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NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2024

CIVIL TECHNOLOGY: CIVIL SERVICES

MARKS: 200

TIME: 3 hours

This question paper consists of 17 pages, including 3 answer sheets.

REQUIREMENTS:

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

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SIX questions: TWO questions are generic and FOUR questions are subject-specific.
2. Answer ALL the questions.
3. Answer each question as a whole. Do NOT separate subsections of questions.
4. Start the answer to EACH question on a NEW page.
5. Number the answers correctly according to the numbering system used in this question paper.
6. Do NOT write in the margins of the ANSWER BOOK.
7. You may use sketches to illustrate your answers.
8. Write ALL calculations and answers in the ANSWER BOOK or on the attached ANSWER SHEETS.
9. Use the mark allocation as a guide to the length of your answers.
10. 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*.
11. For the purpose of this question paper, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
12. Use your own discretion where dimensions and/or details have been omitted.
13. Answer QUESTIONS 2.1, 3.10 and 6.8 on the attached ANSWER SHEETS using drawing instruments where necessary.
14. Write your NAME on every ANSWER SHEET and hand them in with your ANSWER BOOK, whether you have answered the question or not.
15. Owing to electronic transfer, drawings in the question paper are NOT to scale.
16. Google images was used as the source of all photographs and pictures.
17. Write neatly and legibly.



QUESTION 1: SAFETY AND MATERIALS (GENERIC)

Start this question on a NEW page.

- 1.1 Choose the correct requirements regarding scaffolding:
- 1.1.1 It must have a safety factor of at least **2 / 4** (1)
 - 1.1.2 The width of the wooden scaffold platform is at least **114 mm / 228 mm** (1)
 - 1.1.3 Guard rails must be at least **750 mm / 900 mm** high (1)
 - 1.1.4 Toe-boards must be at least **150 mm / 1 500 mm** high (1)
 - 1.1.5 Platforms must have a **non-slip layer / rust-free layer** (1)
- 1.2 Motivate why suspended scaffolding should be as near as possible to the structure where work is being done. (1)
- 1.3 Identify THREE of the regulations below that apply to the supplier of hazardous chemical substances.
- 1.3.1 First-aid measures must be indicated
 - 1.3.2 The supplier of the containers must be indicated
 - 1.3.3 Emergency contact numbers must be indicated
 - 1.3.4 Fire-fighting measures must be indicated
 - 1.3.5 Transport information must be indicated
 - 1.3.6 Storage instructions must be indicated (3 x 1) (3)
- 1.4 What is the minimum and maximum slope of the stairs used during the construction process? (2)
- 1.5 Briefly motivate why aluminium ladders must not be used close to electrical wires. (2)
- 1.6 Describe the difference between the type of surface finish of a water-based paint and an oil-based paint. (2)
- 1.7 Name THREE advantages of the curing process of concrete. (3 x 1) (3)
- 1.8 Briefly describe the process of powder coating. (2)

[20]

QUESTION 2: GRAPHICS, JOINING AND EQUIPMENT (GENERIC)

Start this question on a NEW page.

- 2.1 Use the information on ANSWER SHEET A and complete the site plan on a scale of 1 : 200 according to the following requirements:
- 2.1.1 The site boundaries are measured from point **A**
The site boundaries in front and back are 23 m long
The site boundaries on the sides are 25 m long (2)
- 2.1.2 The front building line is 4 m from the site boundary
The back and side building lines are 2 m from the site boundaries (2)
- 2.1.3 Show the site entrance, 3 m from the western site boundary (1)
- 2.1.4 Show the datum level in the north-eastern corner of the site (1)
- Complete the sewage lay-out and abbreviations of the sewage appliances according to the following requirements:
- 2.1.5 The main sewage from the bathroom to the municipal connection (2)
- 2.1.6 The branch sewage to the bathroom and kitchen (2)
- 2.1.7 Manhole on the site, before the municipal connection (2)
- 2.1.8 Rodding eyes (4)
- 2.1.9 Inspection eyes (4)
- 2.2 Name the FOUR particulars of a bolt which must be provide when it is purchased. (4 x 1) (4)
- 2.3 Briefly describe the advantage of the square shoulder bolt. (2)
- 2.4 Name parts **A** to **D** of the bolt in FIGURE 2.4.

