basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

CIVIL TECHNOLOGY

EXEMPLAR 2016

MEMORANDUM

MARKS: 200

NOTE:
1. A mask must be used to mark all drawings drawn to scale.
2. All answers must indicate the correct unit.
3. Mark positively in the case of calculation errors.
4. Mark positively in the case of measurement errors.

This memorandum consists of 21 pages.

SECTION A: GENERICS (COMPULSORY)

QUESTION 1: SAFETY

1.1 1.1.1 The worker must wear a hard hat. ✓ (1)
OR ANY OTHER ACCEPTABLE ANSWER

1.1.2
- The site must be cordoned off. ✓
- Safety nets must be installed in areas where falling objects may cause injuries. ✓
- The fencing must extend beyond the construction area. (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.1.3
- The worker is sitting on the edge of the beam. ✓
- He is not holding the material properly. ✓ (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.2
- Safety goggles √
- Safety boots √
- Hard hat
- Overall
- Gloves
- Ear protection (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.3
- Hand tools must be in good condition. √
- All cutting tools must be sharp. √
- Do not use tools with broken or no handles.
- Handles must be secured tightly onto tools.
- Keep body parts away from the cutting edge of tools.
- Place tools in places where it will not fall.
- Use the right tools for the right job. (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.4
- Heat √
- Oxygen √
- Fuel √ (3)

1.5
- Stacks of material must not be higher than three times its width. √
- Stacks must be interlocked/bonded. √
- Material must be stacked on strong, firm floors. √
- Position the stack carefully, and make sure that it contains no protruding parts. √
- Stacking the material must not obstruct ventilation, lighting, or fire equipment. √
- Any stack which appears unstable must be broken down and restacked immediately. √
- Workers must use ladders or other aids to reach material instead of climbing on to the stack. √ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.6
- The worker will be negligent. √
- The worker will be less productive. √
- The worker will lose interest in his/her work. √
- The worker will become troublesome. √
- The worker will interfere with other workers on site. √
- The worker may injure himself/herself whilst working. √
- She/He will pose a danger to her/his colleagues. √ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.7
- The worker will appear sleepy. √
- Behavioural changes will be visible. √
- The worker will be tired and apathetic. √
- The worker will be uncharacteristically aggressive and irritable. √
- The worker will lose weight, with needle track marks, red eyes, coughing and a sore throat. √ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

[20]

QUESTION 2: MATERIALS, TOOLS AND EQUIPMENT

2.1

2.1.1	B ✓
2.1.2	J ✓
2.1.3	F ✓
2.1.4	H ✓
2.1.5	G ✓
2.1.6	I ✓
2.1.7	C ✓
2.1.8	D ✓
2.1.9	E ✓
2.1.10	A ✓

(10)

2.2

2.2.1.	D ✓
2.2.2.	B ✓
2.2.3	C ✓
2.2.4	B ✓
2.2.5	A ✓
2.2.6	A ✓
2.2.7	C ✓
2.2.8	C ✓
2.2.9	D ✓
2.2.10	B ✓

(10)

2.3 2.3.1 Folding rule ✓
Use:
- Measuring distances less than a metre. √ (2)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.3.2 Spirit level ✓
Use:
- To check horizontal, vertical and slanted surfaces. √
- Transferring levels from one point to another. √
- Also used as a straight edge. √
- Level test of blocks and bricks. √
- To check level and plumb of doorframes and window frames when built into a brick wall. √ (2)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.3.3 Shifting spanner/Adjustable spanner ✓
Use:
- Fasten and loosen nuts and bolts of various sizes. √
- Fastening and loosening couplings and taps. √ (2)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.3.4 Mortice gauge ✓
Use:
- To mark mortices and corresponding tenons. √
- For marking lines parallel to the edge of timber. √
- To mark out halving joints. √ (2)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.3.5 Tingle ✓
Use:
- Used to prevent the builders line from sagging in the middle when it is stretched over a long distance. √ (2)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.4 2.4.1

- Sand must be well sorted to ensure higher permeability. √
- The grains must be rounded and smooth. √
- Sand must be clean. √
- Sand must be granular. √
- Sand must be hard. √
- Sand must be free of clay, dust and salt. √
- Sand must be free of organic material. √
- Sand must be free of other impurities. √
- Sand must contain coarse as well as fine particulars. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.4.2

- Material that is most corrosion-proof. √
- Does not rust or stain when exposed to water. √
- Easy to clean. √
- Hard, strong and durable. √
- Fairly low thermal and electrical conductivity. √
- Malleable, ductile and pliable. √
- Magnetic to a certain extent. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.4.3

