

T Level Technical Qualification in Building Services Engineering for Construction (8710)

Building Services Engineering Core (8710-30) - Theory exam (2)
(8710-032)

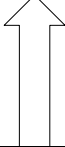
Mark Scheme

Sample

Marker guidance

Unless otherwise stated in the marker guidance for a specific question, the following conventions apply:

- All marking, from start to finish must be consistent and in line with the mark scheme guidance. Continue to refer to the mark scheme throughout marking.
- For questions that ask for a specific number of points, accept the first answers given up to the number requested e.g. State three... only accept the first three answers listed, and disregard any additional answers provided.
- For questions requiring continuous prose answers, mark positively – all correct answers should receive the appropriate mark according to the mark scheme. Any wrong (**but neutral**) answers should be ignored, and no marks should be lost.
- In some circumstances, it is appropriate to disallow a candidate answer that initially appears to give the correct answer as given in the mark scheme, if it is undermined by the fact that it goes on to actively **contradict** its intention. Sometimes the minimal wording used in the mark scheme allows a match that in reality is trivial and it is clear the candidate is referring to the wrong knowledge/understanding. Only the part of the response to which the contradiction applies should be disallowed, not the whole response. Material that is irrelevant/neutral but not contradictory should be ignored and positive marking applied as above.
- Use all marks for a question as described by the mark scheme – e.g. for a 2 mark question, 0, 1 or 2 marks will always be available to award (never just 0 or 2). For levels marking, the full range of marks should be used freely as described by the mark scheme including 0 and full marks.
- Always award whole marks; $\frac{1}{2}$ marks cannot be awarded.
- Allow phonetic misspellings as long as the meaning is clear, i.e. not so similar to another relevant but wrong term that you have to guess which was intended.
- Only allow 'it' as reference to the question topic if it is clear what 'it' refers to.
- Mark crossed out work UNLESS it has been replaced by another response.
- Where judgement is required, apply the guidance. Where the guidance does not sufficiently support for a particular candidate response/interpretation contact your Team Lead.
- Contact your Team Lead if any additional correct answers arise which need to be added to the mark scheme.
- For level of response mark schemes:
 - First, read the full candidate response and decide which band descriptor best fits the overall level of quality of the response.
 - Then, to decide on a mark within the band, consider the **degree to which the response fits the criteria** - depending on the number of marks in the band:

Comprehensively	Top of mark range for the band	5 th	4th	3rd
Substantially		4th	3rd	2nd
Generally		3rd	2nd	
Borderline		Positively mark and place on the bottom of the band	2nd	1st

The table below provides further detail on the descriptors used within each of the mark bands and what is expected at each level. Use the descriptors below alongside the mark scheme to support accurate and consistent judgment of candidate's response and allocation of marks.

	AO2	AO3a	AO3b
Basic	Limited understanding that is relevant to the context or question. Limited accuracy in interpretation through lack of application of relevant knowledge and understanding.	Limited accuracy in analysis through lack of application of relevant knowledge and understanding.	Unsupported evaluation through lack of application of knowledge and understanding. Unsupported judgement through lack of application of knowledge and understanding.
Good	Some understanding that is relevant to the context or question. Some accuracy in interpretation through the application of some relevant knowledge and understanding.	Some accuracy in analysis through the application of some relevant knowledge and understanding.	Partially supported evaluation through the application of some relevant knowledge and understanding. Partially supported judgement through the application of some relevant knowledge and understanding.
Thorough	A range of accurate understanding that is relevant to the context or question. Accurate interpretation through the application of relevant knowledge and understanding.	Accurate analysis through the application of relevant knowledge and understanding.	Supported evaluation through the application of relevant knowledge and understanding. Supported judgement through the application of relevant knowledge and understanding.
Comprehensive	A range of detailed and accurate understanding that is fully relevant to the context or question. Detailed and accurate interpretation through the application of relevant knowledge and understanding.	Detailed and accurate analysis through the application of relevant knowledge and understanding.	Detailed and substantiated evaluation through the application of relevant knowledge and understanding. Detailed and substantiated judgement through the application of relevant knowledge and understanding.