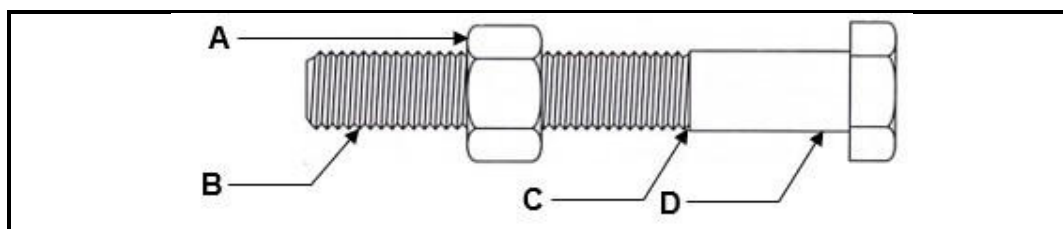


FIGURE 2.4

(4 x 1) (4)

- 2.5 Name TWO requirements to which a trestle scaffold must comply before employees use it. (2 x 1) (2)

- 2.6 Name TWO precautionary measures which must be taken when transporting a ladder. (2 x 1) (2)
- 2.7 Briefly motivate why wooden ladders must not be painted. (2)
- 2.8 Briefly describe ONE use of the dumpy level. (1 x 2) (2)
- 2.9 Name TWO materials that can be detected in walls by a multi-detector. (2 x 1) (2)
- [40]**

QUESTION 3: SAFETY, MATERIAL AND CONSTRUCTION (SPECIFIC)

Start this question on a NEW page.

- 3.1 Name TWO types of risks that must be controlled when working in confined spaces. (2 x 1) (2)
- 3.2 Indicate if the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question numbers (3.2.1 to 3.2.3) in the ANSWER BOOK.
- 3.2.1 A mask that covers one's nose and mouth, offer moderate protection against dust inhalation. (1)
- 3.2.2 Only persons with medical training are allowed to work in a manhole. (1)
- 3.2.3 A safety harness is not needed when a person is using a ladder to enter a manhole. (1)
- 3.3 Briefly motivate why the area around a manhole must be secured when it is open. (1)
- 3.4 In which circumstances must warning signs at manholes be displayed? (1)
- 3.5 Motivate why a respirator must be worn when a manhole is entered. (1)
- 3.6 Zinc is a highly reactive metal. Explain why this property is a disadvantage in a zinc alloy. (2)
- 3.7 Name THREE disadvantages of dezincification in metal pipes. (3 x 1) (3)
- 3.8 Briefly motivate why joints between copper and galvanised pipes must be avoided. (2)
- 3.9 Name THREE factors that determine the thermodynamic and kinetic conditions of galvanic corrosion in metals. (3 x 1) (3)
- 3.10 FIGURE 3.10 on ANSWER SHEET B shows layer 1 of a double return angle in a one-brick wall in a stretcher bond. Draw the alternate layer of the one-brick wall on a scale of 1 : 10 on ANSWER SHEET B. (10)
- 3.11 Explain ONE purpose of the benching of a manhole. (1 x 1) (1)
- 3.12 What is the gradient for a \varnothing 100 mm drainpipe? (1)
- [30]**

QUESTION 4: COLD WATER SUPPLY, WARM WATER SUPPLY AND TOOLS (SPECIFIC)

Start this question on a NEW page.

4.1 FIGURE 4.1 shows a diagrammatic representation of the water supply system to a house. Answer the following questions about the system.

