b> additional mark for an appropriate expansion up to a maximum of <b>four</b> marks.</p> <ul style="list-style-type: none"> <li>• Activities completed in the office are likely to require a quiet environment (1) as excessive amounts of noise would cause distractions / make it more difficult to concentrate (1)</li> <li>• Activities inside the kitchen will themselves tend to produce noise (1) therefore external noise has less effect / which may have an effect in other parts of the building (1)</li> <li>• The home office will require lower levels of background noise than the kitchen (1) since tasks completed in the office are likely to cause minimal amounts of noise themselves (1)</li> </ul>	4

Question number	Working	Answer	Notes	Mark
2(d)	$E = I/r^2$ $I = E \times r^2$ $I = 15 \times 2^2$ $I = 60$ <p>Substituting back</p> $E = 60/1.4^2$ <p>or</p> $E = 60/1.96$ $E = 30.6 \text{ (lux)}$	<u>E = 30.6 (lux)</u>	<p>M1 for rearranging in terms of I</p> <p>M1 for correct substitution of values (ft)</p> <p>A1 for correct value of I</p> <p>M1 for substitution of values (ft)</p> <p>A1 for correct value of E</p>	5

Question Number	Answer	Mark
3(a)	<p>Award <b>one</b> mark for identification and <b>one</b> additional mark for appropriate expansion up to a maximum of <b>two</b> marks.</p> <ul style="list-style-type: none"> <li>• Airborne sound are soundwaves or vibrations in air/traveling longitudinal waves consisting of repeating areas of high and low pressure (1) whereas impact sounds occur from the impact of an object on a building element / travels through structural elements (1)</li> <li>• Airborne sound is produced by speech/music/domestic appliances (1) whilst impact noise is generated by footsteps/dropping objects/jumping (1)</li> </ul>	2

Question Number	Answer	Mark
3(b)	<p>Award <b>one</b> mark for identification and <b>one</b> additional mark for appropriate expansion up to a maximum of <b>four</b> marks.</p> <ul style="list-style-type: none"> <li>• Prescribed mixes have known characteristic compressive strengths (1) therefore an appropriate design can be identified based on the needs of the workshop floors (1)</li> <li>• Prescribed mixes are standardised (1) meaning that the amount of sand/cement/aggregate/water for specific strengths are known (1)</li> <li>• Prescribed mixes can be selected based on factors such as wear resistance/durability/suitability for vehicles (1) so that the workshop floors will perform as required (1)</li> <li>• Prescribed mixes are more likely to achieve specified strength at 28 days (1) because the mix proportions are specified (1)</li> <li>• Prescribed mixes are correct for the job (1) which increases the likelihood of client satisfaction (1)</li> </ul>	4



Question Number	Answer	Mark
3(c)	<p>Award <b>one</b> mark for identification and <b>one</b> additional mark for appropriate expansion up to a maximum of <b>four</b> marks.</p> <ul style="list-style-type: none"> <li>• Ballast lamps have a long/good life span (1) reducing the cost of replacing them/maintenance required/because less electrode sputtering occurs (1)</li> <li>• Ballast lamps have electronic control systems that control the electricity flow (1) therefore ensuring that the lighting output remains constant/does not vary (1)</li> <li>• Ballast lamps use a high frequency electrical current (1) meaning that there is no flicker in the light output (1)</li> <li>• Ballast lamps are provided with a high voltage to strike an arc between electrodes in the lamp (1) so that there is little delay in providing the required amount of light in the workshops (1)</li> <li>• A more stable current output (1) with greater resolution and control. (1)</li> <li>• The intensity of ballast lamps can be controlled/dimmed (1) to provide a more comfortable working environment (1)</li> <li>• Industrial situations may require continuous illumination (1) and ballast lamps provide an energy efficient solution (1)</li> </ul>	4

