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**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2023

**CIVIL TECHNOLOGY: CONSTRUCTION
MARKING GUIDELINE**

MARKS: 200

This marking guideline consists of 15 pages and 2 answer sheets.

QUESTION 1: SAFETY AND MATERIALS (GENERIC)

- 1.1 The purpose of the OHS Act is to ensure the health of the workers **OR** their right to a working environment free of hazards. (1)
- 1.2 Unsafe acts (1) and unsafe conditions (1). (2)
- 1.3 Any ONE reason for inspecting a scaffold:
- To ensure it is stable in all directions
 - To ensure it is able to carry the mass of the load
 - To ensure it is free of any defects (1 x 1) (1)
- 1.4 1.4.1 **A** – Guardrail (1)
- B** – Kickboard **OR** toe-board (1)
- C** – Base (1) (3)
- 1.4.2 Independent scaffolding (1)
- 1.4.3 1 m **OR** 1 000 mm. (1)
- 1.5 1.5.1 Any ONE way to transport waste material from higher levels:
- Chute
 - Conveyor belt
 - H Lift **OR** hoist (1 x 1) (1)
- 1.5.2 Safety net **OR** a catch platform. (1)
- 1.6 1.6.1 False (1)
- 1.6.2 True (1)
- 1.6.3 False (1)
- 1.6.4 False (1)
- 1.7 Water-based paint (1) and oil-base paint (1). (2)
- 1.8 It protects the metal against rust / corrosion. (1)
- 1.9 Any TWO advantages of curing (concrete):
- Allow adhesive bonding
 - Prevent the concrete from drying out too quickly
 - Assures the effective hardening / strengthening of the concrete (2 x 1) (2)
- [20]**

QUESTION 2: GRAPHICS, JOINING AND EQUIPMENT (GENERIC)

- 2.1
- Window numbers
 - Door swings
 - Names of rooms
 - Stair directions
 - Sliding doors
 - Floor covering (6 x 1) (6)

2.2 FIGURE 2.2 on ANSWER SHEET A shows the incomplete elevation of a building. Complete the elevation by drawing in the following parts on scale 1 : 50.

2.2.1 A window with a length of 1 800 mm and a height of 900 mm. The window is built in 700 mm from the right-hand side and one-third of the right side of the window can open. (7)

2.2.2 A door according to standard measurements, 900 mm from the left side of the building. The door opens to the left. There is one step to the ground level. (5)

2.2.3 The barge board against the gable end. (2)

2.3 2.3.1 Unfinished wood (1)

2.3.2 Two-way switch (1)

2.4 2.4.1 Water meter  (2)

2.4.2 Plaster  (2)

2.4.3 Invert level  (2)

2.5 When driven into place (1) it cannot be turned (1). (2)

2.6 **R-RBL** – Anchor name (1)

M06 – Thread diameter (1)

18 – Thickness (1) (3 x 1) (3)

2.7 To set the telescope of the instrument level. (1)

2.10 It can affect the measuring function of the tool. (1)
[40]

QUESTION 3: ROOFS, STAIRCASES AND JOINING (SPECIFIC)

- 3.1 3.1.1 A – Rafter (1)
- B – Strut (1)
- C – Tie beam (1)
- D – King post (1)
- E – Queen post (1)
- 3.1.2 South African / Howe roof (1)
- 3.2 Any THREE requirements that roof trusses should meet:
- Sturdy enough to carry the roof covering safely
 - Able to withstand wind and other forces that act on them
 - Provide adequate height in rooms below the roof and ceiling assembly
 - Should not allow the accumulation of rainwater upon the roof surface
 - Neat and solid to enhance the appearance of the buildings (3 x 1) (3)
- 3.3 3.3.1 100 mm (1)
- 3.3.2 150 mm (1)
- 3.3.3 Reduce the fire hazard to neighbouring properties. (1)
- 3.4 Any TWO advantages for the use of roof underlays:
- Acts as a secondary roof
 - A weather shield during construction
 - Waterproof and weatherproof
 - Condensation barrier
 - Dustproof
 - Protects the building / structure
 - Protects thermal insulation material
 - Protects ceiling boards
 - Superior wind uplifting strength prevents lifting of tiles
 - Vapour resistant
 - High tensile resistance
 - Cost effective
 - High heat resistance (2 x 1) (2)
- 3.5 3.5.1 2 100 mm (1)
- 3.5.2 100 mm (1)
- 3.5.3 38° (1)

