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Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

CIVIL TECHNOLOGY: CONSTRUCTION

NOVEMBER 2023

MARKS: 200

TIME: 3 hours

This question paper consists of 14 pages and 7 answer sheets.

REQUIREMENTS:

1. Drawing instruments
2. A non-programmable calculator
3. ANSWER BOOK

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SIX questions.
2. Answer ALL the questions.
3. Read ALL the questions carefully.
4. Answer each question as a whole. Do NOT separate subsections of questions.
5. Number the answers correctly according to the numbering system used in this question paper.
6. Start the answer to EACH question on a NEW page.
7. Do NOT write in the margins of the ANSWER BOOK.
8. You may use sketches to illustrate your answers.
9. Write ALL calculations and answers in the ANSWER BOOK or on the attached ANSWER SHEETS.
10. Use the mark allocation as a guide to the length of your answers.
11. Make drawings and sketches in pencil, fully dimensioned and neatly finished off with descriptive titles and notes to conform to the *SANS/SABS Code of Practice for Building Drawings*.
12. For the purpose of this question paper, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
13. Use your own discretion where dimensions and/or details have been omitted.
14. Answer QUESTIONS 2, 3.5, 3.6, 4.7, 5.8, 6.3 and 6.5 on the attached ANSWER SHEETS using drawing instruments, where necessary.
15. Write your CENTRE NUMBER and EXAMINATION NUMBER on every ANSWER SHEET and hand them in with your ANSWER BOOK, whether you have used them or not.
16. Drawings in the question paper are NOT to scale due to electronic transfer.
17. Google Images was used as the source of all photographs and pictures.
18. Write neatly and legibly.

QUESTION 1: OHSA, MATERIALS, TOOLS, EQUIPMENT AND JOINING (GENERIC)

Start this question on a NEW page.

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1.1 to 1.1.12) in the ANSWER BOOK, e.g. 1.1.13 D.

1.1.1 Electroplating is the process of ...

- A applying a plastic coating on metal using electrolysis.
- B coating a metal with another metal using electrolysis.
- C applying paint to a metal by means of magnetism.
- D applying liquid zinc to a metal using pressure.

(1)

1.1.2 The process of keeping freshly cast concrete damp will ...

- A provide concrete with more volume.
- B make concrete more watertight.
- C increase the risk of cracking concrete.
- D lead to poor bonding of concrete.

(1)

1.1.3 Why would you coat a metal with a layer of paint?

- A To resist extreme temperatures
- B To prevent corrosion
- C To prevent warping
- D Only A and B

(1)

1.1.4 The minimum size of a wooden scaffold plank:

- A 300 mm wide x 60 mm thick
- B 238 mm wide x 12 mm thick
- C 150 mm wide x 20 mm thick
- D 228 mm wide x 38 mm thick

(1)

1.1.5 When using a scaffold, it must be inspected to ensure that ...

- A the scaffold is not attached to the building.
- B the scaffold platform is supported every 4 m.
- C the scaffold is free from any defects.
- D All the above-mentioned

(1)

1.1.6 ... of scaffolds should be secured vertically.

- A Transoms
- B Diagonal braces
- C Standards
- D Base plates

(1)

- 1.1.7 The guard rail on a scaffold will ensure that ...
A a worker does not fall from the scaffold.
B tools do not fall from the scaffold.
C the scaffold is stable.
D the scaffold is braced. (1)
- 1.1.8 Toe boards must be at least 150 mm high from the level of the ...
A scaffold platform.
B guard rail.
C horizontal transoms.
D base plate. (1)
- 1.1.9 The employer must ensure that the rungs of wooden ladders are ...
A not painted.
B free from grease.
C not cracked.
D All the above-mentioned (1)
- 1.1.10 The material safety data sheet for hazardous chemicals must have the following information:
A Quantity in the container
B Cost of the chemicals
C Disposal considerations
D Manufacturing process (1)
- 1.1.11 Stairways must be installed at a minimum of ... degrees from the horizontal.
A 50
B 30
C 40
D 60 (1)
- 1.1.12 The purpose of the builder's hoist is to transport ...
A workers and materials.
B materials and heavy construction machines.
C equipment and heavy machines.
D materials and furniture. (1)