- Adheres well to most materials. √
- Does not rust when applied to metal. √
- Dust does not enter joint. √
- It is flexible. √
- Ensures good adhesion. √
- Joint will have a very smooth exterior surface. √
- Can be used outdoors because it is waterproof. √
- Can withstand both low and high temperature use. √
- Sealant contains UV inhibitors. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.5

- PVC adhesives are transparent/clear. √
- It dries quickly when in contact with PVC pipes.√ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.6 **Steel square:**

- Used for setting out foundations. √
- Brickwork √
- Staircases √
- Roof trusses √
- Concrete work √
- Generally used to check the straightness of larger objects. √
- Testing squareness of cupboards. √ (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

Try square:

- Marking lines perpendicular to the edge of most materials. √
- Testing squareness and straightness. √
- If the blade is calibrated it can be used as a ruler. √
- Mark squared cutting lines on a small piece of wood. √
- Can be used as a straight edge to test if surfaces are flat and straight. √ (1)

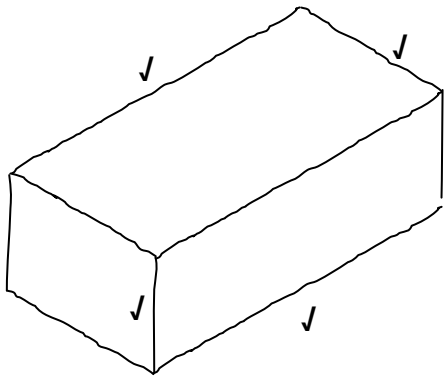
ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

[40]

QUESTION 3: GRAPHICS AS MEANS OF COMMUNICATION

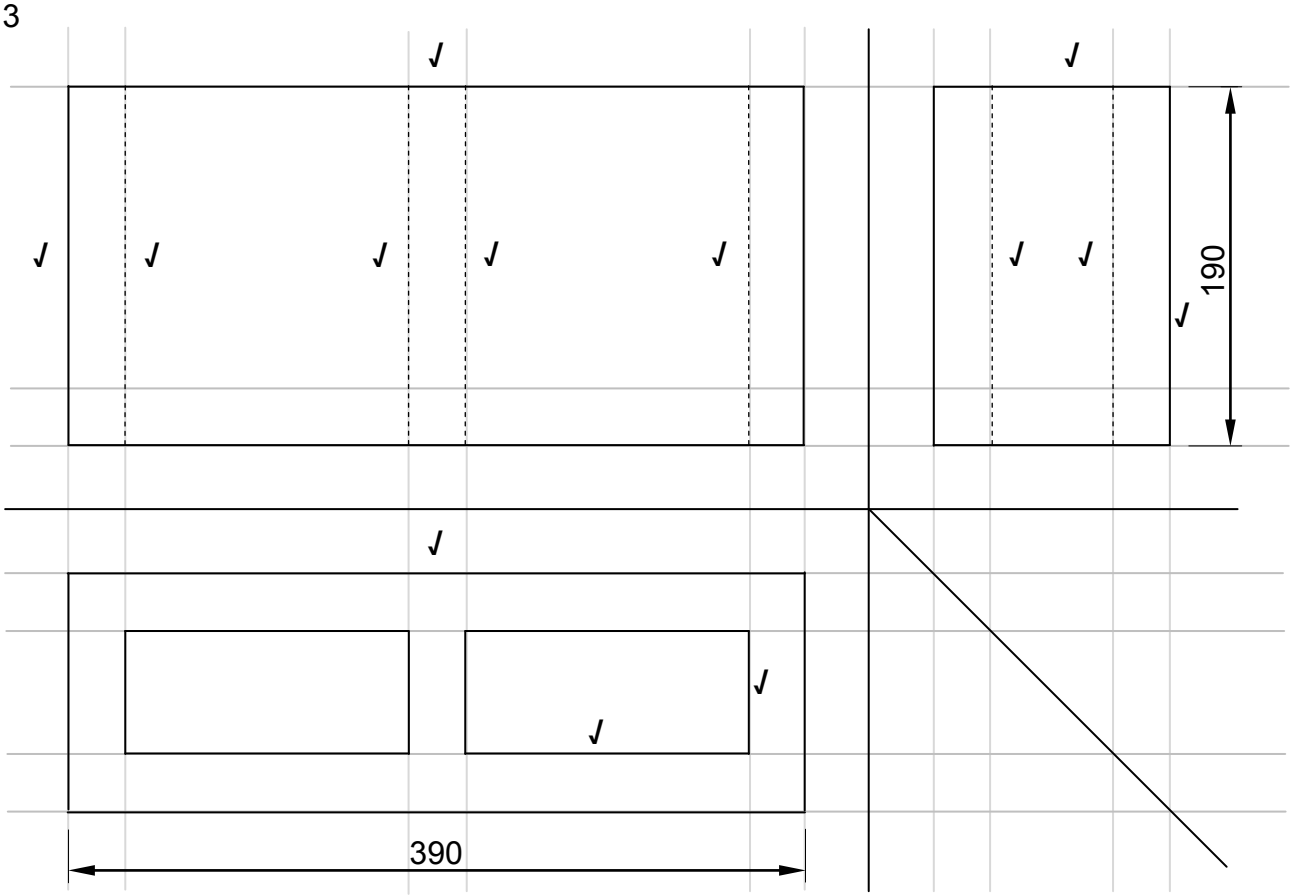
3.1 Computer-aided drawings (CAD) are scale drawings drawn on computer using a specific CAD program. ✓ (1)

