

TQUK Level 3 Certificate in Design, Engineer, Construct. The Digital Built Environment (RQF)

Paper ID: KNIL – 11 Certificate

Assessment date: PASTPAPER2

Mark Scheme

Mark scheme information

This mark scheme is intended to support the valid and consistent marking of the examination paper identified above. This mark scheme includes:

- the total mark available for each question
- the individual subject content coverage of each question
- further considerations which could or should be followed.

Information for the marker

- All marking must be completed consistently, and the mark scheme must be applied fairly
- Markers should award full marks if the candidate deserves full marks
- Markers should be prepared to award zero marks if the candidate's response is not worthy of credit according to the guidance for that activity
- Crossed-out work should be marked unless the candidate has replaced it with an alternative response
- There are no marks for spelling, punctuation and grammar, therefore errors are not penalised
- Unless indicated, quotations and candidates' own words are acceptable

Mathematics

- **(M)** = Method mark awarded for application of a correct method.
- **(CAO)** = Mark awarded for a correct answer only.
- **(FT)** = Follow-through – where an answer requires a number of calculations if the answer to the first calculation is incorrect, and this is carried into another calculation, the candidate should **not** be penalised in the second calculation.
- **(OE)** = or equivalent. Where an answer could be rounded up or down, for example, or where an alternative method could be used.

Key

SC	Subject Content Coverage (as identified in the Qualification Specification)
----	---

Text in brackets	May be included but is not essential to be awarded the mark
------------------	---

Grade boundaries:

E	20
D	27
C	34
B	41
A	48
A*	54

Q	Answer	Marks	SC
1a.	<p>Identify one type of hydrological data collected when producing a hydrology study.</p> <p>Award 1 mark for a correct type of hydrological data, for example:</p> <ul style="list-style-type: none"> • rainfall (data) / precipitation (data) (1) • streamflow (data) (1) • soil characteristics (1) • water lost through evaporation / evapotranspiration rates (1) • flood records (1). <p>Accept any other suitable response.</p>	1	1.3.5

Q	Answer	Marks	SC
1b.	<p>Hydrological data is used as part of a site survey. Identify three other types of data that should be used during a site survey.</p> <p>Award 1 mark for each correct answer, up to a maximum of 3 marks. This must not be hydrological data as in the stem of the question. For example:</p> <ul style="list-style-type: none"> • topographical (1) • geotechnical (1) • ecological (1). <p>Accept any other suitable response.</p>	3	1.3.5

Q	Answer	Marks	SC
1c.	<p><i>State four tools or pieces of equipment used during a site survey.</i></p> <p>Award 1 mark for each correct tool or piece of equipment used during a site survey, up to a maximum of 4 marks. For example:</p> <ul style="list-style-type: none"> • total station (1) • Global Positioning System (GPS) (1) • Global Navigation Satellite System (GNSS) (1) • theodolite (1) • measuring tapes (1) • plumb bob (1) • steel stakes / rebar (1) • surveyor's compass (1) • surveying rods (1) • range poles (1) • boundary markers (1) • laser rangefinder (1) • (surveyor's) chain (1) • Ground Penetrating Radar (GPR) (1) • Electronic Distance Measurement (EDM) (1) • drill for bore hole (1) • spade or shovel for trial pit (1) • drones / UAV (1). <p>Accept any other suitable response.</p>	4	1.3.1

Q	Answer	Marks	SC
2a.	<p>Identify two features of a shell structure.</p> <p>Award 1 mark for each correct feature, linked to a shell structure, up to a maximum of 2 marks. For example:</p> <ul style="list-style-type: none"> • a (usually) curved surface (1) • gives evenly-distributed stress (1) • curvature-resist bending (1) • thin in comparison to their overall size (1) • lightweight (while still maintaining strength) (1) • transfer forces efficiently across its surface (1) • minimal need for internal bracing / heavy materials (1) • balance of material in compression on the outer surface and in tension on the inner surface (1) • structural strength-resisting bending / compression (1) • material efficiency / uses less material compared to other types of structures (1) • environmentally efficient (1). <p>Accept any other suitable response.</p>	2	3.2.1