- 1.2 You have been tasked by a contractor to install a 20 kg gate to the pier of a boundary wall.
- 1.2.1 Name the joining fixture you will use to secure the gate to the pier. (1)
- 1.2.2 Motivate why you will use this joining fixture. (2)
- 1.2.3 Explain how you will install the gate by using the joining fixture in QUESTION 1.2.1, if the positions of the holes have been marked on the pier. (3)
- 1.3 Predict what will happen if a laser level is stored in extremely cold areas. (1)
- 1.4 How will you ensure the accuracy of a dumpy level? (1)
- [20]**

QUESTION 2: GRAPHICS AS MEANS OF COMMUNICATION (GENERIC)

Start this question on a NEW page.

FIGURE A and FIGURE B on the next page show drawings that appear on a building plan. Analyse the drawings and complete the table on ANSWER SHEET 2.

QUESTION 3: ROOFS, STAIRCASES AND JOINING (SPECIFIC)

Start this question on a NEW page.

3.1 Cast-in anchors are used to join steel sections to concrete. Draw in your ANSWER BOOK neat two-dimensional drawings of the following cast-in anchors showing the sectional views through the concrete:

3.1.1 The L-bolt cast-in anchor (4)

3.1.2 A welded headed stud cast-in anchor (4)

3.2 FIGURE 3.2 below shows a staircase with some incorrect labels.

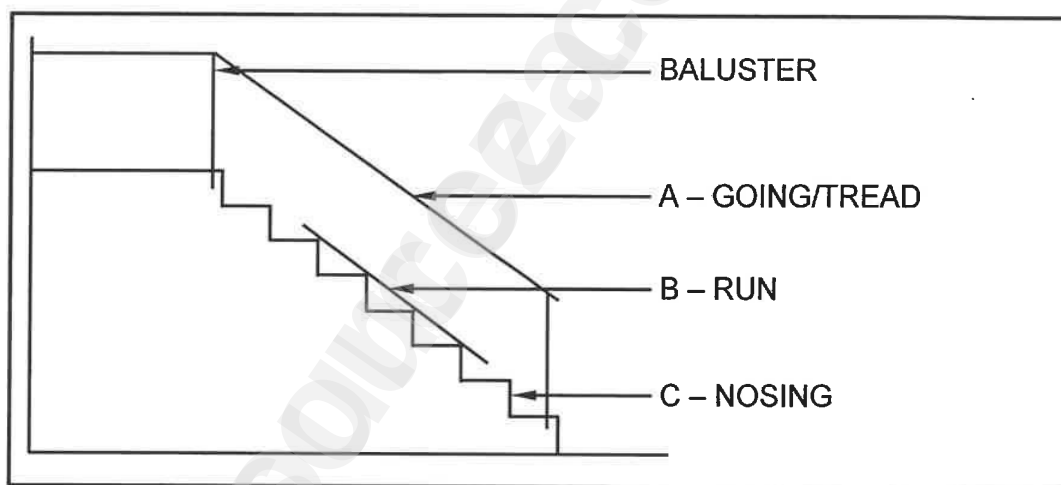


FIGURE 3.2

3.2.1 Give the correct labels for A to C. (3)

3.2.2 Explain the term *stairwell* of a staircase. (1)

3.3 Explain why roof trusses are spaced closer together for concrete roof tiles and further apart for corrugated iron sheets. (2)

3.4 Differentiate between a *couple roof* and a *close-coupled roof* with reference to the maximum span of the roofs. (2)

3.5 Use ANSWER SHEET 3.5 and draw to scale 1 : 5 the ridge construction of a couple roof truss.

Use the following specifications:

- 114 x 38 mm timber
 - 228 x 38 mm timber
- (6)

3.6 Use ANSWER SHEET 3.6 and draw to scale 1 : 50 a roof truss for a lean-to roof. The external lines of the brick walls are shown on the ANSWER SHEET.