Assessment Objectives

AO1a	AO1b	AO2	AO3
Recall of knowledge	Demonstrates understanding	Apply knowledge and understanding to different situations and contexts	Analyse and evaluate information and issues

Sample

This exam has been split into **two** sections.

Below details the types of questions and marks available for each section. Please allow time for each section accordingly.

Section A is made up of **77** marks and includes **25** short answer and medium answer questions.

Section B is made up of **33** marks and includes **3** extended response questions.

Sample

Section A

Q1	State two environmental effects that can cause materials to degrade.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<ul style="list-style-type: none"> • Rain • Ultraviolet • Freezing conditions • Heat • Mould growth • Insect attack • Rising damp 	Award 1 mark for each	2	2.3 AO1a
KO	KO2 Construction science principles			
Paper	4 lines			

Q2	State the two factors, along with Force, used to determine the mechanical power required to move a load.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	Distance Time	Award 1 mark for each	2	2.4 AO1a
KO	KO2 Construction science principles			
Paper	4 lines			

Q3	During the design stage there are various methods used to display the overall finished look of a project. State two of these methods.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<ul style="list-style-type: none"> • 3D model • 3D Cad drawing • Artist Impression 	Award 1 mark for each	2	10.2 AO1a
KO	KO10 Digital technology in construction			
Paper	4 lines			

Q4	During an installation project at a new hotel, a refrigeration engineer is given a layout drawing to work from. State two pieces of information that can be determined from a layout drawing for a new installation.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	Accept specific examples of items normally found on a floor plan <ul style="list-style-type: none"> • Locations of specific items / rooms / appliances • Dimensions / area / length / measurements 	Award 1 mark for each	2	8.4 AO1a
KO	KO8 Information and data principles			
Paper	4 lines			

Q5	State the SI unit of measurement for each of the following a) Energy b) Temperature.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	a) Joules b) Kelvin	Award 1 mark for (a) Award 1 mark for (b)	2	2.1 AO1a
KO	KO2 Construction science principles			
Paper	4 lines			

Q6	A circuit is to be extended that was wired using the older red and black live conductors. State the current cable core colour that is matched to an existing black coloured conductor.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	Blue	Only acceptable answer	1	12.7 AO1a
KO	KO12 Building Services Engineering (BSE) systems			
Paper	2 lines			

Q7	Explain one way 3D modelling could be used at the beginning of a construction project.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	3D modelling is used to simulate potential designs (1) to identify any flaws within architectural models (1) Show the client what the finished project will look like to finalise design (1)	Award 1 mark for 'simulate potential designs' Award the 2nd mark for the reason/explanation	2	10.2 AO1b
KO	KO10 Digital technology in construction			
Paper	4 lines			

Sample

Q8	Describe <i>planned maintenance</i> and <i>reactive maintenance</i> , giving an example of each.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>Planned maintenance - identifying and stopping issues from becoming a problem</p> <p>Example: Annual boiler service.</p> <p>Reactive maintenance - repair/replace once something has gone wrong</p> <p>Example: Faulty component</p>	<p>Award 1 mark for a suitable description of planned maintenance</p> <p>Award 1 mark for a suitable description of reactive maintenance</p> <p>Award 1 mark for an example of planned maintenance</p> <p>Award 1 mark for an example of reactive maintenance</p> <p>Accept any suitable alternative description for the above such as:</p> <p>Routine checks to the condition of heating system components (but it must include a component such as boiler or valves rather than a general system and it must include wording indicating checking condition or health rather than simply checking)</p> <p>Emergency replacement or repair but the description must include descriptions that something has gone wrong and requires resolving</p>	4	13.1 AO1b
KO	KO13 Maintenance principles			
Paper	8 lines			

