Rewarding Learning

General Certificate of Secondary Education
2023

Construction and the Built Environment

Unit 2

Sustainable Construction

[GCN21]

THURSDAY 15 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.

Assessment Objectives
Below are the assessment objectives for Construction.

Candidates must:

AO1 recall, select and communicate their knowledge and understanding of concepts, issues and terminology;
AO2 apply skills, knowledge and understanding in a variety of contexts and in planning and carrying out investigations and tasks; and
AO3 analyse and evaluate evidence, make reasoned judgements and present conclusions.

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.

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 (Basic): The candidate makes only 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. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

Level 2 (Good): The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

Level 3 (Excellent): The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

				AVAILABLE MARKS
1	**(a)**	1. Concrete. [1] 2. uPVC. [1] 3. Lead. [1] 4. Glass		
	(b)	Seven of the following functions: • Access. • Security. • Weather exclusion. • Thermal insulation. • Fire resistance. • Sound or noise reduction. • Durability. • Appearance. • Privacy. • Stability. • Sustainability • Strong [1] per correct function up a maximum of [7] or any other appropriate function.	[7]	
	(c)	A timber architrave would be found around the edge of a door frame. [1] It covers the joint between the plaster and the frame.	[1]	12
2	**(a)**	1. Length 4400 mm. [1] Width 4500 mm. [1]	[2]	
		2. Width 8500 mm. [2] Scaled dimension ± 100 mm tolerance.	[2]	
		3. Length 5100 mm. [2] Width 4500 mm. [2] Scaled dimension ± 100 mm tolerance.	[4]	
	(b)	4450 × 3590 = 15.98 square metres. [1] 3250 × 1200 = 3.9 square metres. [1] Total floor area of bedroom 3 = 19.88 square metres. [1] Process [2]	[3]	
		Accept the mark when the response is within ± 1 m square tolerance.		
	(c)	1. 800 mm. [1]	[1]	
		2. 15 doors [1]	[1]	
		Deduct no marks where the response is ±1 door, i.e. 14 or 16 doors.		13

AVAILABLE MARKS

3 **(a)** Four of the following properties:

- The roof must be resistant to the elements.
- Good thermal insulation properties.
- Require the minimum of maintenance.
- The roof should be structurally stable.
- Fire resistant.
- Aesthetically pleasing.
- Allow the water to run off.
- The materials used must be affordable.
- Long life span/durability
- Roof Conversion
- 37^{o} pitch

[1] per correct property up a maximum of [4] or any other appropriate function. [4]

(b) Roof loads transferred by rafters to walls.
First floor loads transferred by members to walls.
Wall loads transferred to foundations.
Foundation loads transferred to load bearing sub soil.
[1] per description point up a maximum of [3] or any other appropriate property. [3]

(c) **1.** **Dead load**
These are loads created by the building structure. [1]

2. **Imposed loads**
These are loads of the building contents and occupants. [1]

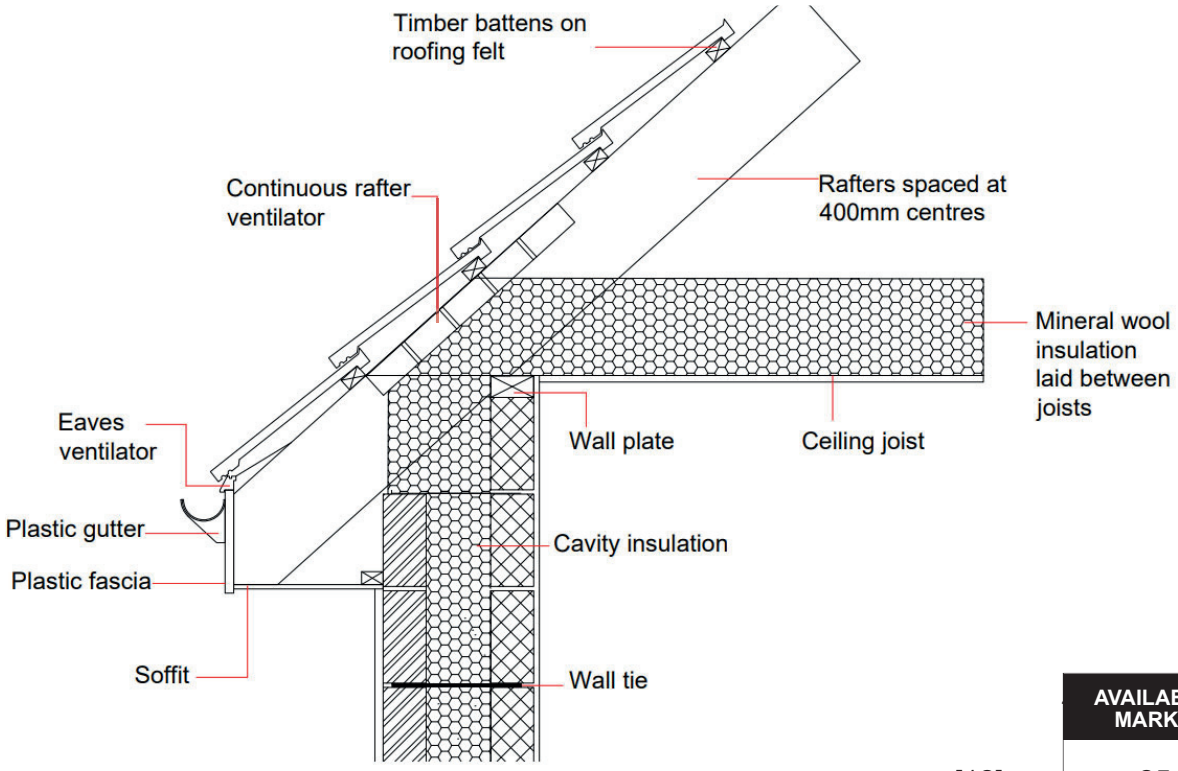
3. **Steel purlin**
Steel Purlins are horizontal roof members supporting the rafters. They are usually supported by load bearing walls. [1]

