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GRADE 12

SEPTEMBER 2020

**CIVIL TECHNOLOGY: CONSTRUCTION
MARKING GUIDELINE**

MARKS: 200

This marking guideline consists of 13 pages.

QUESTION 1: SAFETY AND MATERIALS (GENERIC)

- 1.1 1.1.1 2 (1)
- 1.1.2 228 mm (1)
- 1.1.3 900 mm (1)
- 1.1.4 150 mm (1)
- 1.1.5 Non-slippery layer (1)
- 1.2 Similar answer:
Prevents horizontal movement between the platform and structure (1)
- 1.3 Identify THREE of the following requirements that are applicable to the supplier of hazardous chemical substances:
- 1.3.1 First-aid measures must be shown
- 1.3.4 Fire-fighting measures must be shown
- 1.3.6 Storage instructions must be shown (3 x 1) (3)
- 1.4 Minimum = 30° (1) and maximum = 50° (1) (2)
- 1.5 Similar answer:
Aluminium conducts electricity (1) and workers who use a ladder could be shocked (1) (2)
- 1.6 Describe the difference between the surface finish of a water-based paint and an oil-based paint:
- Water-based – provides an elastic, flexible finish (1)
- Oil-based – provides a hard, durable finish (1) (2)
- 1.7 Any THREE advantages of the curing of concrete:
- Increases strength
 - Decreases permeability
 - Improves durability
 - Reduces cracks
 - Makes concrete more watertight
 - Provides volume stability
 - Concrete can carry more weight (3 x 1) (3)
- 1.8 Briefly describe the powder-coating process:
- Plastic finish in powder form (1) is applied by means of a compressed air spray-gun (1) (2)

[20]

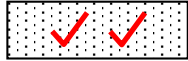
QUESTION 2: GRAPHICS, JOINING AND EQUIPMENT (GENERIC)

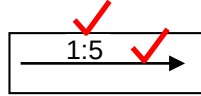
2.1 Answer the following questions with regard to the site plan on ANSWER SHEET A.

2.1.1 See ANSWER SHEET A (10)

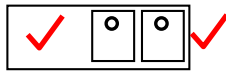
2.1.2 See ANSWER SHEET A (6)

2.2 2.2.1  (2)

2.2.2  (2)

2.2.3  (2)

2.2.4  (2)

2.2.5  (2)

2.3 2.3.1 Unfinished wood (1)

2.3.2 Two-way switch (1)

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

2.5 Prevents backing off **OR** it acts as a lock nut (1) (1)

2.6 18 mm (1)

2.7 2.7.1 1,35 m (1)

2.7.2 $1,412 - 1,285 = 0,127 \times 100 = 12,7 \text{ m}$ (0,1 m leeway allowed) (3)

2.7.3 Minimum = 30 m (1) and maximum = 200 m (1) (2)

2.8 It can affect the measuring function of the tool. (1)

2.9 Batteries must be removed. (1)

[40]

TOTAL SECTION A: 60

QUESTION 3: ROOFS, STAIRS AND JOINING (SPECIFIC)

3.1 Any FOUR types of roofs or roof trusses:

- South African roof truss
- Single Howe truss
- Lean-to-roof
- Couple roof
- Closed couple roof
- Collar-tie roof
- King post roof truss
- W-truss or Fink truss
- Fan truss
- Scissors truss
- Mono-pitched roof

(4 x 1) (4)

3.2 Any FOUR advantages of 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

(4 x 1) (4)

3.3 3.3.1 A – Purlin / Batten (1)

B – Rafter (1)

C – Ridge tile / ridge plate (1)

D – Nail plate (1)

E – King post (1)

3.3.2 38 mm (1) x 114 mm (1) (2)

3.3.3 Holds/fixes the different timber pieces together (1)

- | | | | |
|-----|-----------------------------------|--|-------------|
| 3.4 | 3.4.1 | Concrete tiles, clay or slate /heavy roofs | (1) |
| | 3.4.2 | Thatched roofs | (1) |
| | 3.4.3 | Iron sheeting/steel roof sheets/corrugated/IBR | (1) |
| 3.5 | 3.5.1 | True | (1) |
| | 3.5.2 | False | (1) |
| | 3.5.3 | True | (1) |
| | 3.5.4 | True | |
| 3.6 | 3.6.1 | Joining roof truss to brickwork | (1) |
| | 3.6.2 | A – Galvanized steel strap / hoop-iron strap | (1) |
| | | B – Wall plate | (1) |
| | 3.6.3 | 600 mm | (1) |
| | 3.6.4 | Nailed / Bolted | (1) |
| 3.7 | Any TWO types of cast-in anchors: | | |
| | • 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 | D | hard, but brittle and breaks easily | (1) |
| | 4.1.2 | H | pumps high volumes of concrete | (1) |
| | 4.1.3 | G | alloy of copper and zinc | (1) |
| | 4.1.4 | C | pumps smaller volumes of concrete | (1) |
| | 4.1.5 | A | highly toxic | (1) |
| | 4.1.6 | E | packaging material | (1) |
| 4.2 | 4.2.1 | | Slump test | (1) |
| | 4.2.2 | | 100 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 means of hosepipe or sprinkling | |
| | | | • 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) |

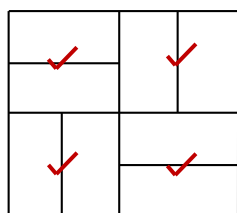
- 4.6 4.6.1 Tamping rammer (1)
- 4.6.2 Any THREE ways of maintaining the tamping rammer:
- Lubricate and adjust according to manufacturer's instructions
 - Clean after use and store in a safe, dry place
 - Repair / replace damaged electrical cords
 - Service regularly
 - Remove loose dirt and soil after use (3 x 1) (3)
- 4.6.3 To keep control of the powerful machine (1)
- 4.7 Any FOUR 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 (4 x 1) (4)
- 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 Avoid trench sides from collapsing (one metre away) (1)
- 4.9.3 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)