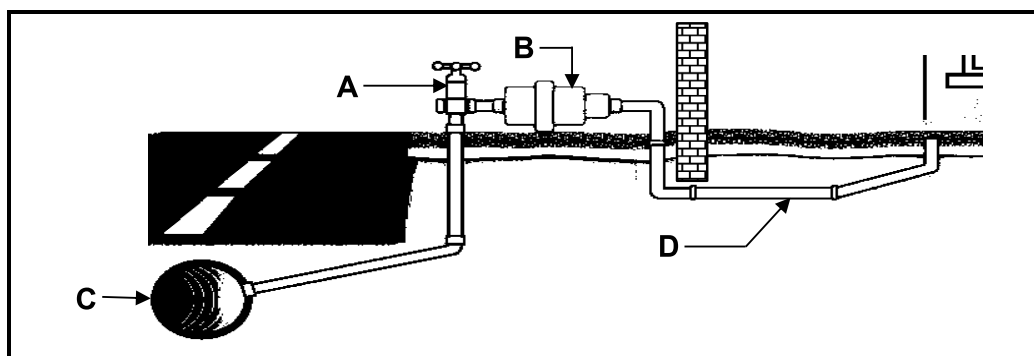


FIGURE 4.1

- 4.1.1 Identify parts **A** to **D**. (4 x 1) (4)
- 4.1.2 Briefly describe the purpose of part **A**. (1)
- 4.1.3 Who is responsible for the maintenance of part **B**? (1)
- 4.1.4 Who is responsible for the maintenance of part **D**? (1)
- 4.1.5 What is the minimum depth that part **D** is laid underneath ground surface? (1)

4.2 Answer the following questions about the valve in FIGURE 4.2.

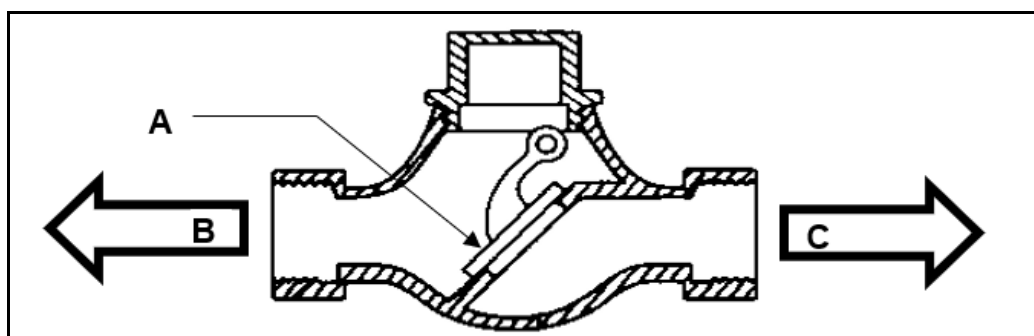
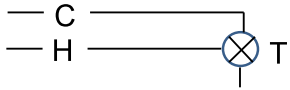
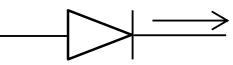
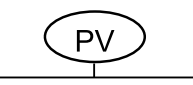


FIGURE 4.2

- 4.2.1 What is this type of valve called? (1)
- 4.2.2 What is part **A** called? (1)
- 4.2.3 Which arrow point indicates the correct flow direction, arrow point **B** or **C**? (1)
- 4.2.4 In which circumstances is this type of valve used? (1)

- 4.3 Briefly describe the water-saving property of an electronic tap. (2)
- 4.4 When a water supply pipe bursts, muddy water may enter the pipe. Briefly motivate why the muddy water must first be pumped out, before the pipe is repaired. (2)
- 4.5 In which circumstances is the long screw fitting used to repair galvanised pipes? (1)
- 4.6 Identify the following hot water system symbols.
- 4.6.1  (1)
- 4.6.2  (1)
- 4.6.3  (1)
- 4.7 Make neat sketches to illustrate the symbols of the following hot water systems.
- 4.7.1 Balancing device (2)
- 4.7.2 Stopcock (2)
- 4.8 Briefly explain why the hot water outlet pipe is installed at the top of a geyser. (2)
- 4.9 Describe the purpose of the following geyser components.
- 4.9.1 Drip tray (1)
- 4.9.2 Pressure-control valve (1)

