



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

CIVIL TECHNOLOGY

NOVEMBER 2014

MEMORANDUM

MARKS: 200

This memorandum consists of 19 pages.

QUESTION 1: CONSTRUCTION, SAFETY AND MATERIAL

1.1.1

- Wear earmuffs / ear protection/ ear plugs ✓
- Wear an overall ✓
- Wear safety gloves ✓ (3)
- Safety goggles/ Face shield
- Dust mask
- Safety guard on machine
- Safety boots

1.2.1

Safe handling

- Avoid bringing the ladder into contact with electricity. ✓
- Place the ladder so that its stiles are a quarter of its length from its support.
- A ladder that is not securely tied at the top, must be held by a person at the bottom when in use.
- Where ever possible it should project 900 mm (Three steps) above its support.
- A ladder should be inspected regularly.
- As paint conceals defects use varnish or wood oil to preserve ladders.
- Keep ladders clean.
- Do not use / leave ladders on wet ground or expose to weather conditions.
- Ladders lying on floors may cause someone to trip and fall.
- Do not use ladders horizontally as runways or scaffolding.
- Use ropes to haul up tools and equipment.
- Never leave a ladder in front of a door / where it may be knocked over.
- Ladders should be fitted with non slip feet.
- Store ladders in a cool place.
- Use both hands when climbing up or down a ladder.
- Never wedge one stile up when the floor surface is uneven.
- Beware of wet, greasy or icy rungs.
- Never make the ladder stand on something to give it extra height. (1)
- Not more than one person on the ladder at any time.

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.2.2

Maintenance

- Store ladders in a cool/dry place. ✓
- As paint conceals defects use varnish or wood oil to preserve ladders.
- Keep ladders clean.
- Store on hooks / brackets/ horisontaal. (1)
- Inspect ladder regularly.

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.3

- Temporary guard rails must be secured in the opening to prevent a person from falling off. ✓
- Guard rails must be placed at approximately 900 mm high. ✓
- Where materials might fall on a person's head below, a sufficient catch-net should be placed just below the surface.
- Toe boards should be secured on the floor to prevent overstepping.
- Toe boards should be secured on the floor to prevent materials from falling off.
- Sufficient warning notices should be placed.
- Open platforms and stairs should be kept free from rubbish.
- Open platforms and stairs should be kept free from unnecessary obstruction or material. (2)
- Wear safety harness. (Safety clothing not accepted)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.4

- A notice should be displayed on the machine stating its safe work load. Do not overload hoist. ✓
- A notice should be displayed on the machine, stating that no person must ride on the hoist. ✓
- An automatic and a manual brake must be fitted to prevent materials from over running.
- A builders hoist should also have all the necessary safety features such as safety guards etc. (2)
- Opening on floor where hoist is not park must be fenced of.

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.5

- Remove any traces of dust, rust, oil or grease, clean it. ✓
- Sand down the metal using emery cloth (sandpaper)
- Apply rust proof under coat / primer. ✓
- Apply paint. ✓ (3)

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.6.1 Double casement window/ Sash rail (1)

1.6.2 A - Frame head ✓
 B - Top rail /sash rail/top rail of window ✓
 C – Casement (window) stile / Stile ✓
 D - Glazing bar / vertical glazing bar/ putty / wooden strip ✓
 E – Frame stile/ jamb ✓ (5)

1.7

- To obtain a fairly level smooth surface. ✓
- To remove marks made by the straight edge. ✓
- To help to compact the concrete surface. ✓
- To embed stones just beneath the surface. ✓
- Easy to clean. (4)
- Easier to lay tiles.
- To enhance the appearance.
- To seal the surface.

ANY FOUR OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.8.1 H-beam/ profile ✓ (1)

- 1.8.2
- Easy to weld ✓
 - Can easily be joined
 - Malleable
 - Ductile
 - Prone to rust
 - Grey in colour
 - Strong (1)
 - Resistant to torsion/ bending
 - Strong under compression

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 1.8.3
- Beam above the opening of stage ✓
 - Columns supporting a beam (1)
 - Under the stage
 - Steel roof trusses/pillars/columns

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.9

- It prevents wind from penetrating area between the ceiling and the roof. ✓
- It provides good insulation.
- It keep warmth or coolness inside the building.
- It prevents perching and breeding spots for birds.
- It prevents insects and rodents from entering the roof area.
- It prevents dust from entering the area between the ceiling and the roof. (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 1.10
- Time consuming to build beam filling between purlins. ✓
 - Hot air is trapped in the roof space. (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

