basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

CIVIL TECHNOLOGY

EXEMPLAR 2014

MEMORANDUM

MARKS: 200

This memorandum consists of 15 pages.

QUESTION 1: CONSTRUCTION, SAFETY AND MATERIAL

1.1 1.1.1

A
- Direction of escape route ✓
- Emergency escape

B
- Face protection ✓

C
- Fire and open flames prohibited ✓
- No lighting of matches

(Any ONE of the above or any other acceptable answer) (3)

1.1.2

A
- Workshop, hotels, hospital ✓

B
- Grinding, working with a jackhammers ✓
- Spraying toxic chemicals
- Protection against flying debris

C
- Where flammable gasses and liquids are stored ✓
- Outside stores for petrol and oils

(Any ONE of the above or any other acceptable answer) (3)

1.2 1.2.1 Segregation is the separation of aggregates, such as stone, sand and cement due to transporting of fresh concrete on rough roads. ✓

(Or any other acceptable answer) (1)

1.2.2 A slump is the distance between the top of the concrete and the underside of the straight edge which rests across the top of the mould after a slump test is conducted. ✓

(Or any other acceptable answer) (1)

1.2.3 Compaction is the process of removing trapped air in concrete to make the concrete more dense and strong. ✓

(Or any other acceptable answer) (1)

1.3 1.3.1
- Bags of cement should be stored in a dry place. ✓
- It must be stored on wooden beams. ✓
- It must be covered with plastic sheets or steel plates.
- It must not come into contact with water.

(Any TWO of the above or other acceptable answer) (2)

1.3.2 Cement causes skin disorders and chemical burns. ✓ (1)

1.3.3 Provide them with a dust mask. ✓ (1)

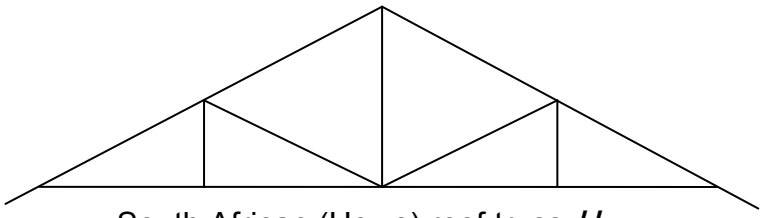
1.4
- Tools should always be in good working order. ✓
- Ensure that all cutting edges of tools are sharp. ✓
- Carry tools that have sharp blades with the blade facing the ground so that others may not be injured. ✓
- Work with sharp parts of tools away from your body.
- Use tools only for purposes for which they were designed.
- Service and maintain tools regularly.
- Work only in well-lit areas.
- Report any defective tools immediately.
- Follow the safety rules of the manufacturer of the tools.

(Any THREE of the above or other acceptable answer) (3)

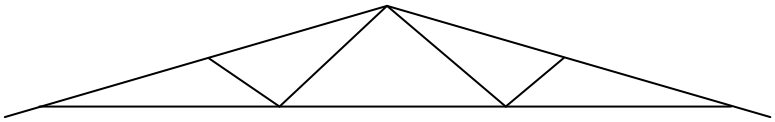
1.5
- Use latex gloves.
- Treat wound with disinfectant. ✓
- Apply direct pressure on the wound with a pad. ✓
- Cover wound with sterile dressings.
- Do not touch blood with bare hands.
- Dress with bandages.

(Any TWO of the above or other acceptable answer) (2)

1.6



South African (Howe) roof truss ✓✓



W (Fink) roof truss ✓✓

(4)

1.7
- Bricks ✓
- Tiles ✓
- Concrete

(Any TWO of the above or other acceptable answer) (2)

1.8 150 mm to 170 mm ✓ (1)

1.9 A – Frame head ✓
B – Rebate/Horn ✓
C – Window stile/Casement stile ✓
D – Glazing bar ✓
E – Bottom rail of casement ✓ (5)

[30]

QUESTION 2: ADVANCED CONSTRUCTION AND EQUIPMENT

2.1 2.1.1 A – Preformed/precast concrete pile. ✓ (1)
B – Cable. ✓ (1)
C – Sledgehammer/drop hammer. (1)

2.1.2
- Unstable, soft soil or loose soil✓
- Non-adhesive soil ✓
- Where there is ground movement
- Soil that is constantly wet

