



Rewarding Learning

**General Certificate of Secondary Education
2022**

Construction and the Built Environment

Unit 2

Sustainable Construction

[GCN21]

THURSDAY 16 JUNE, MORNING

**MARK
SCHEME**

General Marking Instructions

Introduction

Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these general marking instructions.

Assessment Objectives

Below are the assessment objectives for Construction and the Built Environment.

Candidates must:

- recall, select and communicate their knowledge of construction and the built environment and understanding of a range of contexts (AO1);
- apply skills, knowledge and understanding in a variety of contexts and in planning and carrying out investigations and tasks (AO2); and
- analyse and evaluate evidence, make reasoned judgements and present conclusions (AO3).

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Marking calculations

In marking answers involving calculations, examiners should apply the "own figure rule" so that candidates are not penalised more than once for a computational error.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication. Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response

Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for the “best fit” bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement. The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **Intermediate performance:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.
- **High performance:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

Marking calculations

In marking answers involving calculations, examiners should apply the “own figure rule” so that candidates are not penalised more than once for a computational error.

Quality of written communication

Quality of written communication is taken into account in assessing candidates’ response to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

Level 1: Quality of written communication is limited.

Level 2: Quality of written communication is satisfactory.

Level 3: Quality of written communication is excellent.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

Level 1 (Limited): The level of accuracy of candidates’ presentation, spelling, punctuation and grammar is limited. The candidate makes a limited selection and use of an appropriate form and style of writing.

The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary.

Level 2 (Satisfactory): The level of accuracy of candidates’ presentation, spelling, punctuation and grammar is satisfactory. The candidate makes a satisfactory selection and use of an appropriate form and style of writing supported with appropriate use of diagrams as required. Relevant material is organised with some clarity and coherence. There is some use of specialist vocabulary.

Level 3 (Excellent): The level of accuracy of candidates’ presentation, spelling, punctuation and grammar is excellent. The candidate successfully selects and uses the most appropriate form and style of writing, supported with precise and accurate use of diagrams where appropriate. Organisation of relevant material is excellent. There is excellent use of appropriate specialist vocabulary.

COVID-19 Context

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

Candidates are expected to answer **all** questions.

			AVAILABLE MARKS	
1	(a)	1. Tegral Thrutone slate or slate	[1]	
		2. Aluminium	[1]	
		3. PVC	[1]	
		4. Engineered timber or timber or wood	[1]	
		5. Plastic	[1]	
		6. Clay	[1]	
	(b)	Insulation in the cavity of the external wall		
		Insulation behind the sill		
		Insulation on top of the ceiling or joists		
		Insulation in the floor structure		
	Cold bridge insulation at the edge of the solid floor.	[3]		
	[1] per correct function up to a maximum of [3] or any other appropriate function			
(c)	Retain heat within the building and reduce heat loss	[1]	10	
2	(a)	Length 6100 mm	[1]	
		Width 3800 mm	[1]	
	(b)	Length 20 850 mm	[2]	
	(c)	Length 5000 mm allow 4850 - 5100	[2]	
		Width 2800 mm allow 2650 - 2900	[2]	
	(d)	Deduct [1] when the response is incorrect but within ± 1 m square tolerance. $3.6 \times 1.1 + 2.9 \times 1.2 = 7.44 \text{ m}^2$ 7.44 square metres	[2]	
	(e)	Deduct [1] when the response is incorrect but within ± 1 window.		
		7 number 1 800 mm wide windows	[2]	
(f)	Width 900 mm	[1]	13	

3 (a) Framed Ledged Braced and Sheeted door
[1] per correct descriptive word up a maximum of [4]

[4]

AVAILABLE
MARKS

(b) Six of the following performance requirements:

- Access
- Security
- Weather exclusion/draft proof
- Thermal resistance
- Noise reduction
- Durability/strength/stability
- Fire resistance
- Appearance/aesthetics
- Privacy

[1] per performance requirements up to a maximum of [6]
or any other appropriate function.

[6]

10

- 4 [1] for each shaded box completed correctly up to a maximum of [24].
 [1] Additional for getting the total cost of stool correct.