4. **Roof covering**
Materials used for roof coverings must be able to keep the elements out and provide thermal insulation. [1]

5. **Dormer window**
A window coming through a sloping roof. [1]

6. **Ridge board**
The ridge is a horizontal board set on edge to which the rafters are attached. [1]

(d)



[12]

AVAILABLE MARKS

25

4 (a) Sustainable construction

Sustainable construction is development that meets the needs of the present without comprising the ability of future generations to meet their own needs.

Using either wind, solar, biomass or any other form of renewable energy generate energy. A mark could also be awarded for increased insulation in a building, use of timber framed construction or any other suitable answer. [2]

(b) Carbon footprint

Carbon footprint is the amount of carbon dioxide released into the atmosphere because of the activities of a particular individual, organisation, or community.

An example could be burning fossil fuels to heat a building, using petrol to fuel a car, or any other suitable answer. [2]

(c) Pollution

Pollution is the introduction of harmful materials into the environment.

Pollutants can be created by human activity, such as construction site waste, domestic waste, plastic, or any other suitable answer. [2]

(d) Retrofit (Regeneration of buildings)

To install, fit, or adapt an existing building to provide an alternative use.

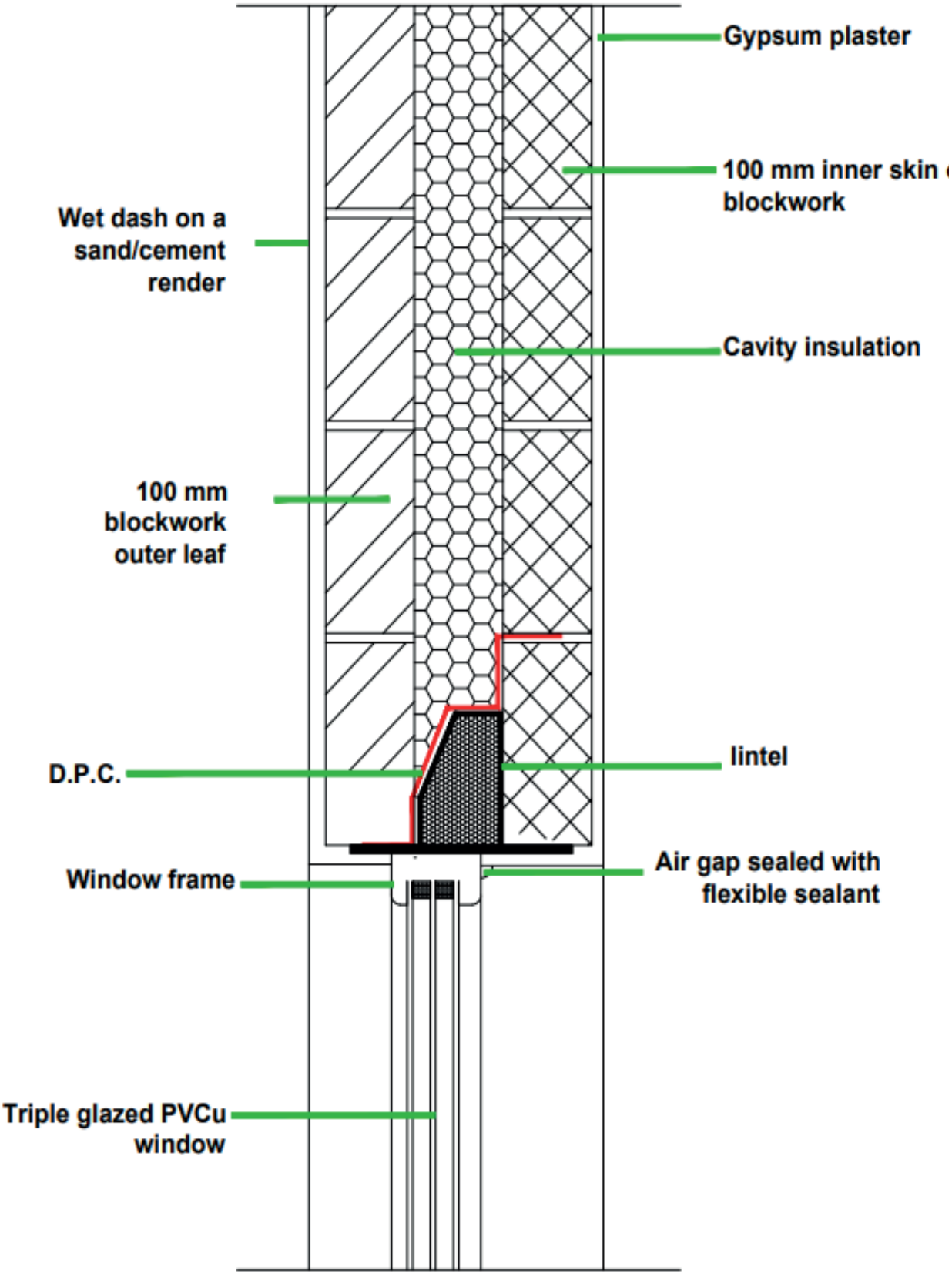
or

Construction activities that improve the quality of life for those who use the buildings.

This could be a complete renovation of a derelict building or replacing part of a building such as heating, lighting, kitchen, or any other suitable answer. [2]

8

			AVAILABLE MARKS
5	**(a)**	Quality of drawing [1] per accurate drawing component completed up to a maximum of [8]	
		1. Outer skin of blockwork. 2. External wet dash plaster. 3. Steel lintel. 4. DPC. 5. Inner skin of blockwork. 6. Window frame. 7. Triple glazing. 8. Gypsum plaster. [8]	
		Quality of hatch pattern [1] per accurate hatch pattern up to a maximum of [4]	
		1. Insulation in the steel lintel. 2. Inner skin of blockwork. 3. Outer skin of blockwork. 4. Cavity insulation. [4]	
	(b)	[1] per label up to a maximum of [10]	
		1. 100mm blockwork outer leaf. 2. Wet dash on a sand/cement render. 3. Lintel. 4. DPC. 5. 100mm inner skin of blockwork. 6. Cavity insulation. 7. Window frame. 8. Triple glazing PVCu window. 9. Gypsum plaster. 10. Air gap sealed with flexible sealant. [10]	22