(Any TWO of the above or other acceptable answer) (2)

2.2

CRITERIA	STRIP FOUNDATION	PILE FOUNDATION
Advantage	Cheap/quicker/no special machines required. ✓	Solution for foundations on unstable soil/less chance of foundation collapsing ✓
Equipment used for digging of foundation	Trenches are dug by workers using shovels and picks or mechanical diggers. ✓	Pile holes are drilled into the earth with an auger type bit or drill. ✓ Mechanical driven auger drill ✓

(4)

2.3 2.3.1 Setting out the template to make the truss./Testing members for squareness. ✓
(Or any other acceptable answer) (1)

2.3.2 Heavy nailwork/extract of nails/Hammering in of nails.✓
(Or any other acceptable answer) (1)

2.4 A – Round bar/mild steel rod ✓ (1)
B – Ribbed bar/high tensile steel ✓ (1)

2.5 A **rough arch** is built using standard, common bricks where wedge-shaped mortar joints form the shape of the arch. These types of arches will be completely plastered. ✓
Gauged arches are built with face bricks or voussoirs that are tapered on both sides before they are used in the arch. These types of arches will not be plastered. The mortar joints are jointed ✓

(Or any other acceptable answer) (2)

2.6 2.6.1 C – Apply gypsum plaster to joints first. ✓
E – Apply self-adhesive gauze to cover equal area on either side of the joints. ✓
A – Apply a second layer of gypsum plaster on top of the self-adhesive gauze. ✓
D – Apply thin final coat of gypsum plaster and let dry. ✓
B – When the joint is dry, sand lightly with fine sandpaper. ✓ (5)

2.6.2
- Dry wall construction is quicker to build. ✓
- It is cheaper to build. ✓
- It is lighter than brick or block walls.

(Any TWO of the above or other acceptable answer) (2)

2.7
- Humidity negatively influences the safety of the entire structure. ✓
- The health of occupants can be negatively affected. ✓
- The furniture can be affected. ✓
- Paintwork can be affected.

(Any THREE of the above or other acceptable answer) (3)

2.8
- The right concrete mix ratio not used. ✓
- The right curing process not followed. ✓
- If the main bars and stirrups is not the right diameter. ✓
- The stirrups/binders not used correctly.
- Insufficient reinforcement
- Binders not spaced correctly

(Any THREE of the above or other acceptable answer) (3)

2.9 2.9.1
A – Steel mat/Reinforcing mesh/Reinforcing bars ✓
B – Reinforcement in ribs ✓
C – Hollow-core concrete blocks ✓
D – Pre-stressed concrete ribs ✓
E – Bearer joist ✓
F – Props/post/pole ✓ (6)

2.9.2
E – To make sure that the ribs and blocks are level.
To prevent the ribs from bending along the span. ✓ (1)
F – To keep the joist and bearer propped up.
It also prevents any bouncing of the material ✓ (1)

(Or any other acceptable answer)

2.9.3 Rib and block construction (1)

2.9.4
- Units are cast in exact shapes and exposed to thorough curing and testing. ✓
- Inflatable foam rubber, plastic-centred rib moulds are used during shaping process. ✓
- This reduces cost and weight. ✓
- Lightweight components require less support during construction. ✓
- The ceiling is ready to be plastered.
- Reinforcement can be inserted during construction.
- High-pressure pumps and vibrators can be used to force concrete into the openings and passages
- Materials are cost-effective

- Excellent structural integrity.
- Easy set-up procedures save time.
- No skilled labour is needed.
- Improved sound and temperature insulation.
- Require minimal formwork.
- Quality plastered soffits (no joints).
- Units reduce the volume of concrete needed.