[40]

QUESTION 5: BRICKWORK AND GRAPHICS (SPECIFIC)

- 5.1 5.1.1 One brick wall / Outside wall (1)
- 5.1.2 220 mm (1)
- 5.1.3 Stretcher bond (1)
- 5.2 Any THREE advantages of cavity walls:
- Prevent rainwater from penetrating the interior wall surface
 - Provide good thermal and sound insulation
 - Cheaper materials can be used for internal walls
 - Reduces / prevent expensive exterior finishes (3 x 1) (3)
- 5.3 See ANSWER SHEET B. (5)
- 5.4 5.4.1 50 mm (1)
- 5.4.2 8 m (1)
- 5.4.3 To remove wasted mortar (1)
- 5.4.4 Wall ties (1)
- 5.4.5 Allows water that penetrates the outside wall to drain (1)
- 5.5 Double triangular pattern (1)
- 5.6 5.6.1 A – Beam filling (1)
- B – Fascia board (1)
- C – Tie beam (1)
- D – Plaster (1)
- 5.6.2 Open eave construction (1)
- 5.7 5.7.1 F (prepared layer beneath paving and bedding sand) (1)
- 5.7.2 C (best edge restraint for paving) (1)
- 5.7.3 A (natural soil on which the paving will be laid) (1)
- 5.7.4 D (final layer upon which paving is laid) (1)

- 5.8 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)
- 5.9 Any TWO reasons for construction failure of 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)
- 5.10 Draw a neat sketch with EIGHT (8) bricks of the basket-weave paving:



Bricks drawn in
good proportion = ✓

(5)

- 5.11 5.11.1 Segmental gauged arch (1)
- 5.11.2 A – Key brick (1)
- B – Skewback (1)
- C – Intrados (1)
- D – Extrados (1)

[40]

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

- 6.1 Concrete is mixed / poured on site (1)
- 6.2 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 support load on its own
 - 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)
- 6.3 6.3.1 A – Soffit / Shutter board (1)
- B – Strut / Prop (1)
- C – Bearer / Head tree (1)
- D – Brace / Strut (1)
- E – Folding wedges (1)
- 6.3.2 Beam (1)
- 6.4 6.4.1 High-tensile steel (1)
- 6.4.2 250 mm (1)
- 6.4.3 16 mm (1)
- 6.5 6.5.1 Tensile stress / force (1)
- 6.5.2 Shear stress / force (1)

- 6.6 Any THREE properties (requirements) for reinforced steel bars:
- 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 temperature fluctuates
 - Readily available and affordable
 - Must be rustproof, otherwise it will impair binding (3 x 1) (3)
- 6.7 Any TWO types of pile foundations:
- Precast concrete piles / prefabricated piles
 - Steel tube caisson piles
 - In-situ (driven) foundation piles
 - Short-bored (auger) piles (2 x 1) (2)
- 6.8 Any TWO reasons for using pile foundations:
- Ground conditions not stable / solid enough
 - Distribute the load to more stable ground (underground / water supports)
 - Provides stability when raft / floating foundation is used
 - When structures are subjected to horizontal forces, resist pile foundations bending stress while still lending vertical support
 - Soils prone to swelling and shrinking (clay soil)
 - Superstructure is exposed to uplifting forces (offshore platforms)
 - Where soil erosion is possible (bridges) (2 x 1) (2)
- 6.9 Foundation strips for a store-room is 5 650 x 3 375 (inside measurements)
The foundation is 750 mm wide and 250 mm deep (thick)

6.9.1 Calculate the centre line of the foundation: (5)

$$\begin{array}{rcl}
 2 / 5\,650 & = & 11\,300 \quad \checkmark \\
 2 / 3\,375 & = & \underline{6\,750} \quad \checkmark \\
 & & 18\,050 \quad \checkmark \\
 \text{Plus corners:} & 4 / 750 & = \underline{3\,000} \quad \checkmark \\
 & & 21\,050 \quad \checkmark
 \end{array}$$

6.9.2 Calculate the volume of concrete needed (3)

Volume = length x width x depth

$$= 21,05 \text{ m} \times 0,75 \text{ m} \times 0,25 \text{ m}$$

$$= 3,947 \text{ m}^3 \quad \checkmark$$

(3)
[30]

TOTAL: 200

ANSWER SHEET <big>A</big>	CIVIL TECHNOLOGY GENERIC	NAME: _____
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2.1 Answer the following questions in regard to the site plan on
ANSWER SHEET A:

2.1.1 Any TEN particulars that are not shown according to the checklist:

- Plot no. 31 is not shown
- Plots depth measurement is not shown
- Street name is not shown
- Branch sewage at S is not shown
- Connecting manhole (1,5m inside plot boundary) is not shown
- Measurements of southern building boundary is not shown
- Structure measurements are not shown
- RE (rodding eye) symbol is not shown
- IE symbols are not shown
- VP and symbol are not shown at WC
- Entrance to plot is not shown
- No datum level is shown

(10)

2.1.2 Identify SIX particulars that are shown incorrectly on the site plan:

- Construction is over the building boundary on the west side
- North arrow must be on the right-hand side, at the bottom of the page
- Scale is wrongly shown
- Corner of branch sewage at WB is wrong
- RE and symbol missing at the change of direction in sewage line
- House depth measurements are not shown

(6)

ANSWER SHEET B	CIVIL TECHNOLOGY CONSTRUCTION	NAME: _____
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5.3 Draw in the damp-proof course (DPC).

(5)