Use the following specifications:

- The parapet wall on the left extends 300 mm above the top of the roof truss.
- The overhang is 250 mm.
- The roof truss is constructed of 114 x 38 mm timber.

(8)
[30]

QUESTION 4: EXCAVATIONS, FORMWORK, TOOLS, EQUIPMENT AND MATERIALS (SPECIFIC)

Start this question on a NEW page.

4.1 Change the underlined word(s) in the following to make the statements TRUE. Write only the appropriate word(s) next to the question numbers (4.1.1 to 4.1.5) in the ANSWER BOOK.

- 4.1.1 When operating a power float, do not place your arms near the moving parts. (1)
- 4.1.2 Operate the plate compactor with care and check the base plate for proper response before use. (1)
- 4.1.3 All construction machines must be stored in a safe, elevated place. (1)
- 4.1.4 When compacting fresh concrete, a power trowel float is used. (1)
- 4.1.5 Construction equipment is normally driven by wind motors. (1)

4.2 FIGURE 4.2 below shows the shuttering that is used in excavations.

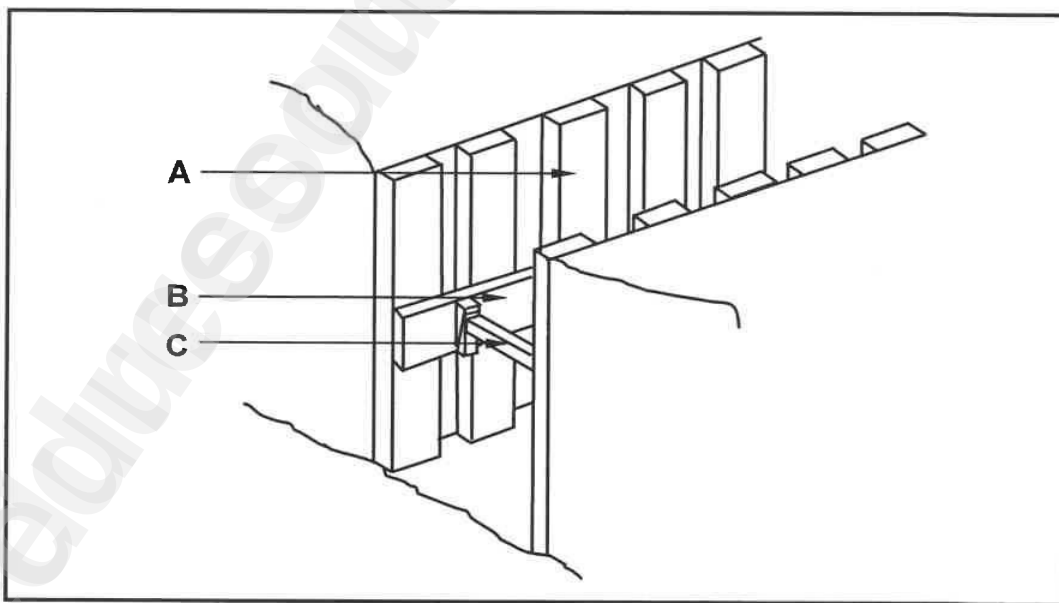


FIGURE 4.2

- 4.2.1 Recommend in which situations this shuttering will be used. (1)
- 4.2.2 Identify A, B and C. (3)
- 4.2.3 Name the member that is used to keep part C in place. (1)

- 4.2.4 Predict TWO consequences if part C is not properly secured. (2)
- 4.2.5 Name ONE characteristic that the timber, used for this type of shuttering, must adhere to. (1)
- 4.3 FIGURE 4.3 below shows a machine used on a construction site.