(Any FOUR of the above or other acceptable answer) (3)
[40]

QUESTION 3: CIVIL SERVICES

3.1

ADVANTAGES	DISADVANTAGES
a) Can be used for cold and hot water. ✓	a) Heavy. ✓
b) Durable ✓.	b) Not easy to work with, screw tread must be cut on both sides✓.
c) Low maintenance. ✓	c) Can rust if acid content of soil is high and placed under water. ✓

(Or any other acceptable answer) (6)

3.2 3.2.1 Manhole at a junction. ✓ (1)

3.2.2 From B and C towards A. ✓ (1)

3.2.3 It is open so that a rod can be used to enter the sewer line in order to get rid of blockages. √
NOTE: It can also be closed if a junction access is used. (1)

3.2.4 Where branch pipes connect to main sewer pipe.✓ (1)

3.2.5 25 metres ✓ (1)

3.2.6 Rodding eye ✓ (1)

3.3 3.3.1 IL ✓ (1)

3.3.2 VP ✓ (1)

3.3.3 DB ✓ (1)

3.4

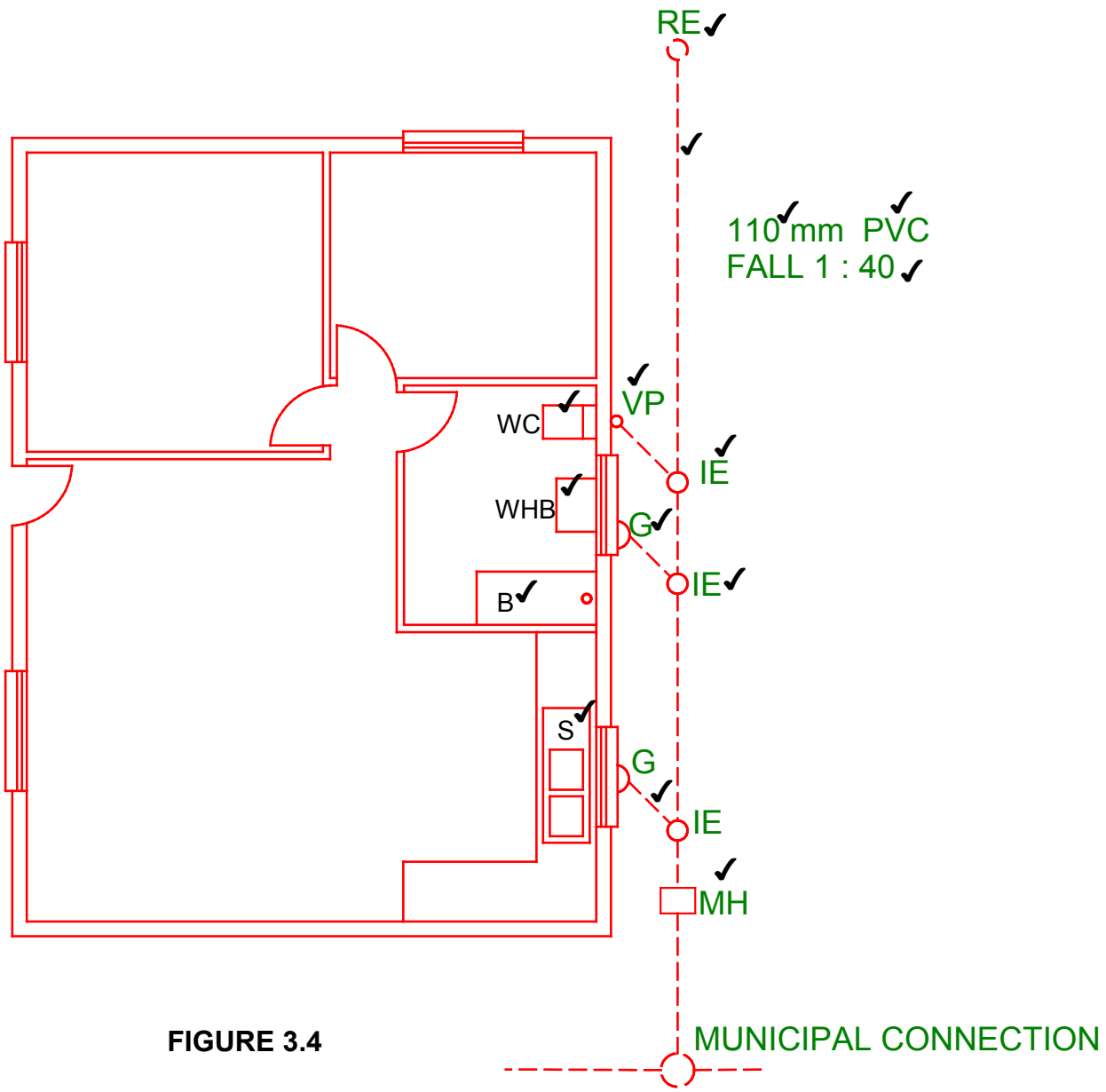


FIGURE 3.4

Line type	1	
Connection angle	1	
Pipe material/gradient	3	
Rodding eye	1	
Gully	1	
Vent pipe	1	
Manhole	1	
Inspection eye	2	
Hand washbasin	1	
Water closet	1	
Sink	1	
Bath	1	
TOTAL	**15**	