1.11.1 Low strength –foundations with no reinforcement, free standing walls, footings

- and mass concrete/ filling/ site concrete/ walkways. ✓ (1)
- 1.11.2 Medium strength – Suspended structural beams, slabs, precast items, heavy duty floor/ walkways reinforced foundations and slabs/light duty house floors. Patios/ steps/ driveways. ✓ (1)
- 1.11.3 High strength – Foundations with reinforcement and slabs, heavy duty floors(suspended floors), paths, patios, steps, driveways and garage floors suspended structural beams/ precast items/bridges/dams/roads. ✓ (1)

[30]

QUESTION 2 ADVANCE CONSTRUCTION AND EQUIPMENT

2.1

- It should be strong enough to bear the mass of wet concrete. ✓
- It should be able to bear the mass of people and equipment working on it. ✓
- It should be nailed together accurately according to the intended size and shape.
- It should be sealed off to prevent unnecessary loss of concrete which may lead to honeycombing.
- Designed to be easily placed in position by hand or lifting equipment.
- It should be made of material that is easily nailed together or assembled.
- It should be designed to be easily erected and dismantled without replacing any parts.
- Repairable on site.

(2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.2.1 Spirit level – to level and plumb the door frame (horizontal and vertical accuracy) doorframe/door /wall.✓

(1)

2.2.2 Steel Square – To check squareness of the corners of the frame/90°. ✓

(1)

2.3

- Lubricate and adjust according to instructions. ✓
- Clean after use. ✓
- Store in a safe place.
- Repair or replace damaged electric cord.
- Keep ventilation holes open and clean.
- Service the plane regularly/inspect the plane regularly
- Avoid planing wood that contains nails.
- Handle it so as not to damage it.
- Use machine only for the intended purpose.
- Do not force the electric plane.
- Blades must be sharp and secured properly

(2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.4

Criteria	Rough Arch	Gauged Arch
Materials	Standard bricks can be used. ✓ Stock bricks can be used. Cheaper bricks. (Any one)	Moulded bricks. ✓ Wedge shaped bricks(voussoirs) Face Bricks can be cut into shape. More expensive bricks. (Any one)
Labour	Semi-skilled labour. ✓ Less time consuming. Must be plastered. (Any one)	Skilled labour. ✓ More time consuming. Must not be plastered (Any one)

ANY OTHER ACCEPTABLE ANSWER

(4)

- 2.5
- Tensile force ✓
 - Compressive force ✓
 - Shear force / lateral forces
- (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 2.6.1
- A – Steel capping/casing ✓
 - B – Undisturbed earth / unstable soil / soft soil ✓
 - C – Steel tip/steel drive point ✓
- (3)

- 2.6.2 A drop hammer ✓ (1)

- 2.6.3
- When the soil is not stable / soft /low density ✓
 - Water content of soil is high.
- (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 2.7.1 Main bars: To act against / counteract the tensile forces. ✓ (1)

- 2.7.2 Anchor bars: To act against the compression forces. ✓ (1)

- 2.7.3 Shear bars: To act against the shearing forces. ✓ (1)

- 2.7.4 Stirrups: To hold, bind or join the main bars together / Resist shear stress. ✓ (1)

2.8

- The wall needs to be cleaned. (chipping of the wall not acceptable)✓
 - Determine where to start tiling. ✓
 - Snap an additional line the width of a tile from each wall using a chalk. line./batten ✓
 - Mix the tile cement ✓
 - Water proofing the wall
 - Apply the tile cement
 - Place or press tiles into position, position spacers
 - Cut tiles where necessary
 - Insert edging on corners
 - Grout / remove excess grout
- (4)

ANY FOUR OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 2.9.1 Ridge capping/ridge/ ridge plate/ galvanised ridge ✓ (1)

- 2.9.2 To cover/seal the opening between the two galvanised roof sheets at the ridge. ✓ (1)
To prevent dust, rain and vermon to enter the roof.