Q	Answer	Marks	SC
2b.	<p>Identify three features of steel.</p> <p>Award 1 mark for each correct feature of steel, up to a maximum of 3 marks. For example:</p> <ul style="list-style-type: none"> • high strength-to-weight ratio (1) • flexibility / behaves elastically (1) • ease of fabrication and assembly (1) • durability (1) • recyclability (1) • toughness / strong in tension / strong in compression (1) • ductile / ductility (1) • susceptible to corrosion (1) • can distort / buckle in fire (1) • conductive (thermal bridge) (1). <p>Accept any other suitable response.</p>	3	3.2.5

Q	Answer	Marks	SC
2c (i).	<p>Identify two advantages of a mass structure.</p> <p>Award 1 mark for each correct advantage of a mass structure, up to a maximum of 2 marks. For example:</p> <ul style="list-style-type: none"> • compressive strength (1) • fire-resistance (1) • cost-effectiveness (1) • versatility (1) • durability (1) • ability to be poured into form (1). <p>Accept any other suitable response.</p>	2	3.2.5

Q	Answer	Marks	SC
2c (ii).	<p>Identify two disadvantages of a mass structure.</p> <p>Award 1 mark for each correct disadvantage of a mass structure, up to a maximum of 2 marks. For example:</p> <ul style="list-style-type: none"> • heavy material use / require more materials (1) • long curing / setting time (1) • labour-intensive (1) • inherently rigid / inflexible (1) • higher dead load (1) • lack of aesthetic variety (1) • high transportation costs (1) • issues with thermal insulation (1) • energy-efficiency issues (1) • (traditional mass structures made of stone, brick, or concrete) may not provide the best insulation (1). <p>Accept any other suitable response.</p>	2	3.2.5

Q	Answer	Marks	SC
3a (i).	<p>What is responsible procurement?</p> <p>Award 1 mark for a correct answer, for example:</p> <ul style="list-style-type: none"> • (procurement that considers) social / environmental / economic impacts to support sustainable development (1) • (procurement that takes into account) compliance with environmental legislation and / or regulation / consider environmental impact in procurement (1). <p>Accept any other suitable response.</p>	1	1.2.4

Q	Answer	Marks	SC
3a (ii).	<p>Identify three environmental reasons to use ethical sourcing practices.</p> <p>Award 1 mark for each correct environmental reason to use ethical sourcing practices, up to a maximum of 3 marks. For example:</p> <ul style="list-style-type: none"> • sustainability / sustainable resources / packaging (1) • effective management of resources (1) • energy-efficiency (1) • waste reduction (1) • carbon footprint reduction (1) • animal welfare (1). <p>Accept any other suitable response.</p>	3	1.2.4

Q	Answer	Marks	SC
3b.	<p><i>Explain three reasons a construction company would want to minimise waste.</i></p> <p>Award 1 mark for each correct reason given linked to minimising waste, up to a maximum of 3 marks. For example:</p> <ul style="list-style-type: none"> • material savings (1) • reduced disposal costs (1) • better use of materials (1) • recycling / reusing materials (1) • higher profitability (1) • competitive advantage (1) • avoiding fines (1) • reducing liability (1) • faster completion times (1) • reduced labour costs (1). <p>Accept any other suitable response.</p> <p>Award 1 mark for each linked explanation, up to a maximum of 3 marks. For example:</p> <ul style="list-style-type: none"> • construction materials can be expensive, so waste reduction helps the company avoid purchasing unnecessary materials (1) • improper disposal of waste or the need to remove excess material can incur additional costs (1) • optimised material usage ensures that fewer materials go unused or get wasted (1) • waste reduction can lead to a culture of recycling and reusing (1) • by reducing waste, construction companies can lower overhead costs / improve operational efficiency / increase profitability (1) • clients may prefer working with firms that are committed to sustainability (1) • fines or penalties are imposed on companies that fail to comply with waste management regulations (1) • construction waste can be hazardous so improperly managing it can result in costly accidents / injuries / health risks (1) • involves better project planning leading to smoother operations and fewer delays (1) • by reducing waste, construction companies can optimise workforce productivity (1). <p>Accept any other suitable response.</p>	6	1.2.3