(15)
[30]

QUESTION 4: QUANTITIES AND CALCULATIONS AND JOINING

4.1
4.1.1

A Multiply	**B** Dimension per Item	**C** Answer	**D** Description
			Total area of wall
1/	6 ✓		
	2,7✓		
		16,2 m² ✓	(3)

4.1.2

			Area of Window 1
1/	1,2 ✓		
	1,5 ✓		
		1,8 m² ✓	(3)

4.1.3

			Area of Door 1
1/	2,0 ✓		
	0,9 ✓		
		1,8 m² ✓	(3)

4.1.4

			Total area of wall, excluding the window and door
1/	16,2 ✓		
	-3,6 ✓		
		12,6 m² ✓	(3)

4.1.5

			Total number of bricks, including 5% for wastage
1/	12,6		
	110		
		1 386 ✓	1 386 bricks
			+ 5% of 1 386 = 69,3 or 70 bricks ✓
			1 386 + 70 = 1 456 bricks ✓ (3)

4.2 4.2.1 Capillary joint – solder is used to keep the pipes from moving apart. ✓
Compression joint – ferrule and cup nut will keep the pipes from moving apart. ✓ (2)

4.2.2 Monkey wrench. ✓
Adjustable spanner (Shifting)/open-end spanner correct size. ✓ (2)

4.3
- Hammer fix nylon anchor. ✓
- Universal plug. ✓
- Wall plug. ✓ (2)

4.4
- The cube must first be cleaned. ✓
- Apply a layer of mould oil on the inside of the cube. ✓
- The concrete should be placed in the form in layers of 50 mm. ✓
- Each layer must be tamped 38–45 times with a tamping rod to get rid of all the air bubbles. ✓
- The last layer should be higher than the top of the cube form and is levelled with a steel trowel.

(Any FOUR of the above or other acceptable answer) (4)

4.5
- A slump test is carried out to determine the consistency and workability of the different batches of freshly mixed concrete for one single placing ✓
- To determine whether the ratio between water, sand and stone is correct

(Any one of the above) (1)

4.6 A – Used as beams in the building industry. ✓
B – Carports, steel roof trusses. ✓
C – Manufacturing of steel roof trusses, columns, pillars and bridges. ✓ (3)

4.7
- You can galvanise it. ✓
- It could be plated with zinc, chrome or brass.
- It can be painted.

(Any one of the above) (1)
[30]

QUESTION 5: APPLIED MECHANICS

5.1 ANSWER SHEET 5.1

Area of figure A1 (Square) = s x s
= 60 x 60
= 3 600 mm²

Area of figure A2 (Triangle) = ½ b x h
= ½ x 60 x 15
= 30 x 15
= 450 mm²

Total Area = 3 600 mm² + 450 mm²
= 4 050 mm²

Position of centroid from B on Y-axis = $\frac{(A1 \times d) + (A2 \times d)}{\text{Total area}}$

✓ ✓ ✓ ✓

= $\frac{(3\,600 \times 45) + (450 \times 10)}{4\,050\ mm^2}$ ✓

= $\frac{162\,000 + 4\,500}{4\,050\ mm^2}$ ✓

= $\frac{166\,500}{4\,050\ mm^2}$ ✓

= 41,11 ✓ mm ✓

Take moments around B on Y-axis

✓ ✓ ✓ ✓ ✓

4 050 mm² x X = (3 600 x 45) + (450 x 10)