- 2.9.3 Purlin ✓ 50 mm x 76 mm ✓ (2)

- 2.9.4 38 mm x 38 mm ✓ (1)

- 2.9.5 IBR or Corrugated galvanised roof sheeting /cement fibre sheets/Perspex sheet/ fibre glass/ metal sheeting.✓ (1)

2.9.6 King post (1)

2.10 Formwork can be described as a mould or a box/temporally support, ✓ which is prepared in situ into which fresh concrete can be poured to form the shape of the required structure/staircase// similar structures/ columns. ✓ (2)

OR ANY OTHER EXPLANATION MEANING THE SAME AS ABOVE

- 2.11
- Can be used repeatedly ✓
 - No colour differences between different castings of concrete ✓
 - Lasting longer /stronger
 - Not easily damaged (2)
 - Quicker to install and dismantle

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

2.12.1 Distance = (Top stage line reading – Bottom stage line reading) × 100
 = (1,535 – 1,485) ✓ × 100
 = 0,05 ✓ × 100 ✓
 = 5 ✓ m (4)
 OR

$$= (1,535 \checkmark - 1,485) \times 100 \checkmark$$

$$= 5 \text{ m } \checkmark \checkmark$$

Only the answer 2 marks

[40]

QUESTION 3: CIVIL SERVICES

3.1.1

- It is reliable under normal conditions. ✓
- It is relatively cheap. (Only capital expense is in sinking the borehole) ✓
- Water is good enough for human consumption if water is not contaminated.
- It is independent from municipal supply.
- You will have your own water supply.
- There is no restriction on the use of water from boreholes.
- It saves money.
- It can add value to your property.
- Easy to use.
- Possible better taste/cleaner water.

(2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

3.1.2

- The pump can be stolen ✓
- The pump can break ✓
- The pipes can get clogged and takes time to be cleaned.
- Water can become contaminated.
- Electric cables can be stolen/power outages.
- Draught/ water table.
- Reliable water.

(2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 3.2 It reduces the incoming water supply with too high pressure to an acceptable pressure value. ✓
It forwards a constant pressure into the installation. ✓
It regulates the water pressure entering the geyser /makes it possible to open two hot water taps at the same time without the pressure dropping.

(2)

ANY OTHER ACCEPTABLE ANSWER

- 3.3.1 Any setting between 30°C and 70°C (centigrade) is acceptable ✓ (1)

- 3.3.2 Element ✓ (1)

- 3.4.1
- The system should be installed in a manner so that enough space is left for maintenance and repair work. ✓
 - All pipe joints must be leak free. ✓
 - Gas pipes leading to the system should be flexible to ease installation. ✓
 - The system must have a cut off valve and a drain valve to cut off gas in case of an emergency.
 - Gas cylinder should be placed outside on a concrete slab.
 - A safety sign “No open flames” should be visible at the gas cylinder.
 - If the gas cylinder have to be on the inside of the room, it should be well ventilated.
 - Gas pipes should never be chased into a brick wall.
 - Gas pipes should pass through a steel tube through the exterior wall.
 - Should be installed out of reach of children.

- Must be installed according to laws and municipal regulations. (3)
- Must be installed by a qualified person.
- Not installed near flammable materials.
- Must be installed in rooms larger than 20 square meters.

ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 3.4.2
- Does not use electricity ✓ (2)
 - Water is rapidly heated ✓
 - Hot water available all the time as long as there is gas, even during electricity outages / failure.
 - Running/Maintenance cost is cheaper.

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 3.5.1 Prepaid electrical meter/ electrical meter ✓ (1)
- 3.5.2 To punch in the prepaid voucher number. ✓
To punch in the number on your slip. (1)
To punch in the number/ code.

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 3.5.3 An electrician /municipality ✓ (1)
- 3.5.4 Install in the kitchen or in the passage or can also be installed outside the house in the meter box. ✓ (2)
To monitor and manage electricity consumption. ✓
Open-ended
- 3.5.5 Against the wall, ✓ so that it can be monitored easily ✓ or (2)
In a cupboard, so that it is not visible for esthetic purposes.
Open-ended

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 3.6 Conduits are used as sleeves for electrical wiring ✓ or (1)
Conduits protect wires against damage by rodents.

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 3.7 Chased conduits are placed in channels that are chased into the wall or floor. ✓
Chased conduits are plastered into the channels and are not visible.

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- Surface mounted conduits are fitted on to the surface of the walls and secured with saddle clamps. ✓ (2)
Surface mounted conduits are visible.