Q9	Describe the purpose of quality control in a construction project.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	To ensure the project outcomes meet the customer standards/needs (1)	Accept any other suitable description which demonstrates an understanding of the purpose of quality control	1	11.8 AO1b
KO	KO11 Construction commercial/business principles			
Paper	4 lines			

Q10	Give two examples of how construction companies can incorporate corporate social responsibility (CSR) into construction projects.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<ul style="list-style-type: none"> ● Community led design ● Energy efficiency initiatives ● Use of local operatives/trades ● Use of sustainable/local materials ● Supporting community initiatives 	Award 1 mark for each Accept any other suitable answers that demonstrate understanding of how corporate social responsibilities (CSR) are incorporated in construction projects	2	11.4 AO1b
KO	KO11 Construction commercial/business principles			
Paper	4 lines			

Q11	Explain the benefit of a limited company model with reference to liability protection.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	Should your company run into trouble your personal assets are secure (1). This is because a limited company is treated as a separate legal entity, a legal “person” in its own right. (1)	Award marks for a suitable explanation that demonstrates understanding of the difference of benefits of a limited company with reference to liability protection.	2	11.1 AO1b
KO	KO11 Construction commercial/business principles			
Paper	4 lines			

Q12	Explain the difference between a short circuit and an earth fault, giving a description of each and a potential risk should each occur in a wiring system			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>Description A short circuit is caused when a live conductor makes contact with a neutral conductor (1).</p> <p>Potential risk The additional heat generated by the extra electricity can cause fires (1)</p> <p>Description An Earth fault is an accidental contact between an energized conductor and ground or metallic equipment frame (1).</p> <p>Potential risk Earth faults can accidentally energise exposed and extraneous conductive parts and this may create a dangerous contact voltage situation which can lead to an electric shock to anyone touching the earthed conductive part.(1)</p>	<p>Award 1 mark for the suitable description of a short circuit.</p> <p>Award 1 mark for suitable description of an earth fault.</p> <p>Award 1 mark for describing a potential risk of a short circuit in a wiring system.</p> <p>Award 1 mark for describing a potential risk of an earth fault in a wiring system.</p>	4	12.4 AO1b
KO	KO12 Building Services Engineering (BSE) systems			
Paper	10 lines			

Q13	During the planning stage of a multi-discipline construction project, you are required to provide an estimated timescale of activities. Describe how time scales are estimated for construction projects.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<ul style="list-style-type: none"> • Break the project down into various tasks (1) • Put them in the correct sequence (1) • Allot a time scale to each task (1) • Total up the time for the job (1) 	Award 1 mark for each point Accept any alternative suitable answers	4	9.3 AO1b
KO	KO9 Relationship management in construction			
Paper	8 lines			

Q14	Explain how the convection cycle is used to transfer heat in a room.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	Answers should cover the following points, with details of how the convection cycle is used to transfer heat in a room <ul style="list-style-type: none"> • Heat source / radiator etc heats air (1) • Hot air rises drawing in cooler air (1) • Hot air moving into room / away from heat source cools (1) • Air falls as it cools, causing a cycle (1) 	Award 1 mark for each point up to a maximum of 4 marks Cycle may be mentioned during any key stage, but the cycling of air must be referenced for full marks	4	2.7 AO1b
KO	KO2 Construction science principles			
Paper	10 lines			

Q15	<p>You are part of the design team for an office refurbishment project. The client is unsure of the types of heating system they should have installed.</p> <p>Describe 5 advantages which make convection heaters suitable for this project.</p>			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>Answers should include, but are not exclusive to, the following points, with details of the advantages of convection heaters.</p> <ul style="list-style-type: none"> • Convection heaters warm up a room evenly. • Convection panel heaters can be mounted higher up on any open wall space in any size of room. • Convection heaters can also be recessed into the floor, which means they can be placed directly in front of a stairway or floor-to-ceiling windows. • With convection heaters of any kind, the temperature of each room can be controlled individually. • In most cases, convection heaters are silent. • Convection heaters save about 10 per cent more in energy costs when compared to electric baseboard heaters. 	<p>Award 1 mark for each description up to a maximum of 5 marks</p> <p>Accept any other suitable description which demonstrates an understanding of the advantages of convection heaters.</p>	5	2.7 AO2
KO	KO2 Construction science principles			
Paper	10 lines			