4 050 mm² x X = 162 000 + 4 500

X = $\frac{166\,500\ mm^2}{4\,050\ mm^2}$ ✓ ✓

= 41,11 ✓ mm ✓

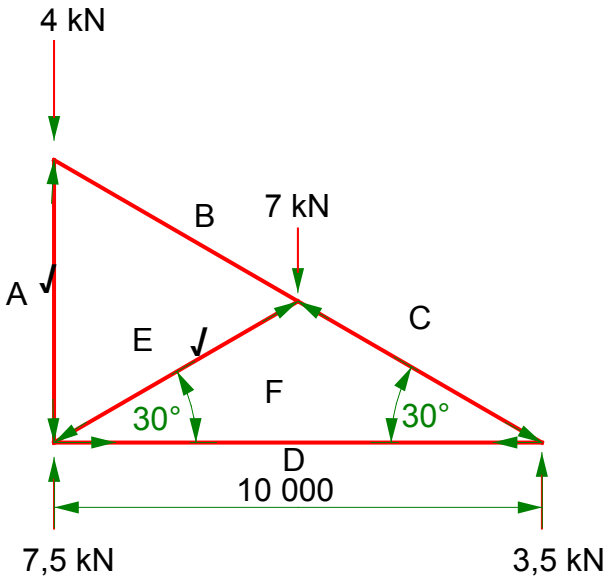
PART	AREA (A)	X	AREA OF X (Ax)
Square	3 600 mm² ✓	$\frac{S}{2} = \frac{60}{2} = 30 + 15 = 45$ ✓	162 500 mm²
Triangle	450 ✓	$\frac{h}{3} = \frac{15}{3} = 5 + 5 = 10$ ✓	4 500 mm²
Σ	4 050 mm² ✓		166 500 mm² ✓

$\frac{\Sigma AX}{\Sigma A}$

= $\frac{166\,500\ mm^3}{4\,050\ mm^2}$ ✓

= 41,11 ✓ mm ✓ (9)

5.2.3



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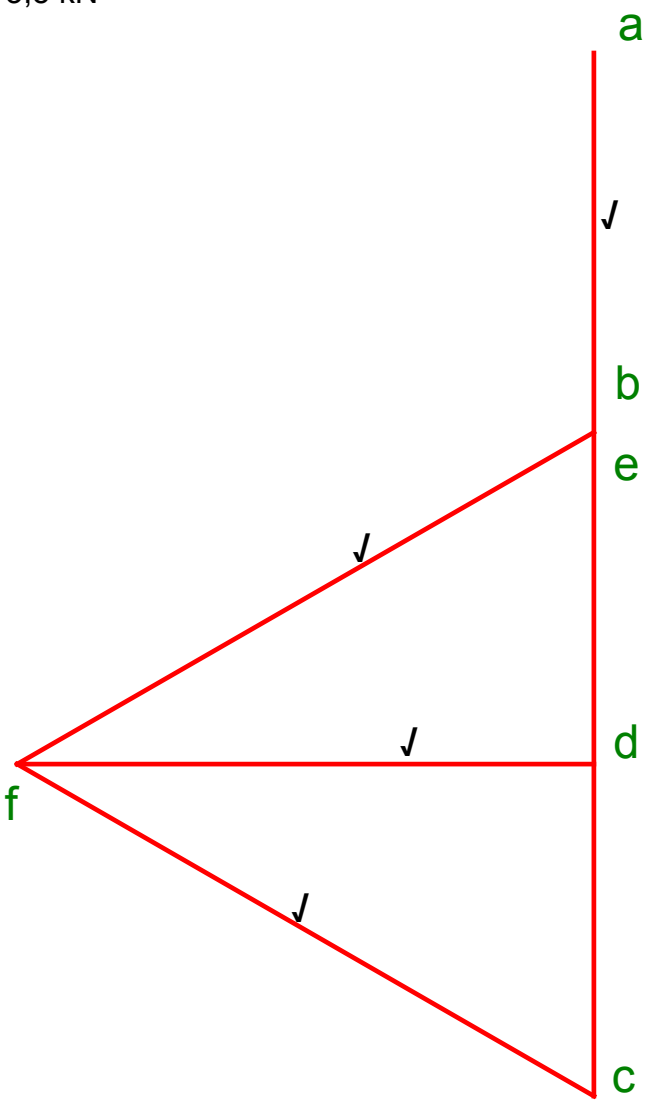
5.2.1



(4)