4.10 Answer the following questions about the geyser system in FIGURE 4.10.

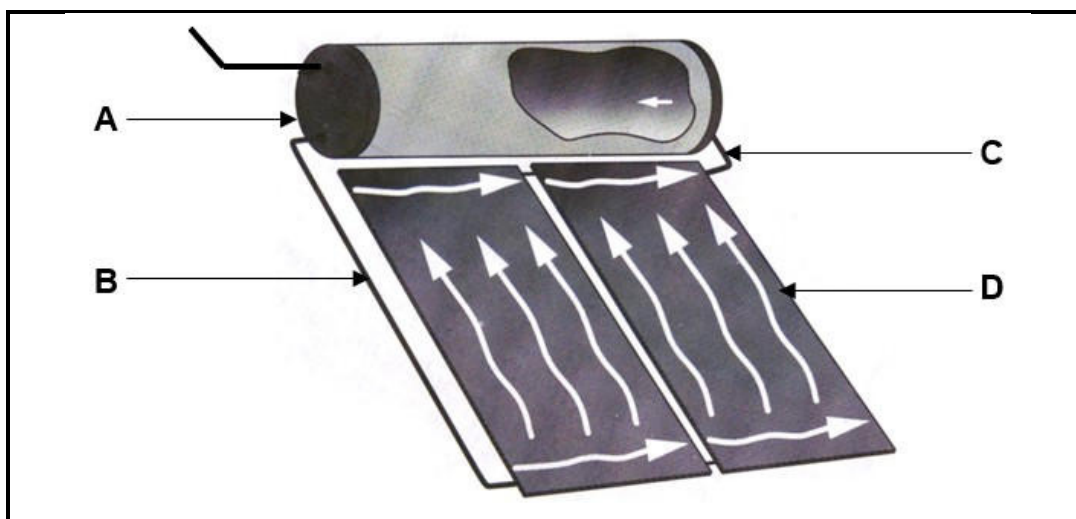


FIGURE 4.10

4.10.1 Name this type of geyser system. (1)

4.10.2 Name parts **A** to **D** of this geyser system. (4 x 1) (4)

4.10.3 What is the purpose of the glass cover which seals off the interior network? (1)

4.11 Name TWO causes of water hammering in water pipes. (2 x 1) (2)

4.12 Answer the following questions about the tool in FIGURE 4.12.



FIGURE 4.12

4.12.1 Name the tool. (1)

4.12.2 What is the purpose of the filter in the suction pipe of the tool? (1)

4.12.3 Name TWO systems where this tool is used. (2 x 1) (2)

[40]

QUESTION 5: DRAINAGE AND QUANTITIES (SPECIFIC)

Start this question on a NEW page.