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- | | | | |
|-----|-----------------------------------|--|-------------|
| 3.6 | 3.6.1 | Landing | (1) |
| | 3.6.2 | Tread / going | (1) |
| | 3.6.3 | Balustrade | (1) |
| 3.7 | 3.7.1 | A – Baluster | (1) |
| | | B – Handrail | (1) |
| | | C – Riser | (1) |
| | 3.7.2 | Any ONE material that a hand railing can be made from: | |
| | | <ul style="list-style-type: none"> • Stainless steel • Timber • Plastic • Concrete • Similar answer | (1 x 1) (1) |
| 3.8 | 3.8.1 | True | (1) |
| | 3.8.2 | True | (1) |
| | 3.8.3 | False | (1) |
| | 3.8.4 | False | (1) |
| 3.9 | Any TWO types of cast-in anchors: | | |
| | | <ul style="list-style-type: none"> • Hex-head bolt with washer • L-bolt • J-bolt • Welded headed stud | (2 x 1) (2) |

[30]

QUESTION 4: MATERIAL, EQUIPMENT AND TOOLS, EXCAVATIONS (SPECIFIC)

- 4.1 4.1.1 G (alloy of copper and zinc) (1)
- 4.1.2 E (packaging material) (1)
- 4.1.3 D (hard, but is brittle and breaks easily) (1)
- 4.1.4 C (pumps smaller volumes of concrete) (1)
- 4.1.5 B (highly toxic) (1)
- 4.1.6 H (pumps high volumes of concrete) (1)
- 4.2 4.2.1 Slump test (1)
- 4.2.2 200 mm (1)
- 4.2.3 600 mm (1)
- 4.2.4 Any TWO reasons for the purposes of the slump test:
 • To test the density of concrete (percentage water)
 • To determine the workability and consistency of batches
 • To determine the slump of the mixture (2 x 1) (2)
- 4.3 Any TWO ways of curing concrete:
 • Water by spraying
 • Cover with water-retaining substances such as damp sand, sacking, straw, hessian and canvas
 • Plastic membrane and plastic sheets
 • Commercial sealant
 • Pool forming
 • Similar answer (2 x 1) (2)
- 4.4 Ferrous (1) and non-ferrous metals (1) (2)
- 4.5 Any THREE types of cladding for buildings:
 • Tile cladding
 • Brick slip cladding
 • Stone cladding
 • Timber cladding
 • Metal sheet cladding (3 x 1) (3)

- 4.6 4.6.1 Plate compactor (1)
- 4.6.2 Any TWO ways of maintaining:
- Lubricate and adjust according to manufacturer's instruction
 - Clean after use and store in a safe, dry place
 - Repair / replace damaged electrical cords
 - Service regularly / ensure that parts are fully attached
 - Remove loose dirt and soil after use (2 x 1) (2)
- 4.6.3 Compaction of soil / back-filling / paving (or similar) (1)
- 4.7 Any THREE causes for the collapse of an excavation:
- Heavy rains
 - Poor soil strata, structure or composition
 - Sides not dug at the correct angle
 - Improper use of formwork or shoring to support walls
 - Vibration by machinery or heavy vehicles nearby
 - Water seeping into the excavated area
 - Contact with underground service
 - Access to and exit from the excavation
 - Soil slides due to cracks or loose soil (3 x 1) (3)
- 4.8 Any THREE ways of making excavations safe during the night:
- Fencing
 - Warning signs
 - Warning lights (red or orange)
 - Covering (3 x 1) (3)
- 4.9 4.9.1 With a ladder / scaffolding (1)
- 4.9.2 One metre (avoid trench sides from collapsing) (1)
- 4.9.3 1,3 metre (test for low oxygen, hazardous fumes and toxic gases) (1)
- 4.10 4.10.1 False (1)
- 4.10.2 False (1)
- 4.10.3 False (1)
- 4.11 4.11.1 Firm soil / hard soil / stable soil (1)
- 4.11.2 **A** – Strut (1)
- B** – Walling board (1)
- C** – Wedge (1)