5.2.2

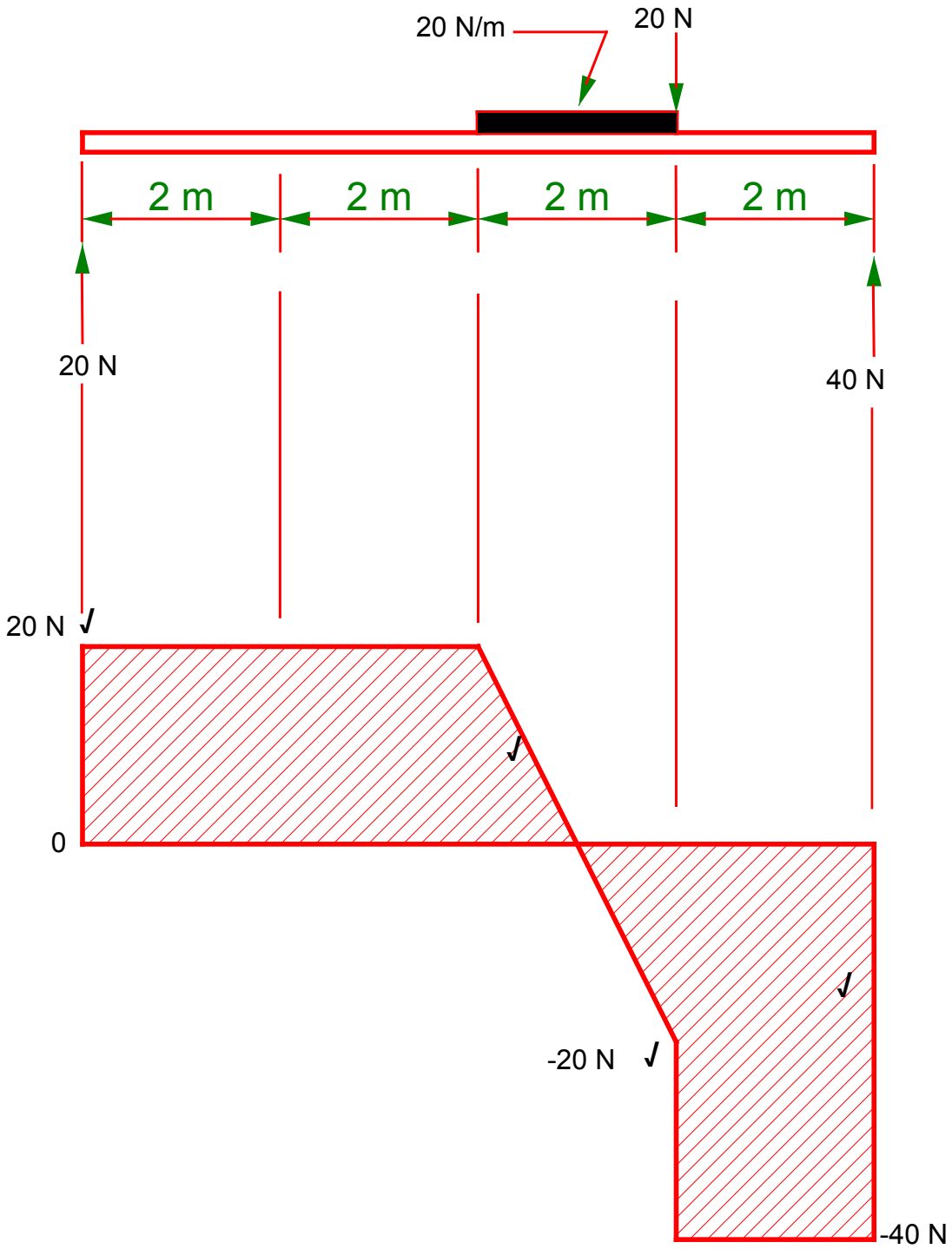
MEMBER	NATURE	MAGNITUDE OF FORCE
AE	Strut ✓	4 kN ✓
BE	---------	---------
CF	Strut	7 kN ✓
DF	Tie ✓	6,1 kN ✓
EF	Strut ✓	7 kN

(6)