Q16	List three methods of how personal and financial data, relating to clients, can be kept secure when carrying to and from the worksite for accessing on a PC or tablet.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>Answers to include methods of protecting data which may include:</p> <ul style="list-style-type: none"> Using pin coded data storage devices (USB drives) If stored on PC or tablet, security system enabled to allow remote removal of data (find my iphone etc) Encrypted file/data transfers such as those used by credit card companies when taking mobile payments 	<p>Award 1 mark for each</p> <p>Answer to cover at least three security measures that are relevant to the context</p>	3	8.3 AO2
KO	KO8 Information and data principles			
Paper	6 lines			
Q17	<p>A 1:100 scale drawing of a new proposed building is to be produced on an A1 sheet of paper. The dimensions of the building are 30m wide x 50m long. An A1 sheet of paper measures 840mm x 594mm</p> <p>a) Calculate the dimensions of the building width and length on the scale drawing. (4 marks)</p> <p>b) Stating the dimensions, what proportion in size is an A3 sheet when compared to the A1 sheet. (2 marks)</p> <p>Show your workings.</p>			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>a)</p> <p>The 30 m dimension will be shown as:</p> $\frac{30}{100} = 0.3 \text{ m } \textit{or} \text{ 30 cm } \textit{or} \text{ 300 mm } (2)$ <p>The 50 m dimension will be shown as:</p> $\frac{50}{100} = 0.5 \text{ m } \textit{or} \text{ 50 cm } \textit{or} \text{ 500 mm } (2)$	<p>Award marks for the following</p> <ul style="list-style-type: none"> correct calculation (1 mark) and scale for 30 m wall (1 mark) correct calculation (1 mark) and scale for 50 m wall (1 mark) explanation of relationship in proportions (1 mark) 	6	6.3 AO2 (4) AO1b (2)

	<p>b)</p> <p>Acceptable answers include for 1 mark:</p> <ul style="list-style-type: none"> • A quarter of the area of A1 OR half the length of each side (1 mark) • Dimension 420 x 297 (1 mark) 	<ul style="list-style-type: none"> • actual size of A3 (1 mark) <p>Award full marks for correct answers without workings shown.</p>		
KO	KO6 Construction measurement principles			
Paper	12 lines			

Q18	Name two mechanical devices used within a centrally heated wet radiator system to automatically control the flow or pressure of the water.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>Two from the following:</p> <ul style="list-style-type: none"> • Pump • Motorised/port valve • Manifolds 	Award 1 mark for each	2	12.3 AO2
KO	KO12 Building Services Engineering (BSE) systems			
Paper	4 lines			

Q19	List three building service engineering systems, together with their components, that would be supported on perforated metallic tray.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	Answers may include <ul style="list-style-type: none"> • Electrotechnical - cables • Fire alarm - cables • Security Systems - cables • Air conditioning - pipework/cable • Refrigeration systems - pipework/cable 	Award 1 mark for each Must show system with component for the mark. Will accept cable or pipework where shown Electrical is suitable alternative to electrotechnical	3	12.1 AO2
KO	KO12 Building Services Engineering (BSE) systems			
Paper	6 lines			

Q20	Calculate the energy required to raise a 20 kg mass to a height of 15 m.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	$20 \times 9.81 \times 15 = \underline{2943 \text{ J}}$ Accept - Gravity rounded to 10: $20 \times 10 \times 15 = \underline{3000 \text{ J}}$	Answer must be given in the correct units (J or Joules) Working does not need to be seen	1	2.4 AO2
KO	KO2 Construction science principles			
Paper	2 lines			