5.1 Answer the following questions regarding the drainage system in FIGURE 5.1.

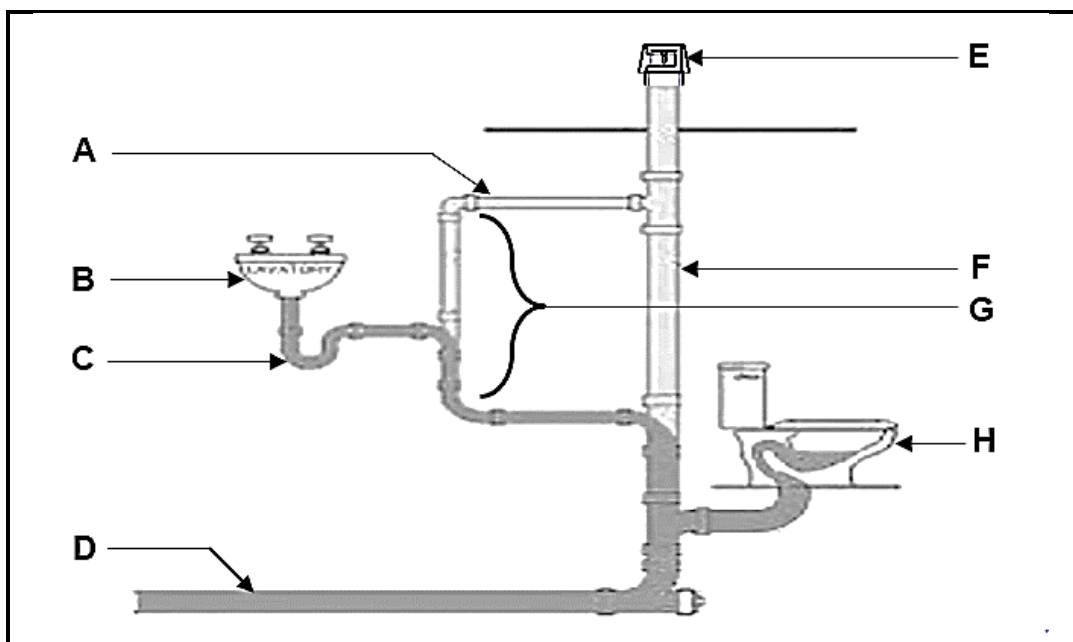


FIGURE 5.1

- 5.1.1 Name the parts **A** to **H** of this drainage system. (8 x 1) (8)
- 5.1.2 Give the abbreviations of parts **B** and **H**. (2 x 1) (2)
- 5.1.3 What is the purpose of the water seal in part **C**? (1)
- 5.1.4 Explain how part **E** prevents malodorous gases from entering the building. (3)
- 5.1.5 What is the purpose of part **F**? (1)
- 5.2 Which letter, **A** or **B**, indicates the flow direction of the sewage in the sewer pipe in FIGURE 5.2?

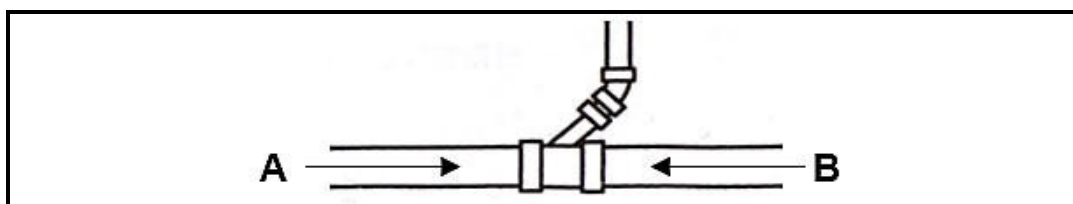


FIGURE 5.2

- 5.3 Briefly describe the purpose of a manhole in a drain system. (2)
- 5.4 Briefly explain what a *vacuum tank* is. (3)