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

3.8.1 INVERT LEVEL AT A: = Ground cover + Pipe diameter
= 340 mm ✓ + 110 mm ✓
= 450 mm ✓ (3)

INVERT LEVEL AT B: = Invert level at A +(distance x slope)
= 450 mm ✓ + (40 000 x 1 ÷ 40) ✓
= 450 mm + 1 000 mm
= 1 450 mm ✓ (3)

3.8.2 Rodding eye/ manhole ✓ (1)
[30]

QUESTION 4 QUANTITIES AND CALCULATIONS AND JOINING

- 4.1 Truss hanger ✓
 Roof wire / hoop iron ✓
 Galvanised strips / straps
 Galvanised steel ribbon (2)
 Bolt and clamp
 Rawl bolts

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWERS

- 4.2 Rawl bolt ✓ (1)
 To fasten gates / brackets onto brickwork, concrete ✓ (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWERS

- 4.3.1 Soldered together/capillary ✓
 Compression joint (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 4.3.2 Threaded joints /fittings ✓ (1)

- 4.4.1 Used to attach materials on to concrete or brick wall. ✓ (1)

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 4.4.2 Used in cabinet making ✓
 Fixing quarter rounds and mouldings ✓
 Built-in cupboards/ knotty pine ceilings (1)
 Window beads/ beadings/picture frames

ANY ONE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

- 4.5 Screws takes longer to drive in ✓ but has a greater holding power ✓
 Nail are quicker to install it has not got the same holding power (2)

OR ANY OTHER ACCEPTABLE ANSWER

- 4.6
- Component / description/ item/ part ✓
 - Number / quantity ✓
 - Unit
 - Length/dimensions
 - Breadth
 - Thickness
 - Sub-total
 - Total
 - Material (2)

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER

ANSWER SHEET 4.7 / ANTWOORDBLAD 4.7

4.7

A	B	C	D
			Centre line: Superstructure
			2/ 6 000 mm = 12 000 mm
			2/ 3 500 mm = <u>7 000 mm</u>
			TOTAL: = 19 000 mm
			Minus 4/ 220 = <u>880 mm</u>
			= 18 120 mm $\checkmark\checkmark$
			Centre line = 18,12 m
1/	18,12 \checkmark		Area of wall for superstructure
	<u>2,6</u> \checkmark	47,11 \checkmark	
1/	2 \checkmark		Area of side door
	<u>0,8</u> \checkmark	1,6 m ² \checkmark	
1/	2,4 \checkmark		Area of garage door
	<u>2,1</u> \checkmark	5,04 m ² \checkmark	
1/	1,5 \checkmark		Area of window
	<u>0,9</u> \checkmark	1,35 m ² \checkmark	
			Total area of wall after deductions
			= 47,11 m ² - 1,6 m ² - 5,04 - 1,35
			= 39,12 m ² \checkmark
2/	39,12 \checkmark		
	<u>50</u> \checkmark	3 912 \checkmark	3 912 bricks will be needed for the superstructure
	OR		
1/	39,12		
	<u>100</u>	3 912	3 912 bricks will be needed for the superstructure
			(18)
When answers are done in wrong columns it must be marked and learner penalised with 2 marks			

[30]

QUESTION 5: APPLIED MECHANICS**5.1 ANSWER SHEET 5.1**

$$\begin{aligned} \text{Total Area} &= 900 \text{ mm}^2 + 3\,300 \text{ mm}^2 - 450 \text{ mm}^2 \\ &= 3\,750 \text{ mm}^2 \end{aligned}$$

$$\begin{aligned} \text{Position of centroid from A - A} &= \frac{(A_1 \times d) + (A_2 \times d) - (A_3 \times d)}{\text{Total area}} \\ &= \frac{(900 \times 20) + (3\,300 \times 30) - (450 \times 50)}{3\,750} \\ &= \frac{18\,000 + 99\,000 - 22\,500}{3\,750} \\ &= \frac{94\,500 \text{ mm}^3}{3\,750 \text{ mm}^2} \\ &= 25,2 \text{ mm} \end{aligned}$$

OR

Take moments around A on Y –axis

$$\begin{aligned} 3\,750 \text{ mm}^2 \times Y &= (900 \times 20) + (3\,300 \times 30) - (450 \times 50) \\ 3\,750 \text{ mm}^2 \times Y &= 117\,000 - 22\,500 \\ 3\,750 \text{ mm} & \\ &= \frac{94\,500 \text{ mm}^3}{3\,750 \text{ mm}^2} \\ &= 25,2 \text{ mm} \end{aligned}$$