Gypsum plaster
100 mm inner skin
blockwork
Wet dash on a
sand/cement
render
Cavity insulation
100 mm
blockwork
outer leaf
D.P.C.
lintel
Window frame
Air gap sealed with
flexible sealant
Triple glazed PVCu
window

			AVAILABLE MARKS
6	**(a)**	Sound Reduce heat loss Strong Reduce condensation Cost as apposed to triple glazed windows. An answer to reflect a clear knowledge of double glazed construction [2], partial answer [1] no discussion [0] [2]	
	(b)	Transom A horizontal member in a window frame. Mullion A vertical member in a window frame. [1] for each correct answer up to a maximum of [2] [2]	
	(c)	Any **six** of the following functions: • Security • Weather exclusion • Thermal insulation • Privacy (bathroom) • Sound or noise reduction • Durability • Appearance • Provide resistance to air penetration (drafts) • Stability • Ventilation • Provide Light • Access • Strength [1] per correct function up to a maximum of [6] or any other appropriate function. [6]	10

7 An answer should be evaluative using the following points or any other suitable answer.

AVAILABLE MARKS

Renewable energy can be defined as
"meeting the needs of the present without compromising the ability of future generations to meet theirs."

Energy Resource	Advantages	Disadvantages
Wind turbines	Clean and cheap to run.	Expensive to set up and wind does not always blow. As the site is in the bottom of a valley and surrounded by mature trees it will not be a viable option.
Biomass	Two hectares of land at the rear of the site which could be used to plant fast growing trees like willow to be used as Biomass. Fairly cheap to grow.	Expensive to harvest. Take at least three years to grow. Biomass must be very dry and chipped before it can be burned in a biomass burner. Expensive to set up. May be cheaper to rent out the land to grow trees or other crops and buy in chipped biomass.
Geothermal ground pumps	Clean to run. Very reliable. All pipes are buried in the ground.	Very expensive to run as electricity is required for circulation pumps. Large area of land required to place heat pipes in. Expensive to set up.
Solar panels (Photovoltaic)	Clean and cheap to run. Can be secured to a roof so no space taken/land used up.	Not always sunny and output does not always outweigh initial cost to set up. Solar panels need to run in conjunction with another energy source as most energy is required in the winter months when light levels are low. To get the greatest energy output the panels should face south.