Question number	Indicative content
3(d)	<p>Answers will be credited according to learners' demonstration of knowledge and understanding of the different types of loading that need to be considered for the industrial units, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but should be rewarded for other relevant answers.</p> <ul style="list-style-type: none"> <li>• The industrial units are likely to have large wall/roof areas</li> <li>• The structural frame will need to be able to withstand a combination of different forces</li> <li>• Wind loadings will affect the behaviour of members in the walls and roof of the units</li> <li>• Snow/wind loads for the roof may need to be considered depending on the location</li> <li>• Connections between different members will need to be designed to withstand shear/torsional forces and moments</li> <li>• Structural members will behave differently depending on the loads they are exposed to</li> <li>• Dead loads associated with the self-weight of beams/columns/struts/ties/cladding/roof will provide initial data for designing the structure</li> <li>• Live loads will need to consider furniture/equipment in the units and things which may be attached to the frame</li> </ul>

	<ul style="list-style-type: none"> <li>• Dynamic loads and vibration associated with moving plant and equipment</li> <li>• Structural members will need to be selected taking in to account factors of safety</li> <li>• Depending on the location, seismic loadings may need to be considered.</li> </ul>
Level	Descriptor
0 0 marks	No rewardable material
1 1-3 marks	A few key points identified, <b>or</b> one point described in some detail. The answer is likely to be in the form of a list. Only one viewpoint considered. Points made will be superficial/generic and not applied/directly linked to the situation in the question.
2 4-6 marks	Some points identified, <b>or</b> a few key points described. Consideration of more than one viewpoint but there will be more emphasis on one of them. The answer is unbalanced. Most points made will be relevant to the situation in the question, but the link will not always be clear.
3 7-9 marks	Range of points described, <b>or</b> a few key points explained in depth. All sides of the case are considered and the answer is well-balanced, giving weight to all viewpoints. The majority of points made will be relevant and there will be a clear link to the situation in the question.

Question number	Working	Answer	Notes	Mark
4(a)	<p>Load from the UDL = 22 x 5.5 = 121 kN</p> <p>taking moments around A</p> $R_B \times 22 = (12 \times 6) + (11 \times 121)$ $R_B \times 22 = 72 + 1331$ $R_B \times 22 = 1403 \text{ kNm}$ $R_B = 1403/22$ $R_B = 63.7 (7..) \text{ kN}$	$R_B = 63.7(7..) \text{ kN}$ <p>Accept answers rounding to 64</p>	<p>M1 for calculating the total load of the UDL A1 for correct value for the UDL</p> <p>M1 for the process of taking moments around A</p> <p>M1 for simplification</p> <p>M1 for rearranging to find <math>R_B</math> A1 for correct answer for <math>R_B</math></p>	6

Question Number	Answer	Mark
4(b)	<p>Award <b>one</b> mark for identification and <b>one</b> additional mark for appropriate expansion up to a maximum of <b>four</b> marks.</p> <ul style="list-style-type: none"> <li>• They have a high compressive strength (1) allowing the bridge to be supported safely/will not deviate under pressure (1)</li> <li>• They have low water absorption/relatively waterproof / low porosity (1) therefore the same type of brick can be used below and above the ground / offers good weathering resistance (1)</li> <li>• They are resistant to frost attack (1) reducing the chances of damage in the winter (1)</li> <li>• They have a very hard surface/tough (1) protecting them from impact damage (1)</li> <li>• They are resistant to chemical attack (1) meaning they will not be affected by fuel/oil/chemicals that might leach through from the road surface (1)</li> </ul>	4

Question Number	Answer	Mark
5(a)	<p>Award <b>one</b> mark for the identification and <b>one</b> additional mark for the appropriate expansion up to a maximum of <b>four</b> marks.</p> <ul style="list-style-type: none"> <li>• There may be sulphate present in the ground/atmosphere (1) that will react with the cement (1)</li> <li>• Reduce expansion caused by reactions with sulphates in the ground (1) allowing concrete/mortar to set fully (1)</li> <li>• It could reduce the effects of chemical reactions between any reinforcements in the concrete (1) which in turn will reduce the probability of the reinforcement corroding (1)</li> <li>• Suitable for a location which is close to the coast (1) as it will reduce the effects of atmospheric sulphate attacks in concrete/mortar (1)</li> </ul>	4