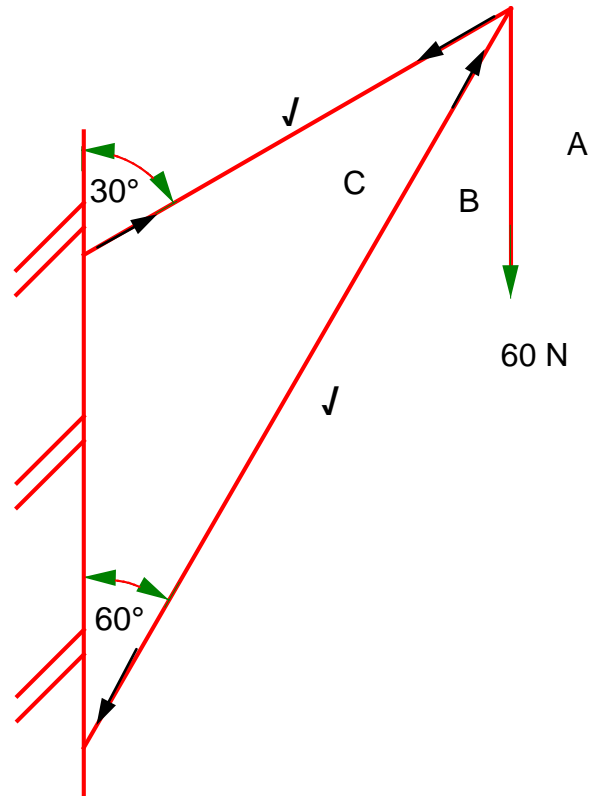
OR

Part	AREA (A)	X	AREA OF X (Ax)
Right-angled triangle	900 mm ²	$\frac{h}{3} = \frac{60}{3} = 20 \text{ mm}$	18 000 mm ³
Rectangle	3 300 mm ²	$\frac{b}{2} = \frac{60}{2} = 30 \text{ mm}$	99 000 mm ³
Isosceles triangle	450 mm ²	$\frac{h}{3} = \frac{30}{3} = 10 \text{ mm}$ C = 60 - 10 = 50 mm OR C = 30 + 20 = 50 mm	- 22 500 mm ³
Σ	3 750 mm ²		94 500 mm ³

$$\begin{aligned} &\frac{\Sigma AX}{\Sigma A} \\ &= \frac{94\,500 \text{ mm}^3}{3\,750 \text{ mm}^2} \\ &= 25,2 \text{ mm} \end{aligned}$$

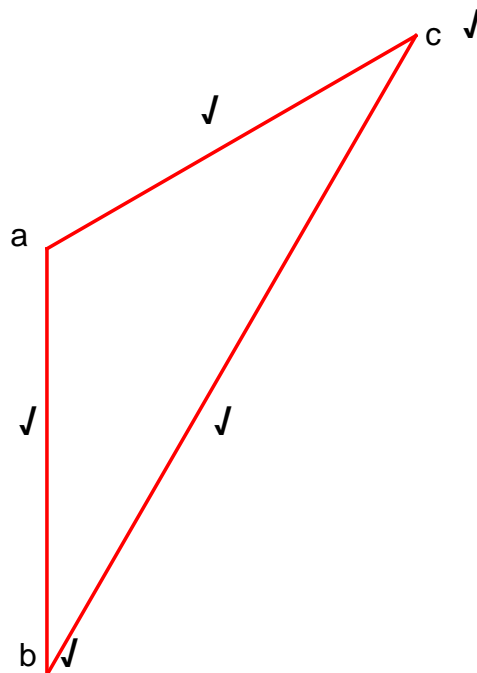
(7)

5.2



(2)

SPACE DIAGRAM
Nature of forces BC and AC = 2 marks



(5)

VECTOR DIAGRAM
NOT ACCORDING TO SCALE

USE A MASK TO MARK THIS QUESTION

MEMBER	NATURE	MAGNITUDE
BC	Strut ✓	104 N ✓
CA	Tie ✓	60 N ✓

Tolerance of 1 N to either side

(4)