5.5 Answer the following questions regarding the drainage plan in FIGURE 5.5.

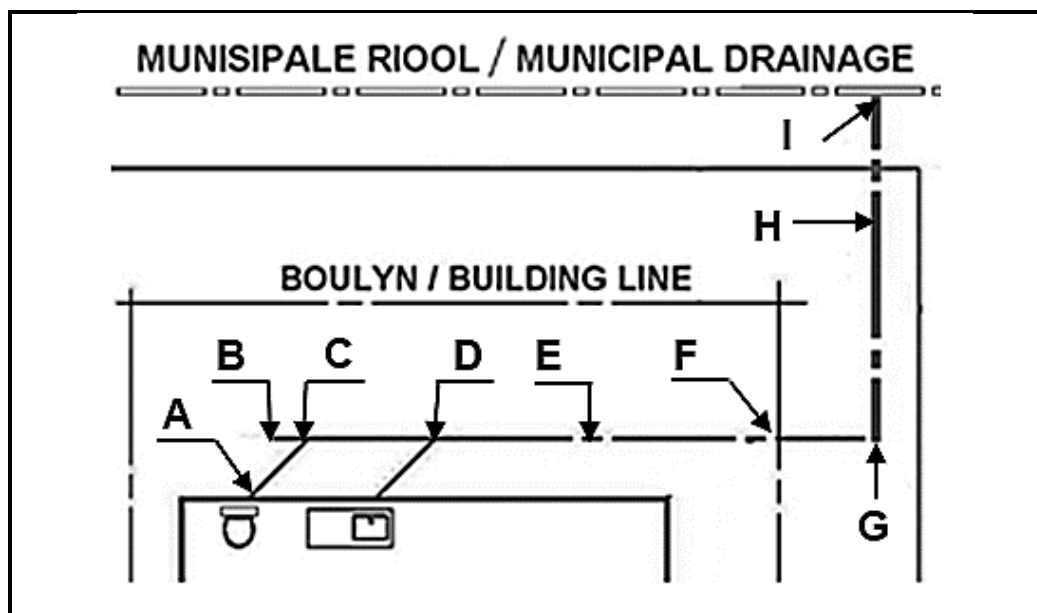


FIGURE 5.5

- 5.5.1 Which letters indicate the positions of inspection eyes? (3 x 1) (3)
- 5.5.2 Which letters indicate the positions of rodding eyes? (2 x 1) (2)
- 5.5.3 Which letter indicates the position of the manhole? (1)
- 5.6 What is the minimum section size of sewer pipes? (1)
- 5.7 Motivate why the following regulations must be applied to sewerage systems.
- 5.7.1 Pipes must be laid at the required gradient. (1)
- 5.7.2 Sewer pipes must be laid in straight lines. (1)
- 5.7.3 Sewerage pipes which run below a building, must be covered with 100 mm thick concrete layer. (1)

- 5.8 FIGURE 5.8 shows the drain lay-out, on a scale of 1 : 100, of a building with a length of 6 000 mm and width of 3 000 mm. Determine the following quantities for the drain system.

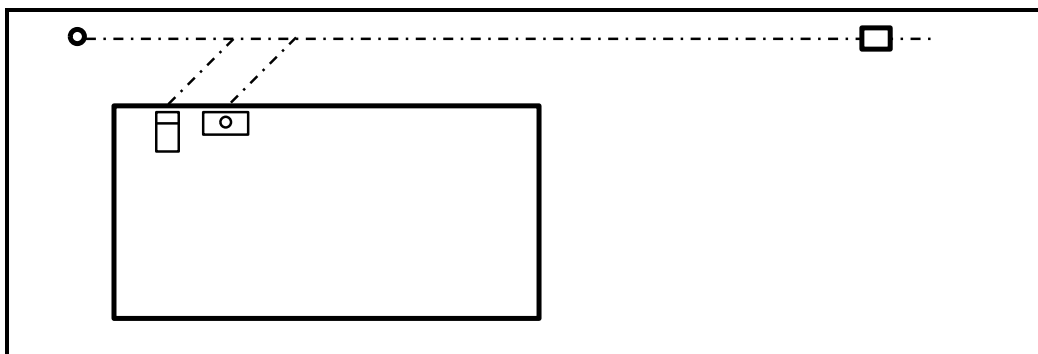


FIGURE 5.8

- 5.8.1 The number of fixed sanitary fitments needed. (1)
- 5.8.2 The total length of branch pipes needed. (2)
- 5.8.3 The total length of sewer pipes needed. (1)
- 5.8.4 The number of access openings which must be installed. (1)
- 5.9 A cylindrical water supply tank is 2 800 mm high and has a diameter of 1 800 mm. Determine the following:
(Show ALL calculations and formulas.)
- 5.9.1 The volume of the tank in m^3 (3)
- 5.9.2 The volume of water that the tank can hold (1)

[40]

QUESTION 6: GRAPHIC COMMUNICATION, ROOF WORK, STORMWATER AND JOINING (SPECIFIC)

Start this question on a NEW page.