Question Number	Answer	Mark
5(b)	<p>Award <b>one</b> mark for the identification and <b>one</b> additional mark for the appropriate expansion up to a maximum of <b>six</b> marks.</p> <ul style="list-style-type: none"> <li>• Reduce the amount of thermal bridges between adjoining houses (1) by providing continuity of insulation/using insulated plasterboard (1)</li> <li>• Install insulation materials in the cavity between the twin leaves (1) to prevent warm air escaping (1)</li> <li>• Any gaps around the edges of the walls could be sealed (1) which would reduce the stack effect of drawing cold air from the outside and it becoming heated (1)</li> <li>• Reduce the possibilities for air movements within the cavity between the leaves (1) which in turn reduces the effects of thermal bypasses (1)</li> </ul> <p><b>Accept any other valid response.</b></p>	6

Question number	Indicative content
5(c)	<p>Answers will be credited according to learners' demonstration of knowledge and understanding of the context, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but should be rewarded for other relevant answers.</p> <p>An analysis of the use of the design, materials and construction method, the appropriateness for the location, or not, supported by relevant points, which may include:</p> <ul style="list-style-type: none"> <li>• Consideration of the climate at the location, including temperature, hours of sunshine, rainfall, wind speed, and days of air frost</li> <li>• The appropriateness of the materials with regards to the type of construction proposed and how they meet legislative requirements.</li> <li>• Consideration of materials to be used: <ul style="list-style-type: none"> <li>○ Resistance to exposure to weather</li> <li>○ Aesthetics</li> <li>○ Property values</li> <li>○ Combustibility/fire resistance</li> <li>○ thermal insulation</li> <li>○ Sustainability/recyclability</li> <li>○ Maintenance</li> <li>○ Finishes</li> <li>○ Resistance to insects/rot/rusting</li> <li>○ Durability</li> <li>○ Sound insulation</li> <li>○ Standard sizes</li> <li>○ ease of drilling/cutting</li> <li>○ Strength which makes it more versatile for homeowners</li> <li>○ ability to take mechanical fixings</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ speed of installation</li> <li>○ Well-established construction method</li> <li>● Consideration of location and climate: <ul style="list-style-type: none"> <li>○ The location is relatively wet in the winter, but does not often have very low temperatures, meaning materials do not need to withstand extreme exposure conditions</li> <li>○ Windspeeds in the location are relatively low even though it is a coastal area</li> <li>○ The location has quite high annual rainfall</li> <li>○ There are less than 20 days of air frost each year</li> <li>○ The location has a high level of sunshine in the summer</li> <li>○ Sunshine is quite limited in the winter</li> </ul> </li> <li>● Consideration of design/construction methods: <ul style="list-style-type: none"> <li>○ The design could be appropriate for the town houses as brick is a traditional cladding material</li> <li>○ Timber frame construction is suitable for three storey construction</li> <li>○ Timber frame could provide a quick method of constructing the houses</li> <li>○ Gives the homes a traditional look</li> <li>○ Provides the external walls with very high levels of thermal insulation</li> <li>○ Pre-fabricated, reduces wastage on site</li> <li>○ Higher quality assurance in production (off site)</li> <li>○ More modern method of construction may be seen as attractive to new buyers</li> <li>○ Considered a more sustainable form of construction</li> </ul> </li> </ul>
Level	Descriptor
0 0 marks	No rewardable material.
1 1-4 marks	Basic arguments on both sides identified, <b>or</b> only one side considered. The answer is likely to be in the form of a list. Points made will be superficial/generic and not applied/directly linked to the situation in the question. No conclusion produced or the conclusion a consequence of only one side of the argument being considered.
2 5-8 marks	Arguments for and against are described, but there will be more emphasis on one side than the other. The answer will be unbalanced. A conclusion is present, but this is either implicit or as a result of unbalanced consideration of the arguments. There is little or unfocused justification of the conclusion. Most points made will be relevant to the situation in the question, but the link will not always be clear.
3 9-12 marks	Balanced explanation of both sides for and against. A conclusion is produced which is justified, clearly linked to the consideration of arguments for and against, and their relative importance to the situation. The majority of points made will be relevant and there will be a clear link to the situation in the question.



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