3.2



Correctness of sketch = 4
Quality of freehand sketch = 1 (5)

3.3



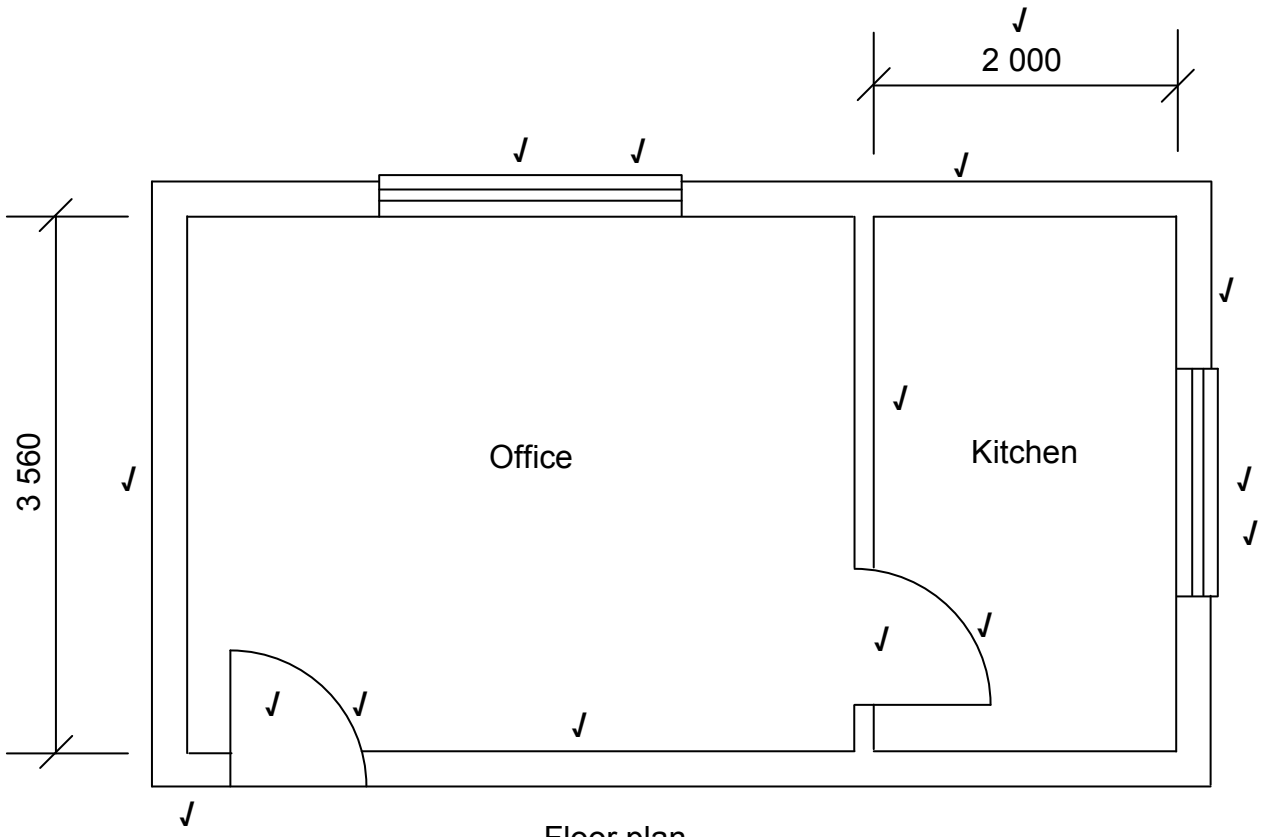
HOLLOW BLOCK ✓ SCALE 1 : 2 ✓

Application of scale ✓✓

Drawing not to scale due to electronic transfer.
Use a mask to mark this question. (17)

CRITERIA	MARK	LM
Drawing of external lines	7	
Hidden details	6	
Printing of title	1	
Printing of scale	1	
Application of scale	2	
TOTAL	**7**	