Q	Answer	Marks	SC
3c.	<p><i>Look at the Resource Document. Identify three positive and three negative impacts a large-scale construction project could have on a local community.</i></p> <p>Award 1 mark for each positive impact on a local community, up to a maximum of 3 marks. For example:</p> <ul style="list-style-type: none"> • job creation (1) • local business opportunities (1) • infrastructure improvement (1) • increased property values (1) • community facilities (1) • tax revenue (1) • skills development (1) • community engagement (1). <p>Accept any other suitable response.</p> <p>Award 1 mark for each negative impact on a local community, up to a maximum of 3 marks. For example:</p> <ul style="list-style-type: none"> • noise pollution (1) • air pollution (1) • traffic disruptions (1) • dust / debris (1) • displacement / gentrification (1) • environmental impact (1) • visual impact (1) • strain on local services (1) • community disruption (1). <p>Accept any other suitable response.</p>	6	1.2.1

Q	Answer	Marks	SC
4a (i).	<p><i>What is occupant comfort?</i></p> <p>Award 1 mark for a correct answer, for example:</p> <ul style="list-style-type: none"> • the overall satisfaction / well-being / contentment of individuals within a built environment (such as homes, offices or other indoor spaces) (1). <p>Accept any other suitable response.</p>	1	3.3.1

Q	Answer	Marks	SC
4a (ii).	<p>Identify three factors that contribute to occupant comfort.</p> <p>Award 1 mark for each contributing factor to occupant comfort, up to a maximum of 3 marks. For example:</p> <ul style="list-style-type: none"> • thermal (comfort) (1) • indoor air quality (IAQ) / air quality (1) • lighting (1) • acoustics (1) • visual (factors) (1) • ergonomics (1). <p>Accept any other suitable response.</p>	3	3.3.1

Q	Answer	Marks	SC
4b.	<p>Look at Table 1 in the Resource Document. Both toilet spaces in the building require a lux of 200 and use 6-watt LED bulbs. Calculate the total number of light bulbs required for the toilet spaces.</p> <p>Use: $\text{lumens} = \text{lux} \times \text{area}$ and Use: $\text{bulbs required} = \text{lumens required} / \text{lumens of 6-watt LED bulbs}$. You must show your workings.</p> <p>Award 1 mark for the method (M) given correctly to calculate the area of the toilet spaces, for example:</p> <p>(area of both toilet spaces =) $24.75 \text{ (m}^2\text{)} + 21.25 \text{ (m}^2\text{)}$ (1)</p> <p>Award 1 mark for the correct answer (CAO):</p> <p>46 (m²) (1)</p> <p>Award 1 mark for the method (M) given correctly to calculate the lumens required, for example:</p> <p>(lumens =) $200 \times 46 \text{ (m}^2\text{)}$ (1)</p> <p>Award 1 mark for the correct answer (CAO):</p> <p>9200 (lumens) (1)</p> <p>Award 1 mark for the method (M) given correctly to calculate the number of 6-watt LED bulbs required, for example:</p> <p>(bulbs required =) $9200 / 400$ (1)</p> <p>Award 1 mark for the correct answer (CAO):</p> <p>23 (bulbs) (1)</p> <p>Please note: Accept 24 bulbs will be required. (If areas calculated independently as two separate spaces.)</p> <p>There are up to 6 marks available.</p>	6	3.3.3