- 6.1 What is the recommended pitch for roof gutters? (1)
- 6.2 What is the purpose of the brackets when gutters are installed? (1)
- 6.3 Briefly explain the use of flashings on roofs. (2)
- 6.4 FIGURE 6.4 shows a ventilation pipe that protrudes above a roof. Name TWO factors which must be considered before the installation of the pipe. (2 x 1) (2)

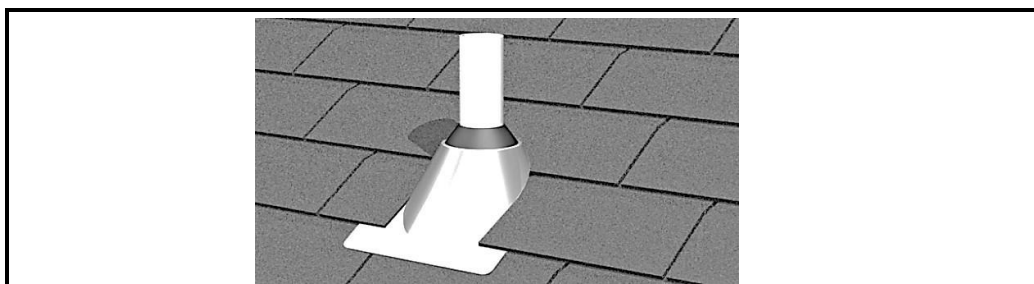


FIGURE 6.4

- 6.5 Choose a description regarding storm water appliances from COLUMN B that matches an item in COLUMN A. Write only the correct letter (A–H) next to the question numbers (6.5.1 to 6.5.5) in the ANSWER BOOK, for example, 6.5.6 I.

COLUMN A		COLUMN B	
6.5.1	Surface channels	A	At least 20 m away from any building
6.5.2	Open stormwater channels	B	Route sewer water to dams
6.5.3	Hard surfaces	C	Collect roof water
6.5.4	Soakaways	D	Route stormwater to dams
6.5.5	Manholes	E	Water from underground stormwater systems is discharged into this
		F	At least 5 m away from any building
		G	Is placed underneath the downpipes
		H	Must be covered with cast iron covers

(5 x 1) (5)



14**CIVIL TECHNOLOGY: CIVIL SERVICES****(EC/SEPTEMBER 2024)**

- 6.6 Name TWO purposes of the flux for soldering. (2 x 1) (2)
- 6.7 What is the purpose of the rubber ring in the compression connection of a PVC pipe? (1)
- 6.8 FIGURE 6.8 on ANSWER SHEET C shows a square-based truncated pyramid.
Draw on ANSWER SHEET C the pattern development for the pyramid. (16)

[30]**TOTAL: 200**

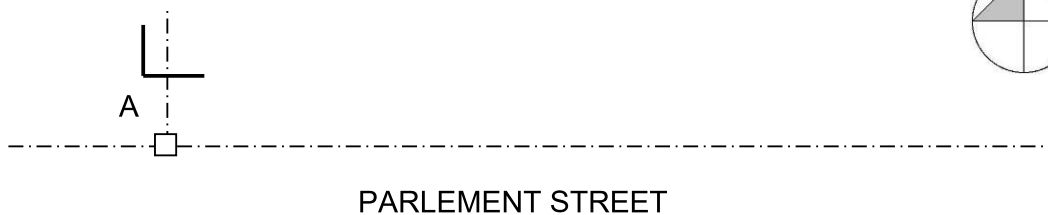
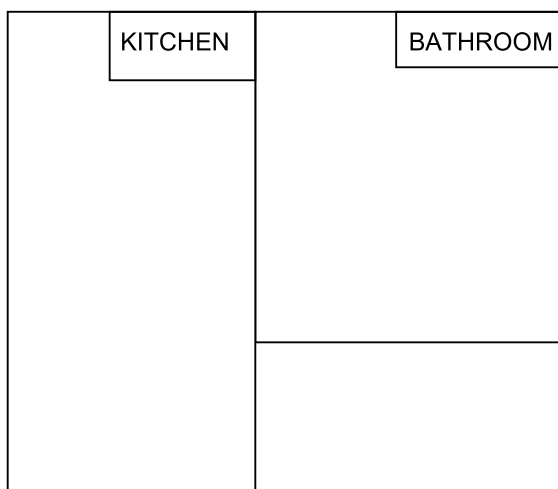
ANSWER SHEET	A	CIVIL TECHNOLOGY (GENERIC)	NAME AND SURNAME:	