Q21	Calculate the Power (work done) required to raise a mass of 50 kg to a height of 3 m in 30 seconds. Show your workings.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	$50 \times 9.81 \times 3 = 1471.5 J$ $\frac{1471.5}{30} = 49.05 \text{ Watts}$ <p>Accept gravity rounded to 10:</p> $50 \times 10 \times 3 = 1500 J$ $\frac{1500}{30} = 50 \text{ Watts}$	<p>Award 1 mark per stage. If carried out in a single formula, award full marks</p> <p>Award full marks for correct answers without workings shown. Answer must be given in the correct units (W or Watts)</p> <p>If incorrect / no units are given award a maximum of 1 mark for correct use of formula</p>	2	2.4 AO2
KO	KO2 Construction science principles			
Paper	4 lines			

Q22	A construction project is in the design stage. Four Refrigeration units are required to be installed in a space measuring height- 2340mm, width – 5469mm depth- 1254mm. These will not be standard units and therefore will need to be ordered in advance and manufactured to fit within the dimensions specified. Explain which design and manufacturing process would be used and how it meets the requirements of this project.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>Award marks for the following points within the explanation</p> <ul style="list-style-type: none"> • CAD/CAM design • Precise measurements • Followed in construction phase and manufacturing of refrigeration units 	<p>Accept any other suitable answer that is relevant to the context</p>	3	10.3 AO2
KO	KO10 Digital technology in construction			
Paper	6 lines			

Q23	Maintenance replacement work is to be undertaken in a large multi-storey office block over the course of three hours.			
	Identify two essential building services that would need assessing for risk to life, when removed for maintenance. Your answer needs to detail what the risk would be.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>Accept answers that identify services that present a risk, for example:</p> <ul style="list-style-type: none"> • Lighting - trips, falls, unable to see • Lift supplies, trapped, firefighter evacuation lift service • Fire detection - unable to sound evacuation in event of fire • Ventilation - air becomes contaminated or lacking O₂ • Firefighter services (dry riser etc) - pumps for emergency firefighting not present if needed 	<p>Services need to provide a risk when removed. Answers not acceptable- Heat, water, drainage etc.</p> <p>1 mark for each valid service + 1 mark for risk associated</p>	4	AO2 13.5
KO	KO13 Maintenance principles			
Paper	8 lines			
Q24	A potential customer is calling to enquire about a small job relating to control equipment that they would like undertaken by an organisation.			
	Explain how the process, from enquiry to completion, is dealt with by the organisation in order for the work to be done efficiently and cost effective to the client.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<p>Answer to include an explanation of the three key stages</p> <ul style="list-style-type: none"> • Enquiry/pre-work / survey - clients requirements outlined and works designed to current regulations. Contract agreed with client with a view to costs/timings and health and safety requirements agreed. 	<p>Award 1 mark for key stage and 1 mark for an explanation of the key actions in relation to the context</p> <p>Do not accept stages that are not relevant to the context.</p>	6	AO2 9.4

	<ul style="list-style-type: none"> • Engineer visit - Work is completed by the engineer in line with the client's requirements/specification and within the boundaries of agreed contract and current regulations • Handover/completion - All relevant documentation submitted to the client, explanations given to any unexpected works/ costs. 			
KO	KO9 Relationship management in construction			
Paper	12 lines			

Sample

The following scenario applies to question 25 a) and b).

A building services company is designing a new large domestic installation. The property will consist of:

- A large 5-bedroom house
- Separate structure housing a furniture workshop
- Separate structure housing a gym and swimming pool.

The workshop structure is to have a separate sub-main installed.