Q	Answer	Marks	SC
4c.	<p>Look at Table 2 in the Resource Document. Calculate the lumens required for cleaning the auditorium.</p> <p>Use: lumens required = lux x area. You must show your workings.</p> <p>Note: Award full marks if correct answer seen.</p> <p>Award 1 mark for the method (M) given correctly to calculate the lumens required for cleaning the auditorium, for example:</p> <p>(lumens =) 350 x 468 m² (1)</p> <p>Award 1 mark for the correct answer (CAO):</p> <p>163800 (lumens) (1)</p> <p>There are up to 2 marks available.</p>	2	3.3.3

Q	Answer	Marks	SC
5a.	<p>Identify one way the orientation of a building affects solar gain.</p> <p>Award 1 mark for a correct answer linked to solar gain, for example:</p> <ul style="list-style-type: none"> • (the building's orientation) determines how much direct sunlight it receives (1) / can reduce the need for heating in colder months (1) • (orienting a building) with solar exposure can lead to overheating in summer (1) / solar exposure can increase the need for cooling (unless proper shading is incorporated) (1). <p>Accept any other suitable response.</p>	1	2.2.4

Q	Answer	Marks	SC
5b.	<p>Identify one way the orientation of a building affects natural ventilation.</p> <p>Award 1 mark for a correct answer linked to natural ventilation, for example:</p> <ul style="list-style-type: none"> • (the orientation of the building) can influence its ability to utilise natural ventilation (1) • buildings oriented to align with prevailing winds can use passive airflow to cool the interior (1) • aligning to prevailing winds can reduce reliance on mechanical air conditioning systems (1). <p>Accept any other suitable response.</p>	1	2.2.4

Q	Answer	Marks	SC
6a.	<p><i>Identify four things a feasibility study could include.</i></p> <p>Award 1 mark for each correct thing that could be included in a feasibility study, up to a maximum of 4 marks. for example:</p> <ul style="list-style-type: none"> financial analysis (to determine the project's financial viability) / estimated costs (of implementation) / capital expenditures / operating expenses / cost comparisons (to the expected revenue and cash flow projections) / potential return on investment (1). economic impact (of the project), job creation / tax benefits / contributions to local economy / economic benefit to the organisation or community (1). technical aspects (of the project) / availability of technology / availability of equipment / availability of materials / expertise required (for implementation) / technical challenges (or constraints that may affect the project's success) (1). discussion of how the project meets planning policies / legislation (1) equality considerations / inclusive design principles and accessibility (such as meeting equality legislation, for example Equality Act 2010) (1) meeting environmental legislation (such as any Tree Preservation Orders (TPOs), the Wildlife and Countryside Act 1981) (1). <p>Accept any other suitable response.</p>	4	2.3.3

Q	Answer	Marks	SC
6b.	<p><i>State three benefits of creating a schedule of accommodation.</i></p> <p>Award 1 mark for each benefit stated, linked to creating a schedule of accommodation, up to a maximum of 3 marks. For example:</p> <ul style="list-style-type: none"> clear space requirements (1) improved planning and design (1) will help with cost estimation (1) efficient project coordination (1) will show evidence of compliance (with regulations) (1) improved time management (1) improved client communication (1) allows for effective change management (1). <p>Accept any other suitable response.</p>	3	3.1.4