2.1 Use the information on ANSWER SHEET A and complete the site plan on a scale of 1 : 200.

ERF 121

ERF 123

ERF 125



Site boundaries	2	
Building lines	2	
Site entrance	1	
Datum level	1	
Main sewerage	2	
Branch sewerage	2	
Manhole	2	
Rodding eyes	4	
Inspection eyes	4	
TOTAL:	20	



ANSWER SHEET	B	CIVIL TECHNOLOGY (SPECIFIC)	NAME AND SURNAME:	

3.10 FIGURE 3.10 on ANSWER SHEET B shows layer 1 of a double return angle in a one-brick wall in a stretcher bond. Draw the alternate layer of the one-brick wall on a scale of 1 : 10 on ANSWER SHEET B.

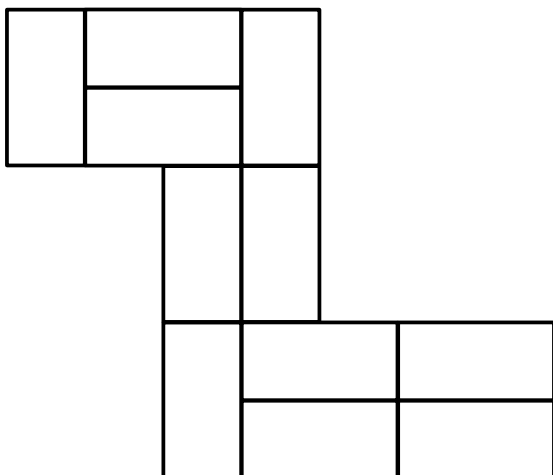


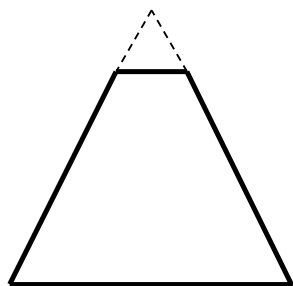
FIGURE 3.10

Brickwork	8	
Application of scale	2	
TOTAL:	10	

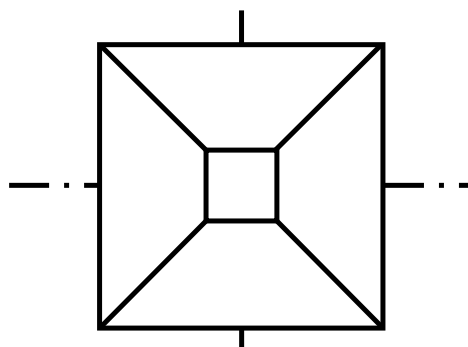


ANSWER SHEET	C	CIVIL TECHNOLOGY (SPECIFIC)	NAME AND SURNAME:	

6.8 FIGURE 6.8 on ANSWER SHEET C shows a square-based truncated pyramid. Draw on ANSWER SHEET C the pattern development for the truncated pyramid.



SIDE VIEW



TOP VIEW

FIGURE 6.8

Construction lines A1 – A3	3	
Arc lines C1 + C2	2	
Base points D1 – D6	6	
Seam lines F1 + F2	1	
Side-lines G1 – G6	2	
Accuracy + neatness	2	
TOTAL:	16	