4.12 Any TWO foundation types:

- Strip foundation / wide strip foundation
- Stepped foundation
- Raft foundation
- Pile foundation
- Block foundation

(2 x 1) (2)
[40]

QUESTION 5: BRICKWORK, GRAPHICS, PLASTER AND SCREED (SPECIFIC)

- | | | | |
|-----|---|---|-------------|
| 5.1 | 5.1.1 | Stretcher bond | (1) |
| | 5.1.2 | Cavity wall | (1) |
| | 5.1.3 | 270 mm (minimum) / 320 mm (maximum) | (1) |
| | 5.1.4 | Damp-proof course / membrane (DPC) | (1) |
| 5.2 | See ANSWER SHEET B. | | (5) |
| 5.3 | 5.3.1 | Drain any water out of the wall. | (1) |
| | 5.3.2 | 8 m | (1) |
| | 5.3.3 | 3 m | (1) |
| | 5.3.4 | Wall ties | (1) |
| | 5.3.5 | Wet regions | (1) |
| | 5.3.6 | 150 mm | (1) |
| 5.4 | Any TWO advantages of cavity walls: | | |
| | <ul style="list-style-type: none"> • Prevent rainwater from penetrating the interior wall surface • Provide good thermal insulation • Provide good sound insulation • Cheaper materials can be used for internal walls • Reduces / prevent expensive exterior finishes | | (2 x 1) (2) |
| 5.5 | Any TWO wall ties: | | |
| | <ul style="list-style-type: none"> • Butterfly pattern • Nylon wall tie • Twisted pattern • Double triangular pattern | | (2 x 1) (2) |
| 5.6 | 5.6.1 | C (best edge restraint for paving) | (1) |
| | 5.6.2 | F (prepared layer beneath paving and bedding sand) | (1) |
| | 5.6.3 | A (natural soil on which the paving will be laid) | (1) |
| | 5.6.4 | D (final layer upon which paving is laid) | (1) |

- 5.7 Any TWO advantages of mortar-set paving:
- Little maintenance is required
 - Low life-cycle cost
 - Resistant to point loads
 - Resistant to fatigue and reflecting traffic patterns
 - Resistant to edge movement
 - User-friendly installation material is used
 - No weeds will be able to grow in between the joints
 - No off-gassing installation products used
 - Insects will not be able to ruin the appearance of the paved structure
- (2 x 1) (2)
- 5.8 Any TWO reasons for construction failure with paving:
- Concrete haunch too thin to support itself and cracks or crumbles under pressure
 - Too little weight to retain the structure and keep paving in place
 - Bond between haunch and edge units is weak and will easily crumble
 - Sub-base is not contained and will be washed out by groundwater
- (2 x 1) (2)
- 5.9 See ANSWER SHEET B. (4)
- 5.10 5.10.1 Segmental gauged arch (1)
- 5.10.2 **A** – Key brick (1)
- B** – Extrados (1)
- C** – Span (1)
- 5.11 Sand (1) and cement (1) (2)
- 5.12 Any TWO types of plaster finishes:
- Smooth finish
 - Splatter finish
 - Wavy finish
 - Bagging finish
- (2 x 1) (2)
- 5.13 Any TWO types of screed layers:
- Dry screed
 - Monolithic screed
 - Bonded screed
- (2 x 1) (2)
- [40]**

QUESTION 6: FORMWORK, REINFORCING, CONCRETE FLOORS AND QUANTITIES (SPECIFIC)