FIGURE 4.3

- 4.3.1 What is the purpose of the machine in FIGURE 4.3? (1)
- 4.3.2 Give TWO important reasons for storing this machine with the opening facing downwards. (2)
- 4.4 Name the machine that will be most suitable for the following situations:
- 4.4.1 Compacting thick layers of backfilling (1)
- 4.4.2 Compacting thin layers of soil in final preparation for paving (1)
- 4.4.3 Finishing off a large concrete floor (1)
- 4.5 Fibreglass lining is used in formwork.
- 4.5.1 Describe the finish that you will get when using fibreglass lining. (1)
- 4.5.2 Explain ONE advantage of using fibreglass lining when it comes to the striking of formwork. (1)
- 4.6 State TWO defects that can occur when shuttering seams and joints are not watertight. (2)
- 4.7 FIGURE 4.7 on ANSWER SHEET 4.7 shows an incomplete drawing of a vertical section of the formwork for a straight flight of concrete stairs with a landing. Use ANSWER SHEET 4.7 and complete the drawing of the formwork. Print any TWO labels. (17)

[40]

QUESTION 5: PLASTER AND SCREED, BRICKWORK AND GRAPHICS AS MEANS OF COMMUNICATION (SPECIFIC)

Start this question on a NEW page.

5.1 FIGURE 5.1 below shows a worker plastering a wall.

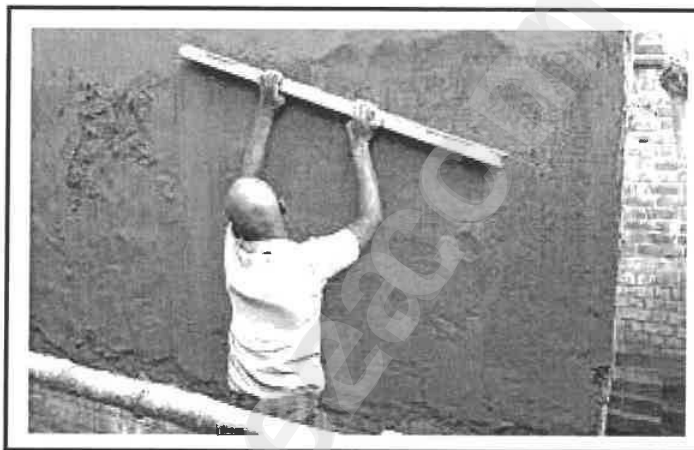


FIGURE 5.1

- 5.1.1 Name the tool used in FIGURE 5.1. (1)
- 5.1.2 What is a clear indication that the plaster is being levelled or scraped? (1)
- 5.1.3 How many wheelbarrows of sand will you use with ONE bag of cement when plastering dams and pools? (1)
- 5.2 Explain the function of water in a screed mixture. (2)
- 5.3 You are tasked to apply a monolithic screed to a freshly cast concrete floor.
- 5.3.1 Recommend when you can start applying the monolithic screed to the freshly cast concrete. (1)
- 5.3.2 Explain how the freshly cast concrete can be prepared to receive the monolithic screed. (2)
- 5.4 Explain the term *beam filling*. (2)
- 5.5 Describe the height of beam filling. (1)
- 5.6 Differentiate, by means of TWO sketches, between a *flat arch* and a *semicircular arch*. Print the correct title under EACH drawing. (4)

5.7 Explain the difference between a *gauged arch* and a *rough arch* in terms of the following:

5.7.1 The shape of the bricks (2)

5.7.2 The shape of the mortar joints (2)

5.8 Use ANSWER SHEET 5.8 and draw to scale 1 : 10 a detailed sectional view of the foot of a roof to show an open eaves.

Use the following specifications:

- The roof overhang is 300 mm.
- The roof is finished off with a 228 x 28 mm fascia board.
- Corrugated iron sheeting is used as roof covering.
- The pitch of the roof is 30°.
- The roof truss is constructed of 114 x 38 mm timber.

(11)
[30]

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

Start this question on a NEW page.