5.3.1 SFa (0 metres from A) = left reaction force
= 20 N ✓
SFb (2 metres from A) = left reaction force – point load b
= 20 N – 0 N
= 20 N ✓
SFc (4 metres from A) = left reaction force – point load b – point load c
= 20 N – 0 N – 0 N
= 20 N ✓
SFe (6 metres from A) = left reaction force – point load b – point load c – uniformly distributed load d – point load e
= 20 N – 0 N – 0 N – 40 – 20 N
= - 40 N ✓
SFf (6 metres from A) = left reaction force – point load b – point load c – uniformly distributed load d – point load e + right reaction force
= 20 N – 0 N – 0 N – 40 – 20 N + 40
= 0 N ✓

(5)

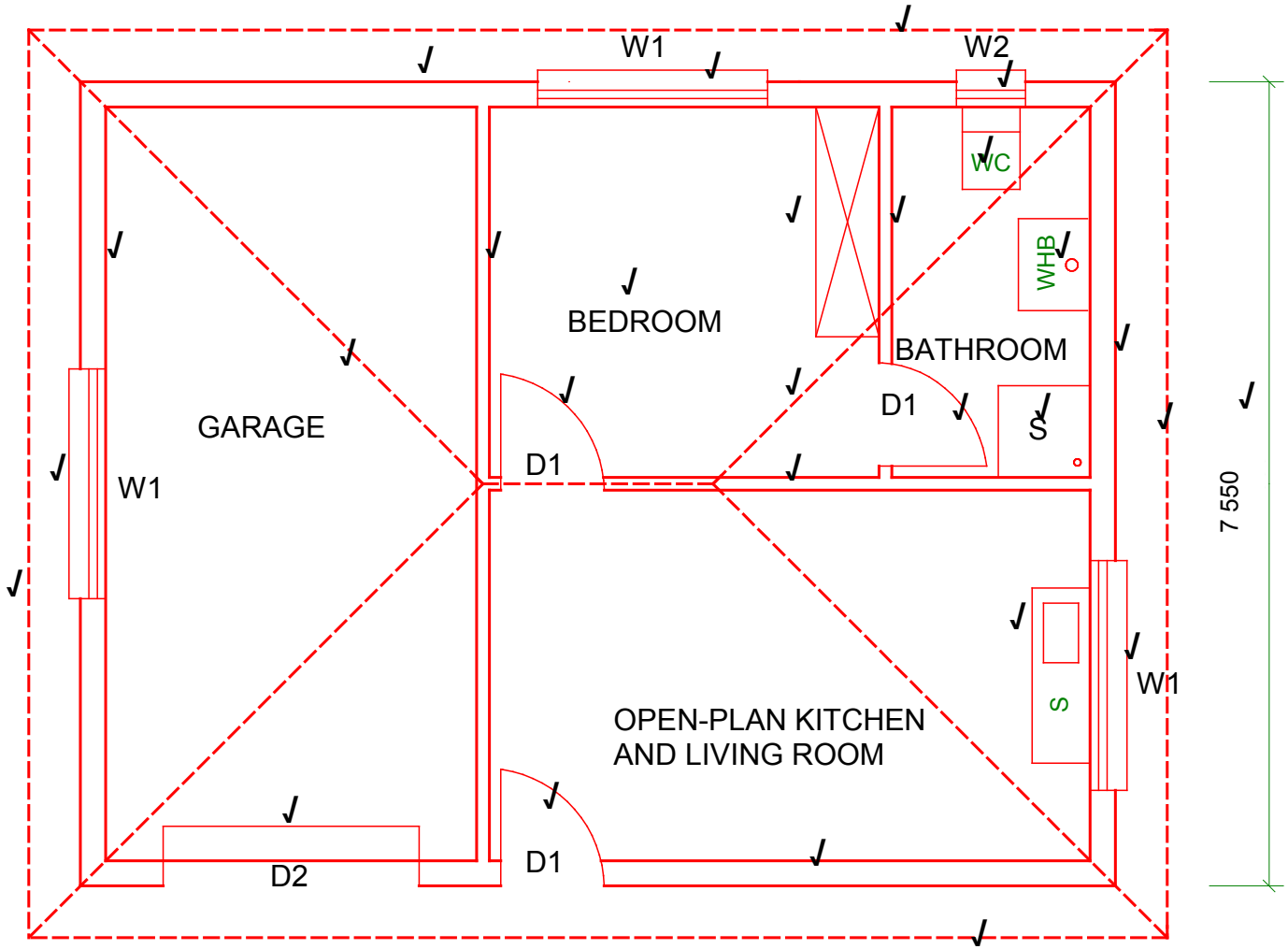
5.4



(4)
[30]

