Affix label with Candidate Code Number here.
If no label, enter candidate Number if known

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No. 9195

Plumbers, Gasfitters and Drainlayers Board

REGISTRATION EXAMINATION, NOVEMBER 2017

CERTIFYING PLUMBER

QUESTION AND ANSWER BOOKLET

Time allowed THREE hours

INSTRUCTIONS

Check that the Candidate Code Number on your admission slip is the same as the number on the label at the top of this page.

Do not start writing until you are told to do so by the Supervisor.

Total marks for this examination: 100.

The pass mark for this examination is 60 marks.

Write your answers and draw your sketches in this booklet. If you need more paper, use pages 19-21 at the back of this booklet. Clearly write the question number(s) if any of these pages are used.

All working in calculations must be shown.

Candidates are permitted to use the following in this examination:

Drawing instruments, approved calculators, document(s) provided.

Publications, Acts, Regulations, Codes of Practice, or Standards other than the ones provided are NOT permitted in the examination room.

Check that this booklet has all of 21 pages in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION

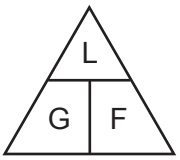
Candidates that sat this examination in November 2017 were provided with the following documents:

- Guide for Safety with Underground Safety
- AS/NZS 3500 Part 1: Water Services
- AS/NZS 3500 Part 2: Sanitary plumbing and drainage

USEFUL FORMULAE

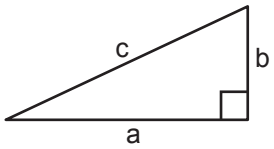
Circumference of circle = $2 \times \pi \times R$ or Circumference of circle = $\pi \times D$

Area of circle = $\pi \times R^2$ or Area of circle = $0.7854 \times D^2$



length = L
gradient = 1:G
fall = F

Volume of cylinder = $\pi \times R^2 \times H$ or Volume of cylinder = $0.7854 \times D^2 \times H$



$a^2 + b^2 = c^2$

Heat energy = mass × specific heat × temp diff

Litres of hot water × temp diff cold to hot = litres of mixed water × temp diff cold to mixed

$$\text{Heating time (seconds)} = \frac{\text{mass of water (kg)} \times 4.2 \times \text{temp diff (ºC)} \times 100}{\text{heat energy input per hour (kJ)} \times \text{efficiency (\%)}}$$

Box's formula: $q = \sqrt{\frac{H \times D^5}{25 \times L \times 10^5}}$

where q = quantity discharged in litres per second
H = head in metres
D = diameter of pipe in mm
L = length of pipe in metres

SECTION A

QUESTION 1

(a) Name the plumbing system that would be considered a specified system for a building warrant of fitness.

_____

(1 mark) ☐

(b) State the maximum time that can pass before the specified system in (a) must be retested.

_____

(1 mark) ☐

(c) State who is responsible for organising the testing of a specified system.

_____

(1 mark) ☐

(d) State who is permitted to carry out the testing of a specified system.

_____

(1 mark) ☐

Total 4 marks ☐

QUESTION 2

The plan below shows a proposed two-storey dwelling and the layout of the sanitary fixtures in the dwelling.

The diagram is drawn to a scale of 1:100

The dwelling is to be built on a concrete pad foundation.

The drainage design for the dwelling has been completed, and the connection point X for the sanitary plumbing is as shown on the plan.

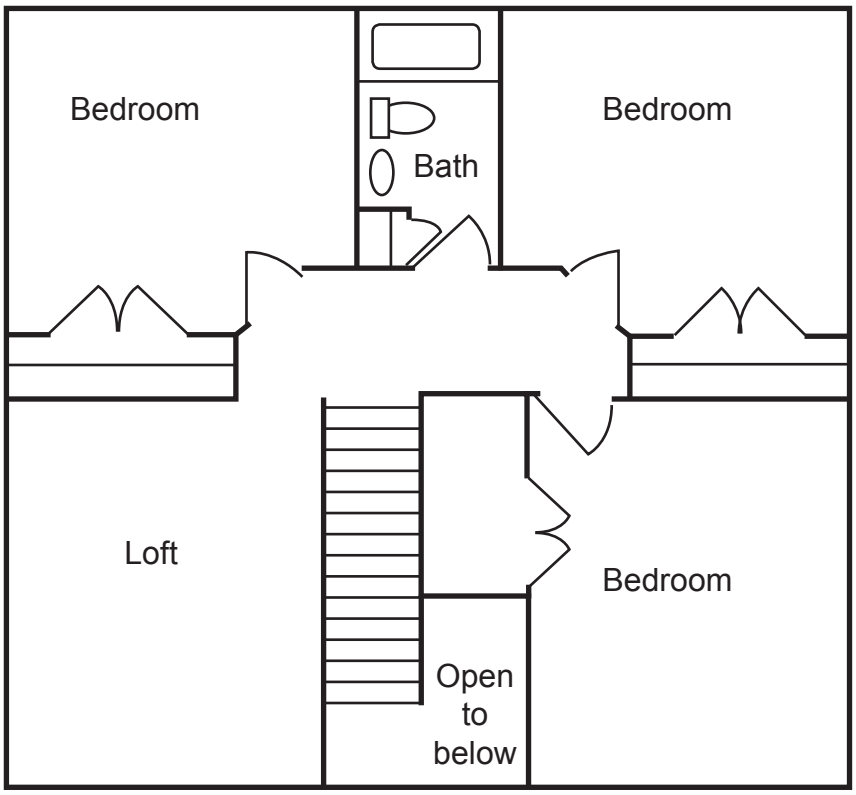
The sanitary plumbing system is to comply with the minimum requirements of AS/NZS 3500 Part 2: Sanitary plumbing and drainage.