3.4



Floor plan

Application of scale ✓✓

CRITERIA	MARK	LM
External walls drawn correctly	4	
Internal wall drawn correctly	1	
Doors drawn correctly	2	
Windows drawn correctly	2	
Correct placement of doors	2	
Correct placement of windows	2	
Dimension of internal width of kitchen	2	
Application of scale	2	
TOTAL	**17**	

[40]

QUESTION 4: QUANTITIES AND JOINING

4.1
- Nails may be driven into timber quicker. √
- Nails may be removed quickly. √
- Nails are cheaper. √
- They are available in a wide variety of lengths. √
- Nails are available with a variety of shapes of head. √
- Nails are tough and resilient. √
- Nails may be straightened and reused. √ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

4.2
- Screws may be removed more easily. √
- Screws may be driven in with a screwdriver which does not cause bouncing of the timber. √
- Screws have a better grip on timber because of their threads. √
- Screws have a better appearance. √
- Screws may be used repeatedly if the heads are not damaged. √
- Screws do not bend easily. √ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

4.3 4.3.1
- It may be used on hinges. √
- It may be used on joints. √
- It may be used to fix table tops to a table frame. √ (1)

4.3.2 The drywall screw is used to attach gypsum boards to battens or drywall frames. **✓**

4.3.3 The round wire nail is used in roof structures and general carpentry work where the visibility of the nail heads does not matter. **✓** (1)

4.3.4 The panel pin is used in cabinet making and where the head of the nail must be driven below the surface of the timber to conceal the nail. **✓** (1)

4.4 4.4.1 3 metres **✓** (1)

4.4.2 0,6 metres **✓** (1)

4.4.3 0,150 metres **✓** (1)

4.4.4 Volume = Length x Breadth x Depth
= 3 m **✓** x 0,6 m **✓** x ,150 m **✓**
= 0,27 m³ **✓✓** (5)

4.5.1 Internal length of building:
= 10 440 mm – 2 (220 mm) = 10 000 mm ✓✓

Internal width of building:
= 6 440 mm – 2 (220 mm) = 6 000 mm ✓✓

Length of skirting required for building
= 2(10) m ✓ + 2(6) m ✓ - 0,9 m ✓
= 31,1 m ✓

OR

= 2(10 000) mm + 2(6 000) mm – 900 mm
= 31 100 mm (9)

4.5.2 Area of floor:
Use inside measurements as calculated above.
= 10,0 m ✓ x 6,0 m ✓
= 60 m^2 ✓✓
Check 5 marks

OR

= 10 000 mm x 6 000 mm
= 60 m^2✓ (4)

4.6.1 Volume of soil excavated: = Length x Breadth x Depth
= 8 m ✓ x 0,6 m ✓ x 0,9 m ✓
= 4,32 m^3 ✓✓ (5)

THE USE OF DIMENSION PAPER WILL ALSO BE ACCEPTED FOR QUESTIONS 4.5.1 TO 4.6.1

4.6.2 Length of wall = 8 000 mm – 2(150) mm
= 7 700 mm ✓
✓ ✓
Area of wall = 7 7 m x 1,350 mm
= 10,395 m^2
= 10,4 m^2 ✓ (4)
[40]

TOTAL SECTION A: 140

SECTION B: CONSTRUCTION

QUESTION 5: FOUNDATIONS, CONCRETE AND BRICK WORK

5.1 5.1.1 Hand hawk ✓ (1)

5.1.2 Plastering trowel ✓ (1)

5.2 The sign means that a hard hat is compulsory and must be worn. ✓ (1)

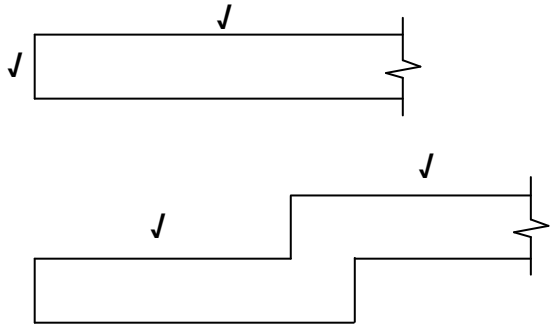
5.3
- The block brush is used to wet surfaces to receive plaster. √
- The block brush is used to wet plaster when floating. √ (2)

5.4
- Soil compaction increases load-bearing capacity.√
- Soil compaction will prevent soil settlement. √
- Soil compaction will provide stability to a structure. √
- Soil compaction will reduce water seepage, swelling and contraction especially in instances such as basements. √ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