Level 1 ([1]–[4])
Candidates demonstrate a limited ability to evaluate the advantages and disadvantages of renewable energy sources for a small social housing complex. They evaluate at least one renewable energy source for a small social housing complex, in a limited form and style of writing. 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 ability to evaluate the advantages and disadvantages of renewable energy sources for a small social housing complex. They evaluate at least two renewable energy sources for a small social housing complex. 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 ability to evaluate the advantages and disadvantages of renewable energy sources for a small social housing complex. They evaluate at least three renewable energy sources for a small social housing complex. 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.

Up to [5] of the total available marks will be awarded for the quality of the written communication. [10]

AVAILABLE MARKS

10

AVAILABLE MARKS

8 **(a)** One of the following reasons:

- Legal obligation to get **Planning Permission** before you can build a new house.
- You are required to show evidence of having received Planning Permission if you ever want to sell any of the five houses.
- A bank or building society will not lend money if you do not have evidence of Planning Permission.
- You can be forced to alter or even demolish the houses if you have not received Planning Permission. [2]

(b) **Green belt**

- Policy for controlling urban growth.
- An area surrounding a town or village where construction is kept to a minimum.
- Limited development is allowed within greenbelt area for farms or other appropriate occupations associated with agriculture.

It is necessary to have such a policy to

- Prevent urban sprawl

[1] to demonstrate an understanding of terms and [1] to give an appropriate reason why it is necessary to have such a planning policy. [2]

(c) **Conservation area**

- A designated area of architectural heritage which is to be retained. (part of a village, town, or city)
- A designated area of outstanding natural beauty which is to be preserved.

One example of a conservation areas such as Gracehill, Cushendall, Loughgall, Portaferry, Randalstown, Stranmillis.
Or any other appropriate answer.

A list of N.I. Conservation Areas is found on the website.
www.planningni.gov.uk/index/policy/planning_statements_and_supplementary_planning guidance/conservation/conservation as.htm

[2] to demonstrate an understanding of the term Conservation Area. [2]

(d) An answer should be constructed using the following points as part of a discussion in an evaluative way.

Design
Location of the building.
Surrounding setting of existing buildings.
Use of vertical windows in keeping with the existing bank.
Does the proposed use secure the upkeep of a building which may become derelict?
Will the proposed hotel enhance the architectural appearance of an area?
Will the new use of the building be appropriate for the area?
Scale
Is the new footprint larger than the existing building?
The contextual gain for an area.
Bring people back into the town/ city or village.
The scale of a new four storey building as opposed to a two storey bank.

Massing
Does the massing integrate with the form and size of a listed building?

[1] for correctly identifying and discussing the importance points of design, scale and massing up to a maximum of [4] or any other appropriate consideration. [4]

AVAILABLE MARKS

10

9 An answer should be constructed using the following points below or any other suitable answer.

The following information is available from analysing the site plan.
Site 2 has an elevated platform.
The elevated platform is made up of spoil. (spoil contains topsoil, builder's rubble, subsoil).
Maximum depth of spoil is 3000 mm.
Soil of a firm bearing capacity was found below the spoil.

Storm drain
The 600 mm storm drain cannot be built over.
It can be diverted but at the client's costs which is generally very expensive.

Foundation type
Strip foundation is not an option because of the requirement to construct the house on an existing spoil heap which is 3000 mm deep.
A raft foundation is not an economic option at the house can be up to 8.0 m ridge height creating an heavy load to be distributed.
Deep strip foundations can be no more than 3000 mm deep.
Short bore pile foundations are the preferred option.

Level 1 ([1]–[4])
Candidates demonstrate a limited ability to analyse the Site Plan and advise the client on the type of foundations they would propose to use. They justify their answer using at least one fact available from the pre-release material. Their discussion 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 ability to analyse the Site Plan and advise the client on the type of foundations they would propose to use. They justify their answer using at least two facts available from the pre-release material. Their discussion 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 ability to analyse the Site Plan and advise the client on the type of foundations they would propose to use. They justify their answer using at least three facts available from the pre-release material. To achieve level three, they must specify pile foundations. Their discussion is coherent and organised in most cases and they use a range of specialist terms. The quality of written communication is excellent.

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

Up to [5] of the total available marks will be awarded for the quality of the written communication. [10]

AVAILABLE MARKS
10
120