Q	Answer	Marks	SC
6c.	<p><i>Explain two responsibilities of the client in a construction project.</i></p> <p>Award 1 mark for each responsibility identified, linked to the client, up to a maximum of 2 marks. For example:</p> <ul style="list-style-type: none"> • defining project objectives / requirements (1) • appointing a project team (1) • securing funding / financial management (1) • obtaining planning permission / approvals (1) • selecting contractors / suppliers (1) • ensuring compliance with legal / regulatory requirements (1) • risk management (1) • monitoring project progress (1) • monitoring project quality (1) • managing health / safety / environmental standards (1) • facilitating communication / coordination (1) • handling changes / variations (1) • approving / certifying payments (1) • handover and occupancy (1) • post-completion evaluation / maintenance (1) • ensuring sustainability / energy efficiency (1). <p>Accept any other suitable response.</p> <p>Award 2 marks for each suitable explanation, linked to the relevant responsibility of the client, up to a maximum of 4 marks. For example:</p> <p>(defining project objectives / requirements)</p> <ul style="list-style-type: none"> • (The client is responsible for) clearly defining the project's scope, budget, timeline, and performance expectations (1). This includes setting out the desired outcome, the functionality of the building and any specific design or technical requirements (1). <p>(appointing a project team)</p> <ul style="list-style-type: none"> • (The client) must appoint key professionals to manage the project (1), such as an architect, project manager, quantity surveyor and engineers (1). <p>(securing funding / financial management).</p> <ul style="list-style-type: none"> • (The client is responsible for) securing the necessary funding for the project (1), which includes budgeting, financing and ensuring sufficient cash flow throughout the project (1). <p>(obtaining planning permission / approvals).</p> <ul style="list-style-type: none"> • (The client must) ensure that all necessary permits and / or planning approvals are obtained before the project starts (1). The client must make sure that all relevant environmental assessments are completed before the project starts (1). <p>(selecting contractors / suppliers)</p>	6	2.1.2

	<ul style="list-style-type: none"> The client plays a key role in selecting the contractors, subcontractors and suppliers who will deliver the project (1). The client must ensure that the team they appoint are competent / suitable / high quality (1). <p>(ensuring compliance with legal / regulatory requirements)</p> <ul style="list-style-type: none"> (The client is responsible for) ensuring the construction project complies with all relevant laws, regulations and building codes (1). The client is also responsible for checking that the project complies with health and safety standards (1). <p>(risk management)</p> <ul style="list-style-type: none"> (The client must) identify potential risks to the project (1) and establish a risk management plan to mitigate these risks (1). <p>(monitoring project progress / monitoring project quality)</p> <ul style="list-style-type: none"> (The client must) ensure that the project is progressing on schedule, within budget and to the specified quality standards (1). (The client takes responsibility for) having regular site visits / meetings with the project manager (1). <p>(managing health / safety / environmental standards)</p> <ul style="list-style-type: none"> (The client is responsible for) ensuring that proper health and safety protocols are followed on site (1) and that environmental sustainability practices are incorporated where applicable (1). <p>(facilitating communication / coordination)</p> <ul style="list-style-type: none"> (The client must) ensure effective communication between all project stakeholders (1), including the project manager, contractors, designers, and regulatory authorities (1). <p>(handling changes / variations)</p> <ul style="list-style-type: none"> (The client is responsible for) approving any changes or variations to the project scope, design or schedule (1). (The client also needs to) manage these changes during the construction process (1). <p>(approving / certifying payments)</p> <ul style="list-style-type: none"> (The client is responsible for) authorising payments to contractors and suppliers (1) based on agreed milestones or completion stages (1). <p>handover and occupancy)</p> <ul style="list-style-type: none"> Upon completion of the project (the client is responsible for) accepting the building and ensuring the handover process is carried out properly (1), including any necessary training on building systems / maintenance (1). <p>(post-completion evaluation / maintenance)</p>		
--	---	--	--

	<ul style="list-style-type: none">• (The client is responsible for) maintaining the building after construction is complete (1). This includes addressing any warranty claims / maintenance issues that arise (1). <p>(ensuring sustainability / energy efficiency)</p> <ul style="list-style-type: none">• (The client has a responsibility to) ensure that sustainable construction practices are incorporated into the project (1). This could include energy-efficient designs / low-carbon materials / environmental impact considerations (1). <p>Accept any other suitable response.</p>		
--	---	--	--

End of Mark Scheme