5.3

$$5.3.1 \quad 20 \text{ N } \downarrow \quad (1)$$

$$5.3.2 \quad 5 \downarrow \text{ m} \quad (1)$$

$$5.3.3 \quad \text{SFd (4 meters from A)} = \text{left reaction force} - \text{uniformly distributed load} - \text{point load b}$$

$$= 17,5 \text{ N } \downarrow - 20 \text{ N } \downarrow - 10 \text{ N } \downarrow$$

$$\text{OR} \quad (3)$$

$$= 17,5 \downarrow - 30 \downarrow \downarrow$$

$$= -12,5 \text{ N}$$

$$\text{SFe (8 meters from A)} = \text{left reaction force} - \text{uniformly distributed load} - \text{point load b} - \text{point load c} - \text{point load d} + \text{RR} \quad (3)$$

$$= 17,5 \text{ N} - 20 \text{ N} - 10 \text{ N} - 5 \text{ N} + 17,5 \text{ N} \downarrow \downarrow \downarrow$$

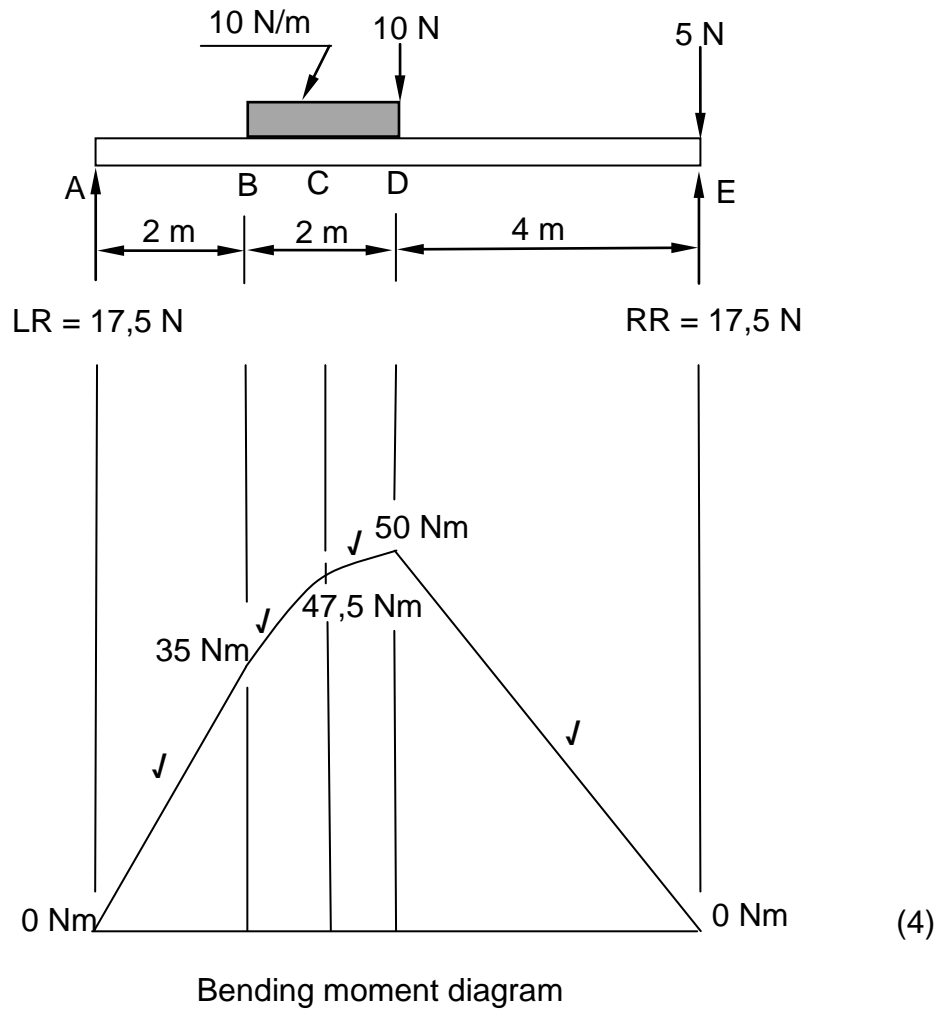
$$= 0 \text{ N}$$

$$\text{OR}$$

$$= -12,5 \text{ N} - 5 \text{ N} + 17,5 \text{ N}$$

$$= 0 \text{ N}$$

5.3.4




Marks are given for lines in 5.3.4 incorrect scale -1.