QUESTION 6: GRAPHIC COMMUNICATION

ANSWER SHEET 6.1



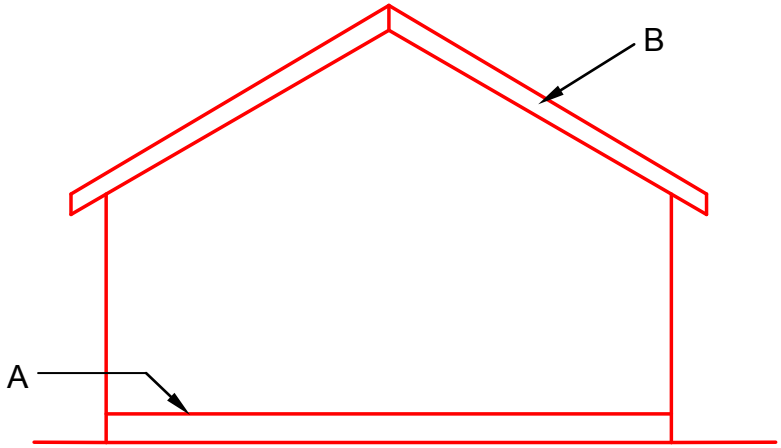
FLOOR PLAN

SCALE 1 : 50

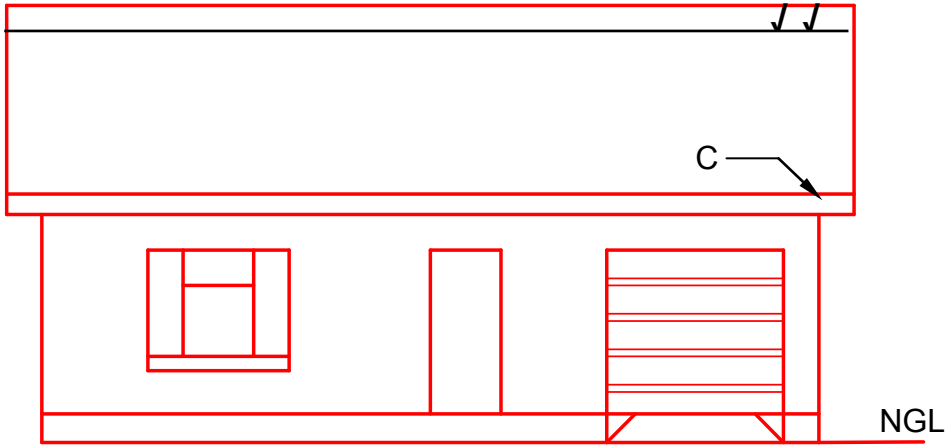
QUESTION	ASPECT	MARKS	
6.1.1	External walls	4	
	Internal walls	3	
6.1.2	Windows	4	
	Doors	4	
6.1.3	Built-in cupboard	1	
	Water closet	1	
	Shower	1	
	Washbasin	1	
	Sink	1	
6.1.4	Hipped roof	5	
6.1.5	Dimension	1	
6.1.6	Title	1	
	Scale	1	
	Accuracy	1	
	Neatness	1	
	TOTAL	**30**	

ANSWER SHEET 6.2

ROOF PITCH 30°



WEST ELEVATION



SOUTH ELEVATION

SCALE 1 : 100

	QUESTIONS	ANSWERS	
6.2.1	What type of roof is on the building?	Gable roof	1
6.2.2	What is the slope of the roof?	30°	1
6.2.3	What is indicated by **A** on the drawing?	Finished Floor Level	1
6.2.4	What is indicated by **B** on the drawing?	Barge board	1
6.2.5	Recommend a suitable finishing for the wall of the building.	Plaster and paint/face brick	2
6.2.6	What is indicated by **C** on the building?	Fascia board	1
6.2.7	What does the abbreviation *NGL* stand for?	Natural ground level	1
6.2.8	Use a pencil and draw, in proportion, the position of the ridge capping on the SOUTH ELEVATION.		2
		TOTAL	**10**

[40]
TOTAL: 200