Item	Part	Quantity	Description of material required	Length in mm	Width in mm	Thickness in mm	Total length required	Total cost
1	Legs	4	Ash	600	44	44	2400	£16.22
2	Top Rails	4	Ash	506	120	20	2024	£14.07
3	Bottom Rails	4	Ash	506	50	20	2024	£9.19
4	Stool Top	1	MDF	600	600	40	8 table tops from one sheet	£8.88
Total cost of glue, connection blocks, varnish etc.								£4.70
Total cost of table								£53.06

Marks will be awarded for working out

Allow total length in mm or m.
 Width and length must be in correct order.

[25]

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AVAILABLE MARKS

5 (a) Candidates should complete the drawing in **Fig.5** to include the following:

1. Outer skin of block work
2. External plaster
3. Window frame
4. Concrete sill
5. Double glazing
6. Sill board
7. Internal plaster
8. DPC
9. Window jamb
10. Inner skin of block work [10]

Candidates should also draw in hatch patterns to represent the following:

1. Outer skin of block work/reveals should not be hatched
2. Cavity insulation/reveals should not be hatched
3. Inner skin of block work
4. Concrete sill [4]

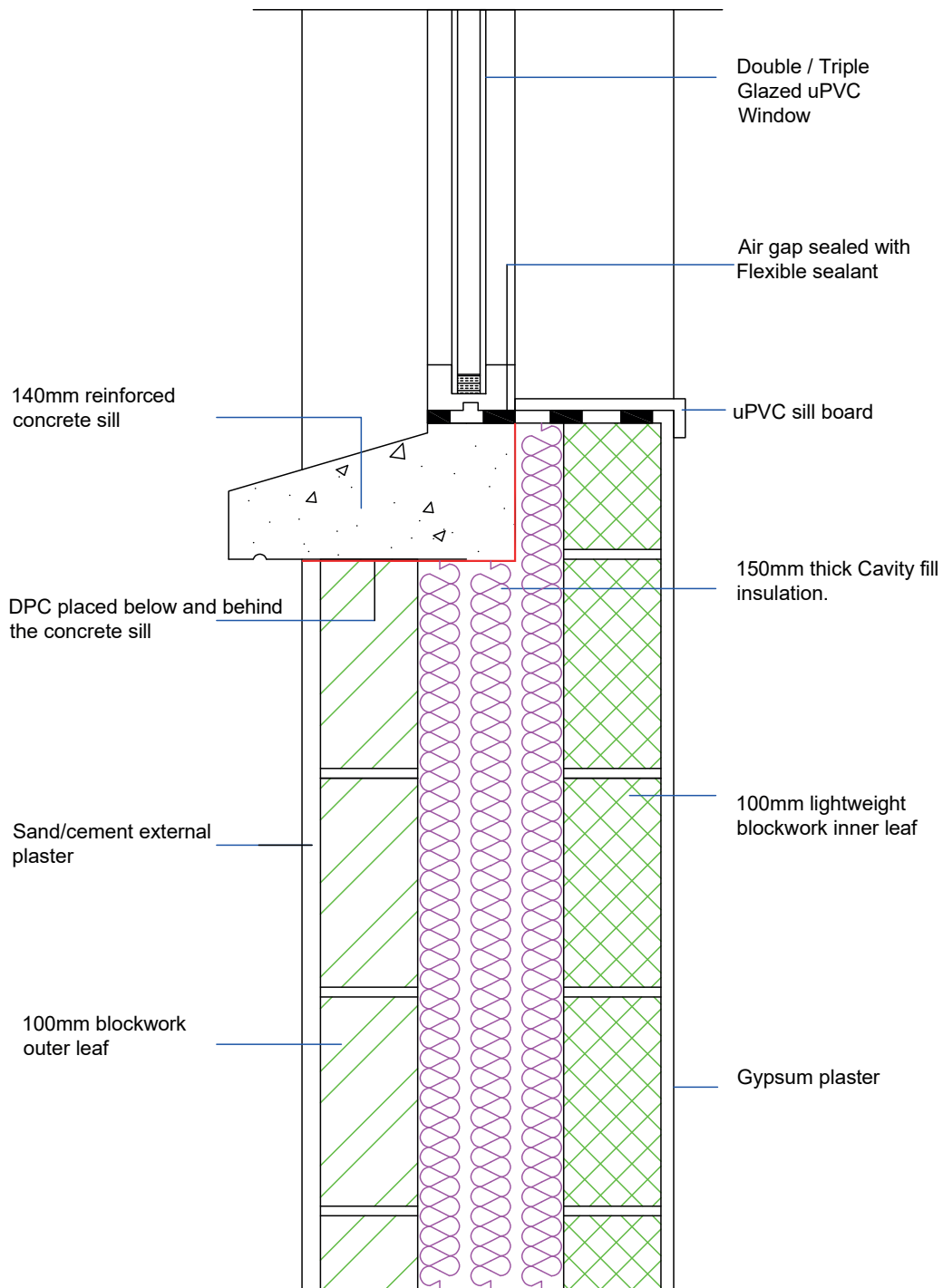
AVAILABLE
MARKS

(b) Candidates should add the labels from the list below once they have completed their drawing. [1] per label.

1. 140 mm reinforced concrete sill
2. DPC placed below and behind the concrete sill
3. 150 mm thick cavity fill insulation
4. uPVC sill board
5. 100 mm lightweight blockwork inner leaf
6. Sand/cement external plaster
7. Gypsum plaster
8. Air gap sealed with flexible sealant
9. 100 mm blockwork outer leaf
10. Double/triple glazed uPVC window

AVAILABLE MARKS

10



(c) Answer must reflect the following as a discussion:

- Insulation behind the sill
- DPC below the sill
- Insulation in the cavity below the sill
- Cavity wall/Flexible sealant

Identification of two of the above [1] each up to a maximum of [2].

Candidate will show how they have analysed the sill detail they have completed in order to demonstrate a basic understanding of how energy performance/damp penetration of the junction between the sill and the wall could be improved. [1]

or

Candidate will show how they have analysed the sill detail they have completed in order to demonstrate a good understanding of how energy performance/damp penetration of the junction between the sill and the wall could be improved. [2]

or

no evidence of the sill detailed has been analysed. [0]

[4]

28

AVAILABLE
MARKS