Q25a	Describe the advantages of using PVC/SWA as the supply cable for the workshop structure.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	PVC/SWA is a hard-wearing electrical cable designed for the supply of mains and sub-mains electricity (1) The high level of mechanical protection it offers allows for it to be used in underground systems (1)	Award 1 mark for each of the points	2	12.4 Ao1b
KO	KO12 Building Services Engineering (BSE) systems			
Paper	4 lines			

Q25b	Explain how the construction of a PVC/SWA cable makes it a suitable design choice for the supply of the workshop structure.			
	Acceptable answer(s)	Guidance	Max marks	Test Spec ref & AO
	<ul style="list-style-type: none"> • Conductors: consists of plain stranded copper making them highly efficient conductors of electricity allowing for a high supply demand such as a workshop. (1) • Insulation: Insulation in cables ensures that conductors and other metal substances do not come into contact with each other, leading to electrical faults on the system. Making them a dependable installation method for a workshop (1) • PVC Inner Sheath: PVC is used to provide a protective boundary between inner and outer layers of the cable supplying added mechanical protection, allowing the cable to be installed in areas that may require added protection due to more severe external influences such as a workshop. (1) • Armour: Steel wire armour provides mechanical protection, which means the cable can withstand higher stresses, be buried directly and used in external or underground projects. Making the installation more aesthetically pleasing as it is underground. (1) 	Accept any other suitable answers that are relevant to the context	6	AO2 12.4

	<ul style="list-style-type: none"> • The armouring is normally connected to earth and can sometimes be used as the circuit protective conductor ("earth wire") for the Circuits supplied by cable. (1) • Sheath: a black PVC sheath holds all components of the cable together and provides additional protection from external stresses, allowing the cable to be installed in areas that may require added protection due to more severe external influences such as a workshop and underground. (1) 			
KO	KO12 Building Services Engineering (BSE) systems			
Paper	12 lines			

Sample

Section B

<p>Q26</p>	<p>The top two floors of a large office building have their water supplied by a set of two pumps.</p> <p>Following a temporary interruption to the water supply, it has been discovered that one of these pumps had failed, leaving only one in service.</p> <p>As a contractor who offers building services maintenance, you have been asked to investigate the failed pump. You discover blocked filters have caused the pump to seize. There are no isolation points on the supply pipework, meaning the cold-water service to the entire building will need to be isolated to enable the exchange of the pump.</p> <p>Discuss the best course of action to replace the pump whilst minimizing disruption to the building, giving recommendations for what could be put in place to prevent this type of failure in the future.</p>		
<p>Acceptable answer(s)</p>	<p>Guidance</p>	<p>Max marks</p>	<p>Test Spec ref & AO</p>
<p>The intention of this question is to allow the candidate to demonstrate their understanding of the scenario in terms of the task at hand (changing the pump) but also a more holistic view of the overall scenario and how future issues could be resolved or prevented</p> <p>The candidate should be able to identify that the pump must be replaced, but that it's not an emergency as the water supply is still working, albeit without a backup. It should be identified this form of maintenance is purely reactive.</p> <p>The water supply being switched off will cause major disruption to the rest of the building and its users and should consider when the works take place, such as outside of working hours, giving advance notification, informing all users of the building.</p> <p>The candidate should introduce the principle of planned/preventative maintenance and what this entails.</p> <p>Recommendations: It's been identified that there is a lack of isolation, rectifying this should be considered, such as fitting isolation points</p>	<p><i>For no awardable content, award 0 marks.</i></p> <p><u>Band 1 1- 3 marks</u> Demonstrates basic analysis of the information provided.</p> <p>Demonstrates basic application of knowledge and understanding of the type of maintenance activity and action required to repair.</p> <p>Demonstrates basic use of evaluative skills providing only brief recommendations of how to prevent this from occurring in the future.</p> <p><u>Band 2 3-6 marks</u> Demonstrates good analysis of the information provided.</p> <p>Demonstrates good application of knowledge and understanding of the type of maintenance activity and action required to repair.</p>	<p>9</p>	<p>13.1 13.2 13.4 13.5 AO3a</p>