- 6.1 Any TWO materials that can be used to obtain a smoother finish on concrete:
- Plastic
 - Metal sheeting
 - Hardboard
 - Fibre-glass
 - Similar answer
- (2 x 1) (2)
- 6.2 Any TWO types of timber boards for formwork:
- Block board
 - Laminated board
 - Shutter board
 - Plywood
- (2 x 1) (2)
- 6.3 Any THREE properties of good formwork:
- Made accurately according to the dimensions indicated
 - Sturdy enough to bear the mass of wet concrete without collapsing
 - Able to bear the mass of workers and equipment
 - Must be strong enough to provide sufficient support, without too much deflection, until the concrete has set
 - Formwork should be easy to repair on site
 - Secured with wire nails, where some should protrude for easy extracting
 - Secured with bolts from 13 mm to 19 mm in diameter
 - Should be sealed properly so that the concrete does not leak and form honeycombs or fins
 - Should be free of dirt (sawdust or releasing agents)
 - Quick and simple to erect, mechanically or by hand
 - Ensure the correct cover depth for reinforcing, to prevent structural failure
 - Fit plywood onto laggings if a smooth finish is required
 - Remove when the concrete has cured and is able to the support load
 - Should be easy to remove without damaging the formwork or concrete
 - Close-fitting along seams and joints
 - Made from recyclable components
- (3 x 1) (3)
- 6.4 6.4.1 **A** – Hollow-core concrete blocks / hollow concrete block / block (1)
- B** – Pre-stressed concrete rib / precast ribs / rib (1)
- 6.4.2 Rib-and-block floor (1)
- 6.4.3 Any ONE disadvantage of the rib-and-block floor:
- Requires mechanical handling on the site
 - Requires manual labour to place blocks between the ribs
- (1 x 1) (1)

- | | | | |
|-----|---|---------------------------------------|-------------|
| 6.5 | 6.5.1 | High tensile steel (High yield steel) | (1) |
| | 6.5.2 | 20 mm | (1) |
| | 6.5.3 | 250 mm | (1) |
| 6.6 | 6.6.1 | Tensile force / stress | (1) |
| | 6.6.2 | Compression force / stress | (1) |
| 6.7 | Any THREE properties (requirements) for reinforced steel bars | | |
| | <ul style="list-style-type: none"> • Free of salt spray, mud, splinters and any oiliness • Completely covered in concrete to protect it against rust and fire hazards • Resistant to tensile stress • Easy to bend into shape • Able to bind firmly with concrete • Of limited expansion prevent tension when the temperature fluctuates • Readily available and affordable • Must be rustproof, otherwise it will impair binding | | (3 x 1) (3) |
| 6.8 | Any TWO purposes of the cover depth: | | |
| | <ul style="list-style-type: none"> • To protect steel against corrosion • To ensure adequate bonding between the steel and concrete • To ensure adequate protection of steel in event of a fire | | (2 x 1) (2) |
| 6.9 | Foundation strips of a store is 8 500 x 4 750 (inside measurements).
The foundation is 700 mm wide and 250 mm thick. | | |

6.9.1 Calculate the centre-line of the foundation:

$$\begin{array}{rcl} & 2 / 8\,500 = & 17\,000 \\ & 2 / 4\,750 = & \underline{9\,500} \checkmark \\ & & 26\,500 \checkmark \\ \text{Plus corners:} & 4 / 750 = & \underline{2\,800} \checkmark \\ & & 29\,300 \checkmark \end{array} \quad \text{OR } 29.3 \text{ m} \quad (5)$$

6.9.2 Calculate the volume of concrete needed.

Volume = length x width x thickness

$$= 29,3 \text{ m} \times 0,7 \text{ m} \times 0,25 \text{ m}$$
$$= 5,128 \text{ m}^3 \quad \text{OR} \quad 5,13 \text{ m}^3 \quad (4 \times 1) \quad (4)$$

[30]

TOTAL: 200

ANSWER SHEET A	CIVIL TECHNOLOGY GENERIC	NAME: _____
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2.1 FIGURE 2.2 on ANSWER SHEET A shows the incomplete elevation of a building. Complete the elevation by drawing in the following parts on scale 1 : 50.