- 6 An evaluative answer should be constructed using the following points below or any other suitable answer:

Timber Framed Construction

- Manufacture in factory controlled conditions reduces wastage.
- The manufacturing process is not affected by inclement weather.
- Rapid completion on site is easily achieved with less wet trades involved.
- The occupier of a timber framed dwelling benefits from the higher insulation which can easily be achieved. The use of low thermal capacity linings absorbs less heat than masonry walls making it is easier to reach the required comfort temperature more quickly.
- Flexible, easy to modify or add to.
- Many types of cladding possible, simple to insulate.

Evaluation of keeping buildings air tight

Advantages of an air tight building

- Lower running costs through reduced heat loss.
- Reduced CO² emissions.
- Improved comfort.
- Reduced carbon emissions.
- Verification of building quality.
- Increased comfort.
- Timber framed construction allows for the use of semi-skilled labour.

Disadvantages of keeping buildings air tight.

- Ensure all employees and sub-contractors are suitably trained/qualified to conduct the work they are required to undertake in order to make a building air tight.
- Increased condensation.
- Need for mechanical ventilation.

Consider the following points when analysing the potential to reduce heat loss within wall and roof structures:

Walls

Cavity fill insulation i.e. 150 mm

Increase the width of the cavity and or use higher specification insulation.

Bond increased insulation to the inside of all external walls.

Make sure well detail insulation construction is used at all openings.

Roof Construction

Increase insulation in roof space from 200 mm to 300 mm

Level 1 ([1]–[4])

Candidates demonstrate a limited ability to evaluate/analyse construction methods to build in a more sustainable way.

They evaluate/analyse at least one of the following: Timber framed construction rather than traditional masonry construction or air tight construction versus possible condensation problems or enhanced insulation for walls and roof construction. Their evaluation is not fully coherent or organised and there is little use of specialist terms. The quality of written communication is basic. coherent or organised and there is little use of specialist terms. The quality of written communication is basic.

Level 2 ([5]–[7])

Candidates demonstrate a satisfactory ability to evaluate/analyse construction methods to build in a more sustainable way.