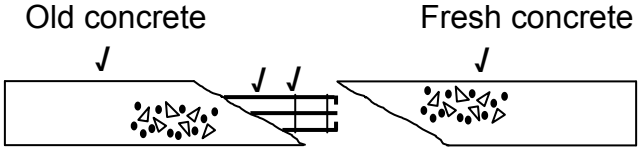
5.5
- The purpose of foundation is to distribute the loads of the structure evenly into the soil. √
- It creates a level surface onto which bricks may be laid. √ (2)

5.6



(4)

5.7



(4)

5.8 The following steps must be followed:
- Assess the damage. √
- Determine the cause of the failure. √
- Design a suitable method to repair the structure. √
- Implement the recommended method to repair damage to or defects in the concrete structure. √ (4)

OR ANY OTHER ACCEPTABLE ANSWER

5.9
- To increase the strength of the wall. √
- To resist wind loads. √
- To resist cracking at the corners of openings.
- To increase the bearing capacity of the walls. (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

5.10
- Crosswise method √
- Hair knot method √
- Crown method (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

5.11 Volume of sand = Volume of concrete required x $\frac{\text{Mixing ratio of sand}}{\text{Total mixing ratio}}$

$= 5 \times \frac{3}{10}$ ✓✓

$= \frac{15}{10}$

$= 1{,}5\ m^3$ ✓✓ (4)

[30]

QUESTION 6: FORMWORK

6.1 Round wire nail/Wire nail ✓ (1)

6.2 A – Wedges ✓
B – Yoke ✓
C – Clamp ✓ (3)

6.3 The operation of removing formwork is referred to as the striking or stripping of formwork. ✓ (1)

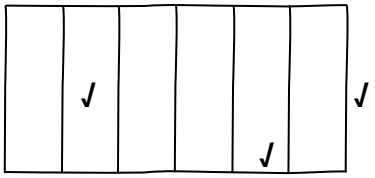
6.4
- Striking of formwork must be done with great care. √
- The decision to strike formwork rests with the architect and engineer. √
- Striking will depend on the average temperature, the loading conditions and the strength of the concrete. √
- Formwork for columns is removed first. √
- The soffit of beams and slabs must be removed after 14 to 21 days and supported by props. √
- The type of formwork used for pillar, beams or concrete slabs (horizontal or vertical) will influence the striking. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

6.5
- Stronger than solid wood for the thickness. √
- Equally strong across the length and width, because the grain direction of one ply is diagonal relative to adjacent plies. √
- Excellent when constructing curves and arches. √
- Ideal for building boats. √
- Does not warp. √
- Minimal shrinking and expansion. √
- Thicker plywood is sturdier than thinner plywood. √
- It does not split when nails and screws are driven in close to the edges. √ (3)

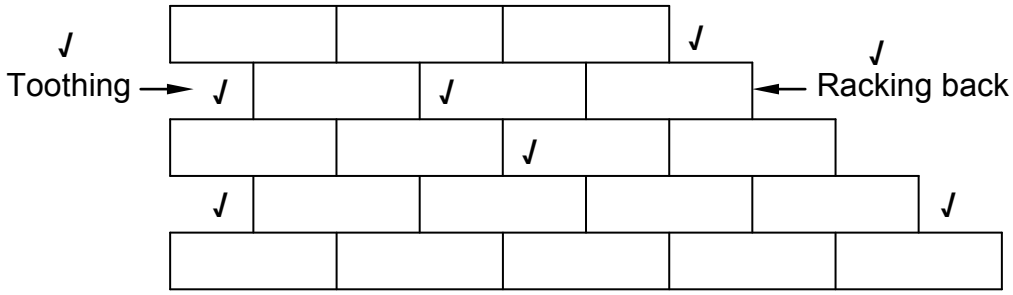
ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

6.6 Correctness of sketch = 2 quality of sketch = 1



(3)

6.7

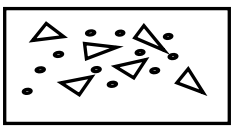


Application of scale √√

CRITERIA	MARK	LM
Correctness of drawing	6	
Labels	2	
Application of scale	2	
TOTAL	**10**	

(10)

6.8



√ √

(2)

6.9
- Rawl bolt √
- Hilti √
- Chemical anchor √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

6.10
- Steel nails √
- Concrete anchor bolts √
- Rawl bolt √ (1)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

6.11
- Separate any radioactive material by clearly marking it with the appropriate warning sign. √
- A warning sign must be displayed to indicate that radioactive material is stored in that space. √
- Cordon/Fence off the area if necessary. √
- Each container that has already been used must be tagged; use a suitable label for this purpose. √
- Always lock containers. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

[30]