- 6.1 Choose a description from COLUMN B that matches the item in COLUMN A. Write only the letter (A–H) next to the question numbers (6.1.1 to 6.1.5) in the ANSWER BOOK, e.g. 6.1.6 J.

COLUMN A		COLUMN B	
6.1.1	Drop hammer	A	the casing is not removed
6.1.2	Auger	B	a beam can carry heavier loads
6.1.3	Precast piles	C	forces pile foundation into the ground
6.1.4	Driven in-situ piles	D	does not require fresh concrete
6.1.5	Steel-tube caisson piles	E	has an enlarged concrete base
		F	used to prepare holes for short-bored piles
		G	used to join main bars
		H	used to dig long trenches for foundations

(5 x 1) (5)

- 6.2 FIGURE 6.2 below shows joining methods of steel bars used in reinforced concrete.

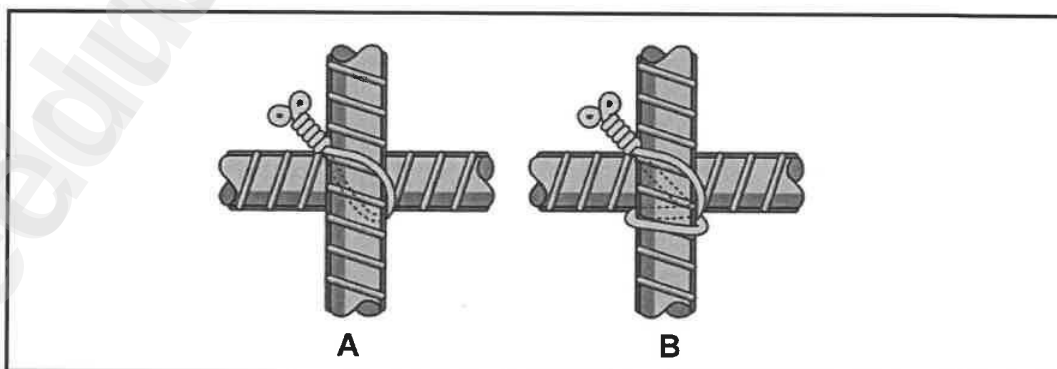


FIGURE 6.2

- 6.2.1 Identify joining methods **A** and **B** above. (2)
- 6.2.2 Identify the type of bars used in FIGURE 6.2. (1)

- 6.2.3 Name TWO types of spacers that are used when reinforcing a concrete floor. (2)
- 6.2.4 Explain TWO purposes of using spacers in reinforcing. (2)
- 6.2.5 Name ONE type of steel that is recommended for use in reinforcement. (1)
- 6.3 ANSWER SHEET 6.3 shows TWO ribs of a rib and block floor. Use ANSWER SHEET 6.3 and draw, in good proportion, a sectional view through the partial rib and block floor up to the finished floor level. Draw ALL omitted detail and add the symbol for concrete. Print any TWO labels. (11)
- 6.4 By means of TWO sketches, differentiate between *tensile force* and *compression force*. Print the correct title under EACH drawing. (4)
- 6.5 FIGURE 6.5 below shows the floor plan of a small classroom.