2.2.1 A window with a length of 1 800 mm and a height of 900 mm. The window is built in 700 mm from the right side and one-third of the right side of the window can open. (7)

2.2.2 A door according to standard measurements, 900 mm from the left side of the building. The door opens to the left. There is one step to the ground level. (5)

2.2.3 The barge board against the gable end. (2)

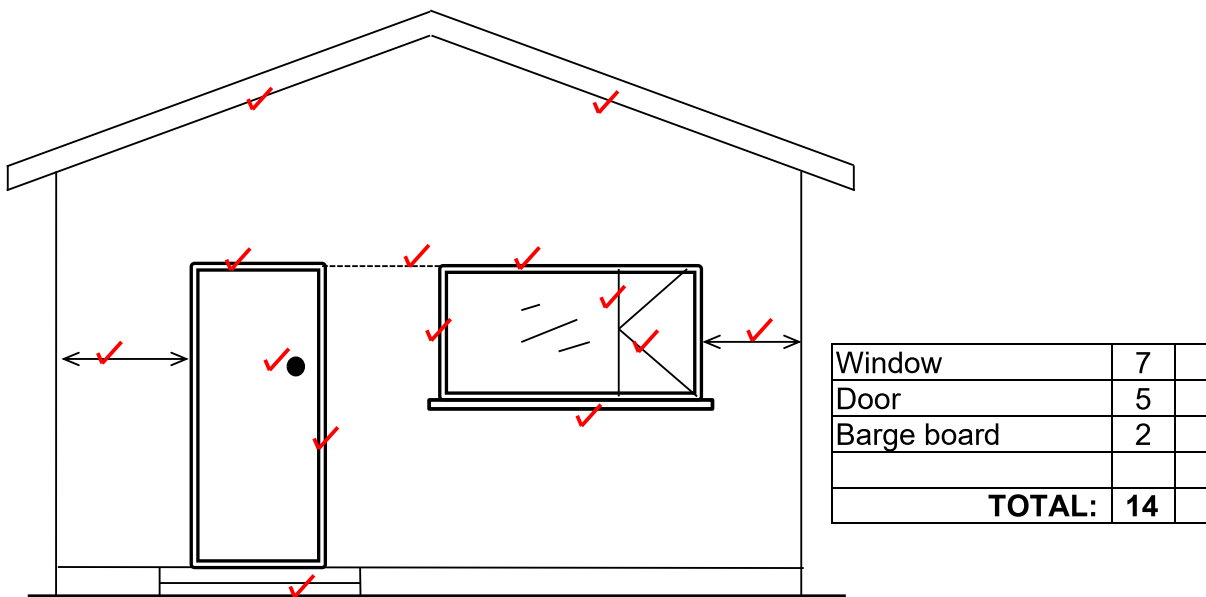
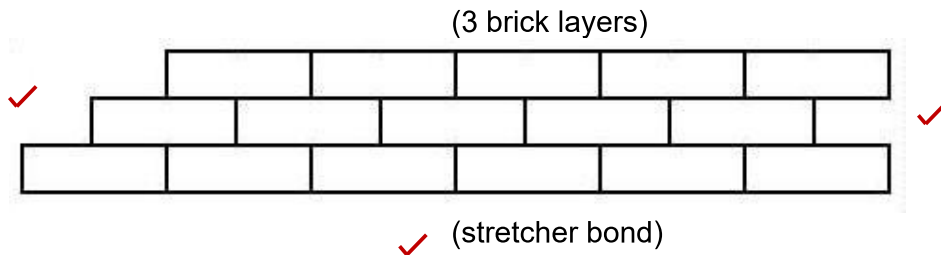


FIGURE 2.2

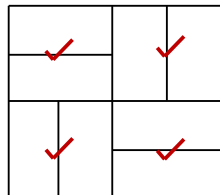
ANSWER SHEET B	CIVIL TECHNOLOGY GENERIC	NAME: _____
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- 5.2 Draw a neat sketch and show a three-brick layer wall in stretcher bond. Show raking back on the left-hand side and toothing on the right-hand side. Use own sufficient scale.



(4)

- 5.9 Draw a neat sketch with eight (8) bricks of the basket-weave paving pattern. Use any sufficient scale.



(4)