	<p>for future maintenance tasks. At a higher level, the candidate should be expected to evaluate the benefits of planned maintenance compared to reactive. Considering points such as</p> <ul style="list-style-type: none"> - Reduced downtime - Less major failures - Lower overall costs - A need for reactive maintenance is often still required - Ongoing costs of planned maintenance compared to higher on off costs of reactive. 	<p>Demonstrates good use of evaluative skills providing some good considerations and recommendations of how to prevent this from occurring in the future.</p> <p><u>Band 3 6-9 marks</u></p> <p>Demonstrates thorough analysis of the information provided.</p> <p>Demonstrates thorough application of knowledge and understanding of the type of maintenance activity and action required to repair.</p> <p>Demonstrates thorough use of evaluative skills providing detailed considerations and recommendations of how to prevent this from occurring in the future.</p>		
KO				
Paper	36 lines			

<p>Q27</p>	<p>You have been asked to be part of the design team for an electrical installation within an equestrian facility consisting of a main house, stables, garage, and out-buildings.</p> <p>One of the outbuildings is to be converted into an indoor horse-riding show arena, offering audience seating and refreshment facilities. The distance between the existing mains board and the proposed sub-main is 20m. The supply and installation is to form a three-phase TN-C-S, 400 V supply, with an Ib of 35amps per phase, where Z_e is 0.35 Ω at the origin of the circuit. Protection for this circuit is by a Type C RCBO. The ambient air temperature is 30°C with an ambient ground temperature of 15°C.</p> <p>Analyse the information provided and recommend a suitable wiring system and cable size for the sub main feed that complies with BS 7671.</p>		
<p>Acceptable answer(s)</p>	<p>Guidance</p>	<p>Max marks</p>	<p>Test Spec ref & AO</p>
<p>(This is a guide only and candidates may select other cables or wiring systems with justification)</p> <p>Cable selection Learners to suggest that as it is an equestrian facility, so you would expect to encounter a number of external influences (such as; temperature, high humidity, corrosion, mechanical damage, installation underground), which the wiring system and cable must be suitable for, as well as being cost effective, aesthetically pleasing etc. Therefore, the most suitable wiring system for the supply would be 70°C thermosetting SWA 4 or 5-core cable, buried at a depth of 0.7m. (Thermoplastic may be chosen but should be rated for 70°C)</p> <p>Determine cable CSA</p> <ul style="list-style-type: none"> • Design current; $I_b = 35$ A per phase (given) • Rating of protective device; $I_n = 40$ A • Installation Reference Method; Table 4A2 Number 72 Reference method D 	<p><i>For no awardable content, award 0 marks.</i></p> <p>Band 1 1-3 marks</p> <p>Basic analysis of the information provided</p> <p>Basic application of knowledge and understanding with only minimal external influences identified within BS7671 and applied in calculations</p> <p>Suitable wiring system, recommended, with limited reasons for their choice</p> <p>Band 2 4-6 marks</p> <p>Good analysis of the information provided</p> <p>Good application of knowledge and understanding with some external influences identified within BS7671 and applied in calculations</p>	<p>12</p>	<p>2.5 3.2 12.4 12.5 12.6 12.7</p> <p>AO2 4 AO3a 4 AO3b 4</p>

	<ul style="list-style-type: none"> • Ambient temperature; air 30 °C Table 4B1, $C_a = 1$ ground 15 °C Table 4B2. $C_a = 1.05$ • Cables buried in the ground; 0.7 m Table 4B3, $C_s = 1.4$ <i>Depth of burial;</i> no factor necessary. • Current-carrying capacity of the cable $Cable\ IT = \frac{IN}{Rating\ factors} = \frac{IN}{C_a \times C_s} = \frac{40}{1.05 \times 1.4} = 27.21\ A$ <p>From Table 4D4A Column 7; Tabulated current-carrying capacity of 4 mm² carries 30 A, but need to satisfy $I_z \geq I_n$, therefore, must select 6 mm² which can carry 38 A, so $38 \times 1.05 \times 1.4 = 55.9 \geq 40\ A$ therefore ok Candidates may select a 10 mm² cable based on $I_t \geq I_n$</p>	<p>Suitable wiring system, and cable sizes recommended, some reasons for their choice</p> <p><u>Band 3 7-9 marks</u></p> <p>Thorough analysis of the information provided</p> <p>Thorough application of knowledge and understanding with a range of external influences identified within BS7671 and applied in calculations</p> <p>Suitable wiring system, and cable sizes recommended, with good reasons for their choice</p> <p><u>Band 4 10-12 marks</u></p> <p>Comprehensive analysis of the information provided</p> <p>Thorough application of knowledge and understanding with a wide range of external influences identified within BS7671 and applied in calculations</p> <p>Suitable wiring system, and cable sizes recommended, with strong reasoning and justifications for their choice</p>		
KO	KO2,3 and 12			