[30]

CENTRE NUMBER:									
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EXAMINATION NUMBER														
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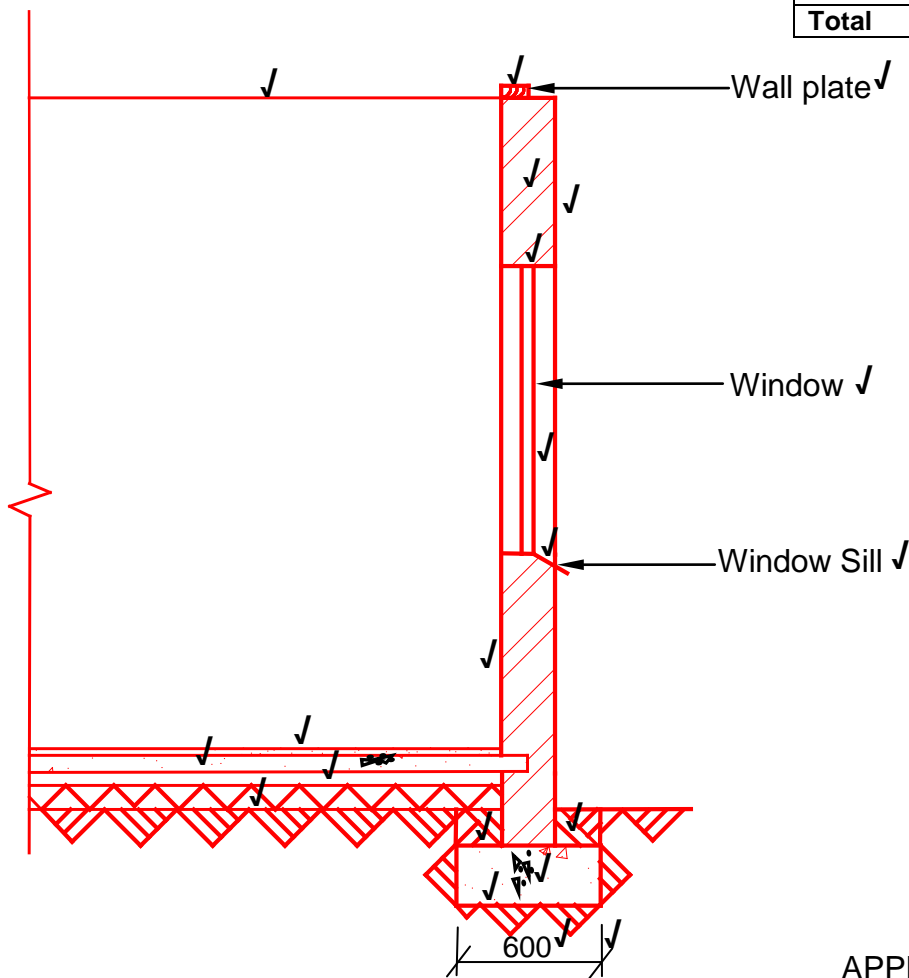
ANSWER SHEET 6.1

NO.	QUESTIONS	ANSWERS	MARKS
1	Identify number 1.	Shower	1
2	Calculate the perimeter of the building.	30 200 mm / 30,2 m	1
3	Draw the symbol for the gully.		1
4	What is the thickness of the inner walls?	110 mm	1
5	Calculate the total area of the house in m ² .	56,0 m ²	2
6	Describe the purpose of number 2.	To wash hands, face and your body	1
7	Give the abbreviation for number 3.	WC	1
8	Identify number 4.	Single sink/ sink	1
9	Identify number 5.	Sliding door	1
10	Name the type of roof of the house.	Gable roof	1
11	Identify the electrical symbol at 6.	Distribution board	1
12	Identify number 7.	Socket outlet / Wall plug Power point	1
13	On which elevations will the gutters be placed in this house?	North and South (Show both for one mark)	1
14	Identify number 8.	Single-pole one-way light switch	1
		Total	15

QUESTION 6: GRAPHICS AND COMMUNICATION

**ANSWER SHEET 6.2
QUESTION 6.2**

Aspect	Marks	Learners mark
Correctness of substructure	6	
Correctness of super-structure	7	
Correctness of any three drawing symbols	3	
Printing of any three labels	3	
Dimension and dimension lines	2	
Print the scale	1	
Application of scale One or two incorrect = 3 Three or four incorrect = 2 More than five incorrect = 1 No measurement correct = 0	3	
Total	25	



SCALE 1:20 ✓

APPLICATION OF SCALE ✓✓✓

**NOT TO SCALE: USE A MASK TO MARK THIS QUESTION
FLOOR ON WRONG SIDE: -1 MARK**

[40]

TOTAL : 200