TOTAL SECTION B: 60

SECTION C: CIVIL SERVICES

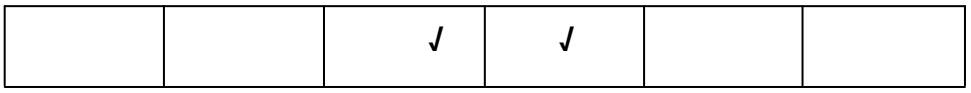
QUESTION 7: CONSTRUCTION, STORM WATER AND ROOF WORK

7.1
- Check suitability of clothing and assess load. √
- Place feet apart and bend the knees. √
- Firm grip, close to the body. Bend the back, knees and hips slightly at the start of the action. √
- Lift load smoothly to knee level and then further to the waist. Do not bend the back again. √
- Keep your load close to the body/waist. √
- Set the load down to waist level or to knee level, and then onto the floor if needed. √ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

7.2 Pythagoras **✓** (1)

7.3



Course 1

Course 2 (4)

7.4
- Collapsing side walls of trenches. √
- Sides not excavated at the correct slope/angle. √
- Poor soil in excavating area. √
- Use of unsuitable props or shoring to support trench wall. √
- Vibration of heavy machinery or vehicles in the vicinity. √
- Inflow of water into trench. √
- Material that can fall on workers during excavations. √
- Contaminated soil. √ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

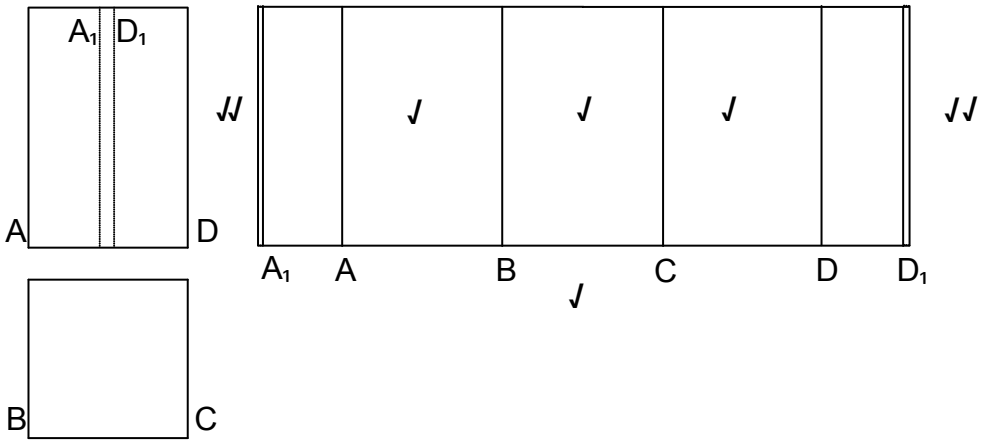
7.5
- Cement √
- Sand √
- Water √ (3)

7.6

TYPE	WALL THICKNESS	USE
Class 0	Thin walled **✓**	Designed for use above ground. Underground use not recommended. **✓**
Class 2	Thick walls **✓**	Can be used above or below ground. **✓**

(4)

7.7



(8)

7.8
- Roof gutters collect rainwater and feed it into downpipes. √
- Water is collected by means of channels or inclined surfaces. √
- Road-side gutters and cambered road surfaces channel storm water to storm water drains. √
- Storm water drains with manholes carry the water away from inhabited areas to be safely discharged into the ocean, rivers or dams. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

7.9
- The length of the roof (gutter run) will determine the slope of the gutter. √
- The direction of the water outlet will be determined by the placement of the down pipes. √ (2)

[30]

QUESTION 8: HOT- AND COLD-WATER SUPPLY AND SANITARY FITMENTS

8.1
- Has no smell. √
- Water is tasteless. √
- Water is crystal clear. √
- The boiling point of water depends on atmospheric pressure; the boiling point will be taken as 100 °C. √
- Clean water freezes at 0 °C. √ (2)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

8.2
- Rain falls in catchment areas. √
- Water flows down to rivers and dams. √
- Water is pumped to purification plants. √
- Water is pumped to towns and houses. √ (4)

8.3 **Wells:**
- Water may be contaminated. √
- The quality may be doubtful. √
- Colour may vary. √

Boreholes:
- Boreholes need maintenance. √
- Boreholes may run dry in a dry season. √ (2)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

8.4
- Water pipes must be embedded at least 600 m below ground. √
- Insulate pipes. √
- Cover exposed pipes. √
- Open taps to allow water to drip constantly. √
- All the pipes inside the roof must be covered. √
- Outdoor water pipes must be covered with waterproof insulating material. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

8.5 8.5.1
- It is used to reduce the pressure of the incoming water from the municipality mains. √
- Water is supplied directly to the geyser via the pressure-reducing or pressure-control valve. √
- Designed and manufactured for high flow capacity with accurate pressure control. √
- To provide water to the geyser at a specific rating for the geyser. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