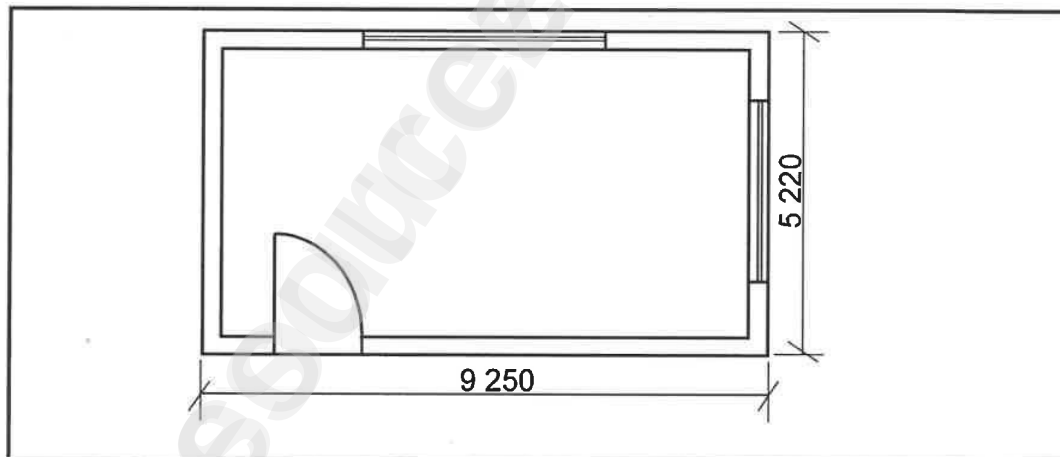


FIGURE 6.5

Use the following specifications:

- The hardcore filling is 170 mm thick.
- The width of the external walls is 220 mm.

Use the dimension paper on ANSWER SHEET 6.5 and calculate the following. Round off your answer to TWO decimals.

- 6.5.1 Volume of hardcore filling for the building (8)
- 6.5.2 The amount of damp-proof membrane (DPM) needed for the building (3)

NOTE: Marks will be awarded for the correct use of dimension paper. (1)
[40]

TOTAL: 200

CENTRE NUMBER:

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EXAMINATION NUMBER:

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ANSWER SHEET 2

NO.	QUESTIONS	ANSWERS	MARKS
1	Give ONE reason why FIGURE B represents the first floor plan.		1
2	Name the SI unit that is used to indicate dimensions on building plans.		1
3	Identify number 1.		1
4	Identify the number indicating the emergency exit.		1
5	What is the purpose of number 3?		1
6	Identify number 4.		1
7	Identify number 5.		1
8	Identify number 6.		1
9	Identify number 7.		1
10	Deduce from the window schedule the dimensions of the window that is installed at number 8.		2
11	Who is the owner of the new dwelling?		1
12	Name the elevation where the sink is located.		1
13	Identify the safety error in FIGURE A.		1
14	Deduce from the building plan why it was not approved after the first submission.		1

CENTRE NUMBER:

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EXAMINATION NUMBER:

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15	Name the material that must be used for the balusters.		1
16	Deduce from the notes column the type of roof illustrated in FIGURE A.		1
17	How many signatures must be indicated on this building plan?		1
18	What are the dimensions for the balusters as indicated by the architect?		2
19	Name the material that must be used for the final finishing of the outside wall.		1
20	Describe the end shape of the balusters.		1
21	How many hinged openings are indicated on Window 1 in the window schedule?		1
22	Draw the symbol for finished wood for the boardroom table.		2
23	Draw the electrical symbol for a three-pole one-way switch.		2
24	How many fluorescent tubes are indicated in the office?		1

CENTRE NUMBER:

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EXAMINATION NUMBER:

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25	Calculate the total height of the wall on the left side of the building from the finished floor level. Give your answer in metre.		4
26	Calculate the area of the exterior wall on the ground floor, that will consist of bricks, from the finished floor level to the top of the floor slab in the south elevation in FIGURE A. Show ALL calculations.		8
		TOTAL:	40

CENTRE NUMBER:							
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EXAMINATION NUMBER:												
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ANSWER SHEET 3.5

ASSESSMENT CRITERIA		
NO.	MARK	CANDIDATE'S MARK
1	2	
2	2	
3	2	
TOTAL:	6	

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CENTRE NUMBER:

EXAMINATION NUMBER:

ANSWER SHEET 3.6



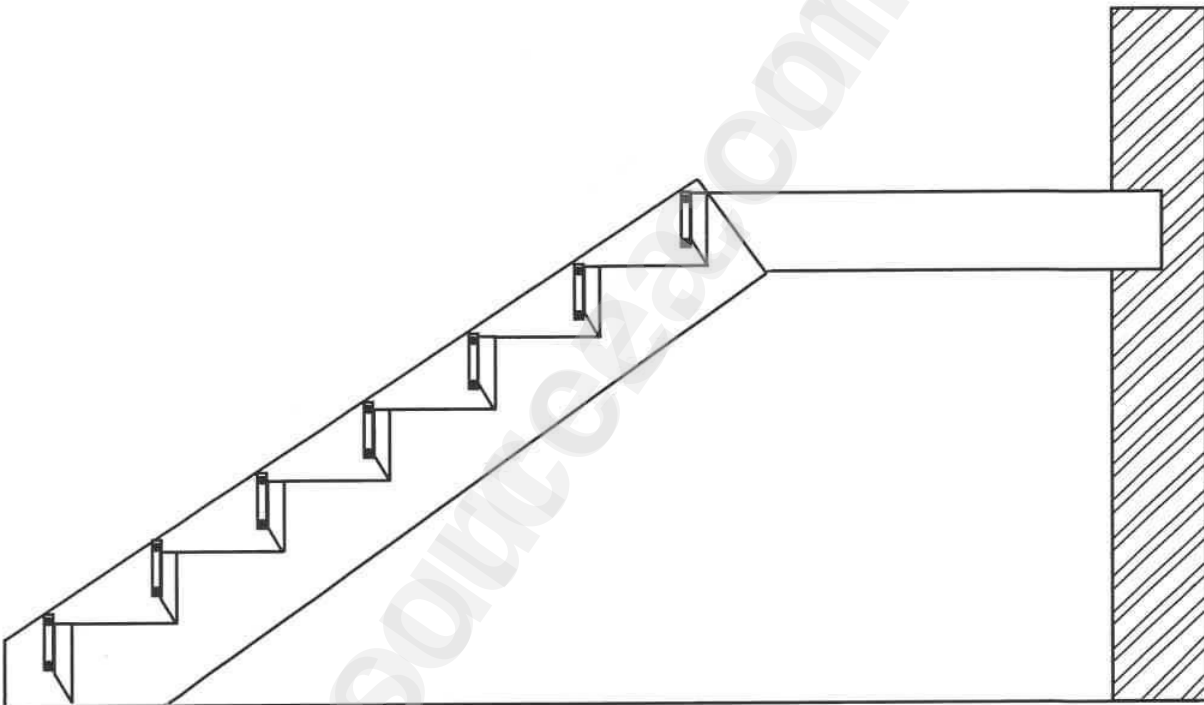
ASSESSMENT CRITERIA		
NO.	MARK	CANDIDATE'S MARK
1	2	
2	1	
3	1	
4	1	
5	1	
6	2	
TOTAL:	8	

CENTRE NUMBER:

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EXAMINATION NUMBER:

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ANSWER SHEET 4.7**FIGURE 4.7**

ASSESSMENT CRITERIA		
NO.	MARK	CANDIDATE'S MARK
1	2	
2	2	
3	2	
4	5	
5	2	
6	2	
7	1	
8	1	
TOTAL:	17	

CENTRE NUMBER:

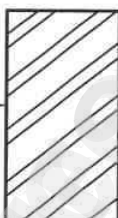
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EXAMINATION NUMBER:

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ANSWER SHEET 5.8

WALL →



ASSESSMENT CRITERIA		
NO.	MARK	CANDIDATE'S MARK
1	1	
2	1	
3	1	
4	1	
5	1	
6	1	
7	1	
8	1	
9	1	
10	2	
TOTAL:	11	

CENTRE NUMBER: EXAMINATION NUMBER:

ANSWER SHEET 6.3

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ASSESSMENT CRITERIA		
NO.	MARK	CANDIDATE'S MARK
1	2	
2	3	
3	2	
4	1	
5	1	
6	2	
TOTAL:	11	

EXAMINATION NUMBER:

ANSWER SHEET 6.5

DIMENSION PAPER

6.5

[illegible]

(8)

(3)

(1)