Sample

<p>Q28</p>	<p>You are working on an international construction project, with many colleagues from different countries.</p> <p>Analyse the different types of measurement methods and discuss how the importance of communicating accurate measurements can impact on the project.</p>		
<p>Indicative content</p>	<p>Guidance</p>	<p>Max marks</p>	<p>Test Spec ref & AO</p>
<p>Intention:</p> <p><i>To allow learners to consider and evaluate different types of and the importance of accurate and appropriate measurement methods, use of Standard units of measurement and measurement techniques. Whilst also gain an appreciation in the importance and use of the Measurement standards, guidance and practice, the use of International System of Units (SI) and Derived SI units.</i></p> <p>Accurate and appropriate measurement on built environment performance</p> <ul style="list-style-type: none"> The benefits to contractors, the client/customer, to profitability and project success detailing the Implications of not having accurate measurements – in terms of costs, time, and safety. <p>Standard units of measurement and measurement techniques</p> <ul style="list-style-type: none"> The types of units of measurement and how these are applied and used in construction projects. <p>Measurement standards, guidance and practice</p> <ul style="list-style-type: none"> How to use standardised procedures for recording measurements knowing their use, including measurement rules <p>International System of Units (SI)</p> <ul style="list-style-type: none"> The Internationally recognised (SI) units of measurement and their application and use in building services engineering calculations 	<p><i>For no awardable content, award 0 marks.</i></p> <p><u>Band 1 1-3 marks</u></p> <p>Demonstrates a basic use of analysis of the different types of measurement methods</p> <p>Demonstrates basic application of knowledge and understanding of how measurements can be communicated</p> <p>Demonstrates basic use of evaluative skills providing minimal impacts that accuracy of measurement can have on the project</p> <p><u>Band 2 4-6 marks</u></p> <p>Demonstrates a good use of analysis of the different types of measurement methods</p> <p>Demonstrates a good use of application of knowledge and understanding of how measurements can be communicated</p> <p>Demonstrates a good use of evaluative skills providing some impacts that accuracy of measurement can have on the project</p>	<p>12</p>	<p>6.1 6.2 6.3 AO2 4 AO3a 4 AO3b 4</p>

	<p>Derived SI units.</p> <ul style="list-style-type: none"> All derived SI units and their application and use in building services engineering including those associated with area, volume, weight, power, energy and force <p>Higher performing candidates will include clear references to the use of standardised units of measure during planning and construction, international systems of units for calculations and derived SI units detailing the impact of not using them in terms of cost, time and safety during construction projects, with recommendations made that are fully justified and conclusions that are fully supported</p>	<p><u>Band 3 7-9 marks</u></p> <p>Demonstrates a thorough use of analysis of the different types of measurement methods</p> <p>Demonstrates a thorough use of application of knowledge and understanding of how measurements can be communicated</p> <p>Demonstrates a thorough use of evaluative skills providing a range of impacts that accuracy of measurement can have on the project</p> <p><u>Band 4 10-12 marks</u></p> <p>Demonstrates comprehensive use of analysis of the different types of measurement methods.</p> <p>Demonstrates comprehensive use of application of knowledge and understanding of how measurements can be communicated</p> <p>Demonstrates comprehensive use of evaluative skills, providing a detailed range of impacts that accuracy of measurement can have on the project</p>		
KO	KO6 Measurement principles			
Paper	27 lines			

Sample

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