8.5.2
- Safety valves are designed to provide protection against overheating of water.√
- Provides protection against excess pressure build-up in the geyser. √ (2)

8.6
- Radiation is the movement of heat in direct rays from the source √ without heating the intervening space. √
- Infra-red rays that may be felt when you stand in front of a fire. √
- Rays pass through the air until they hit a solid object that will absorb them and be heated by them. √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

8.7 **Unbalanced water installation:**
Cold water supply to taps is drawn off before the pressure-control valve and hot-water drawn off after. **✓**
Balanced water installation:
Hot- and cold-water pipes draw off to taps is placed after the pressure control valve. **✓** (2)

8.8 8.8.1 Water closet ✓ (1)

8.8.2  ✓ (1)

8.9 A= T-piece/body ✓
B= Ferrule ✓
C= Nut ✓ (3)

8.10  ✓✓ (2)

8.11 8.11.1 Ø15 mm 90°elbow capillary ✓ (1)

8.11.2 T-piece capillary ✓ (1)

8.11.3 2 ✓ (1)

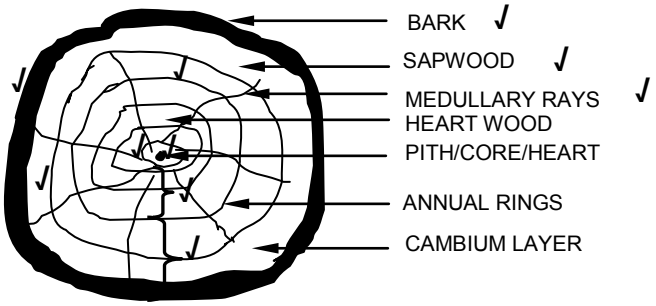
8.11.4 1,450 m or 1 450 mm ✓ (1)
[30]

TOTAL SECTION C: 60

SECTION D: WOODWORKING

QUESTION 9: CASEMENTS

9.1



3 marks for the labels and 7 marks for the drawing (10)

9.2
- A loose knot will have a tendency to move around and fall off the piece of timber. √
- A live knot is solid and stays in place in the timber. √ (2)

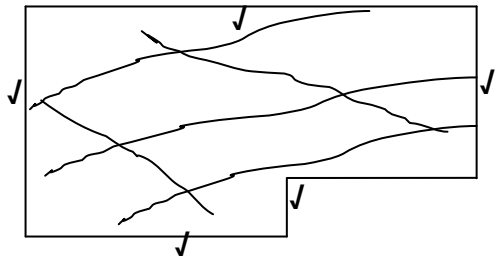
9.3
- The mortice gauge can be used to mark out mortices and corresponding tenons. √
- It can also be used to mark out positions for mortice locks on doors. √ (1)

9.4 The cross peen is used to tap in small panel pins or nails into a timber. ✓ (1)

9.5 9.5.1
A – Frame head ✓
B – Top rail ✓
C – Frame stile ✓
D – Pane/glass ✓
E – Casement stile ✓
F – Bottom rail ✓
G – Sill ✓ (7)

9.5.2 Putty or glazing beads ✓ (1)

9.5.3



Horizontal section through part H (frame stile) (5)

9.6
- The rebate in a frame will house the casement or door. √
- The rebate will prevent dust and dirt entering the room. √
- The rebate allows for privacy (prevent people from seeing √ through the space between the casement and the frame). √
- The rebate enhances the security of a lock on a door. √
- The rebate will secure the casement tightly against the frame. √
- Without the rebate the door/casement will go past the frame and the door or casement can pull off the hinges. √

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER (3)

[30]

QUESTION 10: DOORS

10.1
- Tools will not be stored in its proper place. √
- Time will be wasted looking for tools. √
- Injuries may be sustained. √ (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

10.2
- Plywood √
- Hardboard (Masonite) √
- Veneer √
- Melamine √ (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

10.3 Panel saw ✓ (1)

10.4 PVA glue ✓ (1)

10.5 It must be water-resistant. ✓ (1)

10.6
10.6.1 2 ✓ (1)

10.6.2 114 ✓ (1)

10.6.3 813 ✓ (1)

10.6.4 44 ✓ (1)

10.6.5 Middle lock rail/Lock rail/Middle rail ✓ (1)

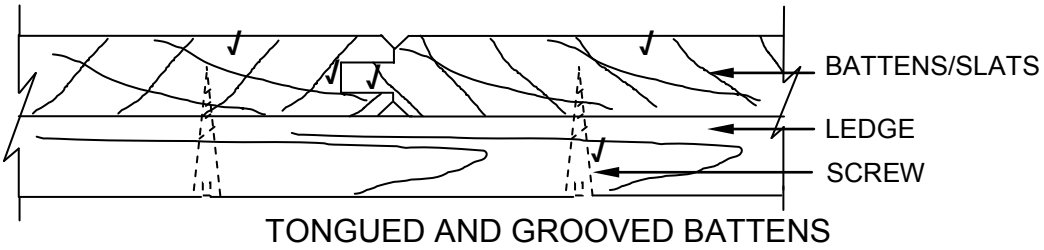
10.6.6 220 ✓ (1)