They evaluate/analyse at least two of the following: Timber framed construction rather than traditional masonry construction or air tight construction versus possible condensation problems or enhanced insulation for walls and roof construction. Their evaluation is coherent and organised in most cases and they use a range of specialist terms. The quality of written communication is good.

Level 3 ([8]–[10])

Candidates demonstrate an excellent ability to evaluate/analyse construction methods to build in a more sustainable way.

They evaluate/analyse at least two of the following: Timber framed construction rather than traditional masonry construction or air tight construction versus possible condensation problems or enhanced insulation for walls and roof construction. Their evaluation is coherent and very well organised in all cases and they use a good range of specialist terms. The quality of written communication is excellent.

When a response is not worthy of credit [0] should be awarded. [10]

10

7 (a) Cavity Wall Construction

Cavity wall construction is used for the external wall construction of the house in the pre-release material. Damp cannot bridge the cavity.

The cavity has the added advantage of creating a location for 150mm of insulation.

[1] for correct location related to the pre-release material and [1] for stating the purpose of cavity wall. [2]

(b) Pitched Roof Construction

A pitched roof is located on both the single and two storey house shown in the pre-release material. Rain quickly runs off this type of roof into the box gutter. The pitched roof allows an opportunity to accommodate high quality insulation.

[1] Mark for correct location related to the pre-release material and [1] for stating the purpose of a pitched roof. [2]

(c) Solid concrete floor with 150mm insulation

A solid concrete floor is located in all ground floor rooms within the house shown in the pre-release material. This type of floor construction is highly insulated to prevent the transfer of heat out of the building. It also contains a DPM to prevent damp entering the building.

[1] for correct location related to the pre-release material and [1] for stating the purpose of a solid concrete floor. [2]

(d) Stainless steel wall ties and spacing

The stainless steel wall ties are located within the cavity wall of the house shown in the pre-release material. The spacing of these wall ties is: 750mm horizontally, 300mm vertically at window or door openings and 450mm between courses.

[1] for correct location within the Cavity walls related to the pre-release material and [1] for stating the purpose of a wall tie. [2]

(e) Solar Panels

The solar panels are located on the south facing roof. These panels provide hot water or electricity for the building.

[1] for correct location of the solar panels related to the pre-release material and [1] for stating the purpose of a solar panel. [2]

(f) Vertical and horizontal DPC

The vertical and horizontal DPC's are located in the wall structure around windows and door openings or located 150 mm above finished ground level. The function of a vertical and horizontal DPC's is to prevent the passage of damp penetrating into the building.

[1] for correct location of the vertical and horizontal DPCs related to the pre-release material and [1] for stating the purpose of a DPC. [2]

(g) Eaves junction/detail

The eaves of the dwelling is the junction between where the roof and the wall are located. The eaves include the fascia board and gutter. The function of an eaves detail is to prevent the passage of damp penetrating into the building.

[1] for correct location of the eaves as related to the pre-release material and [1] for stating the purpose of an eaves detail. [2]

AVAILABLE MARKS	
	14
Total	120

8 Answer must evaluate the following sustainable methods of generating energy or other suitable alternative.

- Wind
- Biomass
- Solar Energy
- Heat pumps

Level 1 ([1]–[4])

Candidates demonstrate a basic evaluation of one different sustainable methods of generating usable energy. Candidates will show a basic understanding of the advantages and disadvantages of each method. Their evaluation is not fully coherent or organised and there is little use of specialist terms. The quality of written communication is basic.

Level 2 ([5]–[7])

Candidates demonstrate a satisfactory evaluation of at least two different sustainable methods of generating usable energy. Candidates will show a satisfactory understanding of the advantages and disadvantages of each method. Their evaluation is coherent or organised in most cases and they use a range of specialist terms. The quality of written communication is good.

Level 3 ([8]–[10])

Candidates demonstrate an excellent evaluation of at least three different sustainable methods of generating usable energy. Candidates will show an excellent understanding of the advantages and disadvantages of each method. Their evaluation is coherent and very well organised and they use a wide range of specialist terms. The quality of written communication is excellent.

When a response is not worthy of credit [0] should be awarded. [10]