10.6.7 Meranti ✓ (1)

10.6.8 1 ✓ (1)

10.6.9 605 ✓ (1)

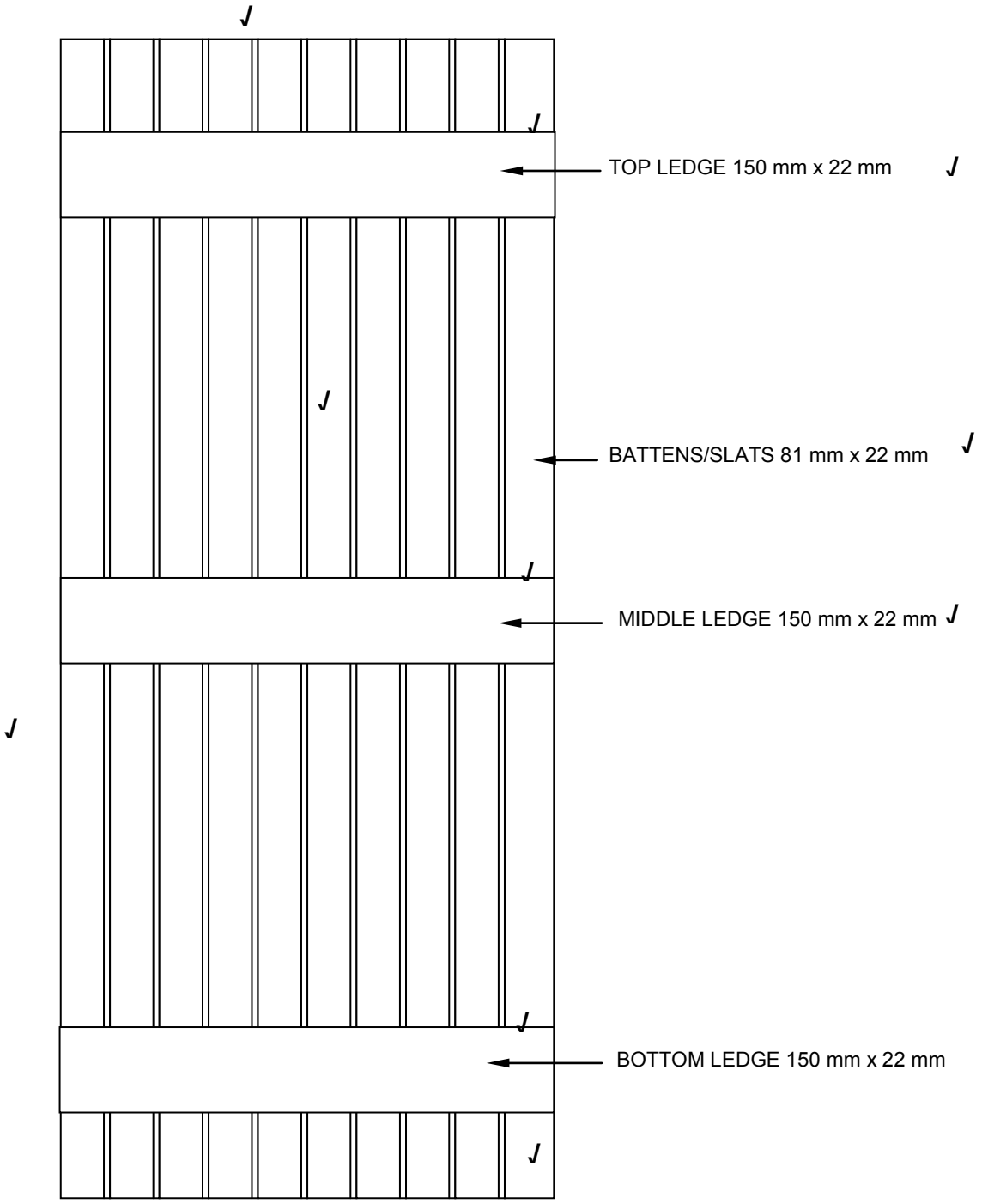
10.7



TONGUED AND GROOVED BATTENS

5 marks for the drawing (5)

10.8



7 marks for the drawing and 3 marks for the labels (10)
[30]

TOTAL SECTION D: 60
GRAND TOTAL: 200