(a) On the plan, draw all required pre-slab discharge pipes and show the location of any required vent(s).

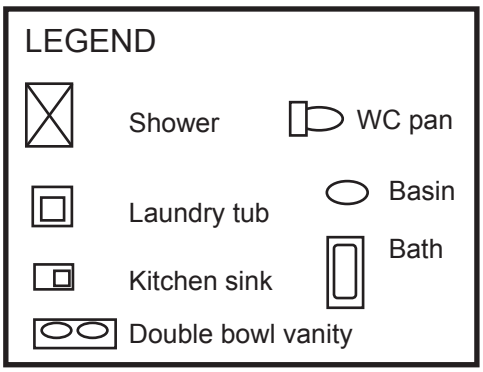
(b) On the plan, show the minimum allowable diameter for each section of discharge and vent pipework drawn in (a).

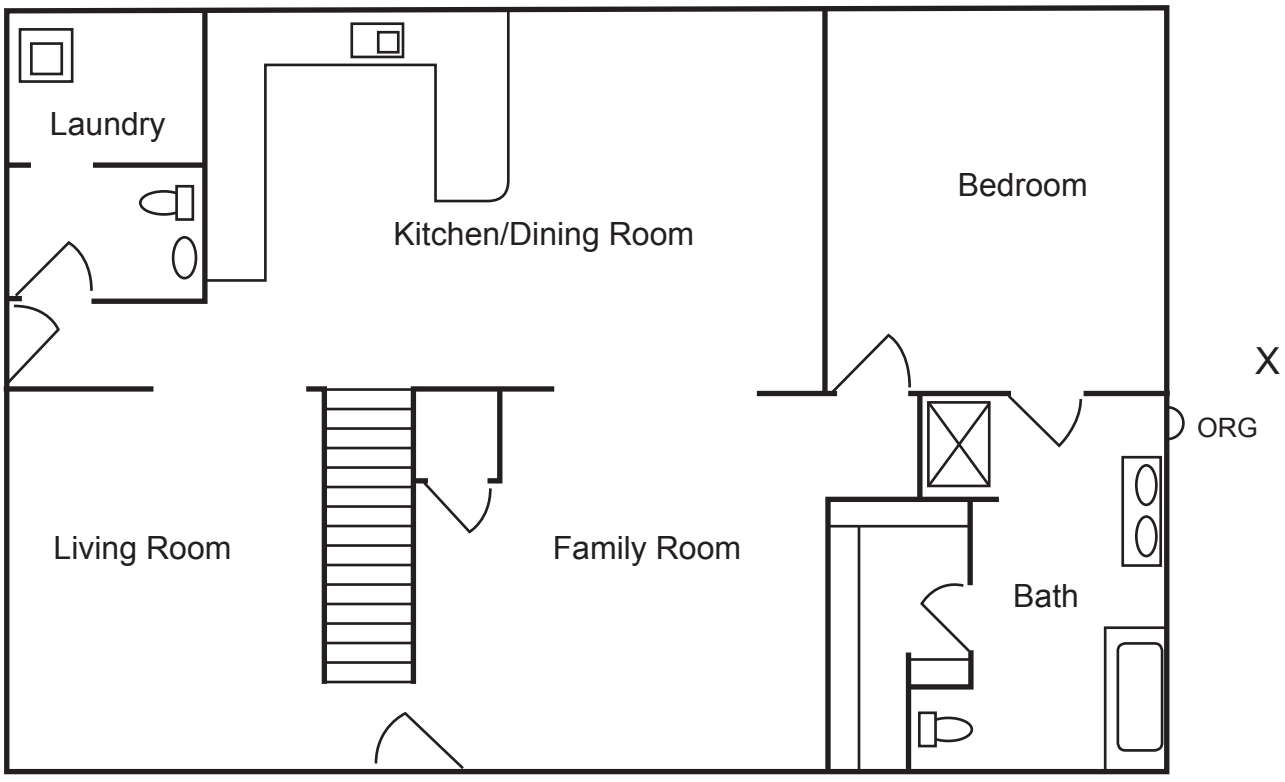
Total 9 marks

QUESTION 2 (cont'd)



First floor





Ground floor

QUESTION 3

A plan view of a single level domestic dwelling, drawn to a scale of 1:100, is shown on the opposite page.

The plan shows the proposed layout for the cold water pipework for the dwelling.

The water main supply can provide 500 kPa water pressure, and is situated 15 lineal metres away from the entry point to the dwelling.

The shower is the highest outlet, and is 3 vertical metres above the water main.

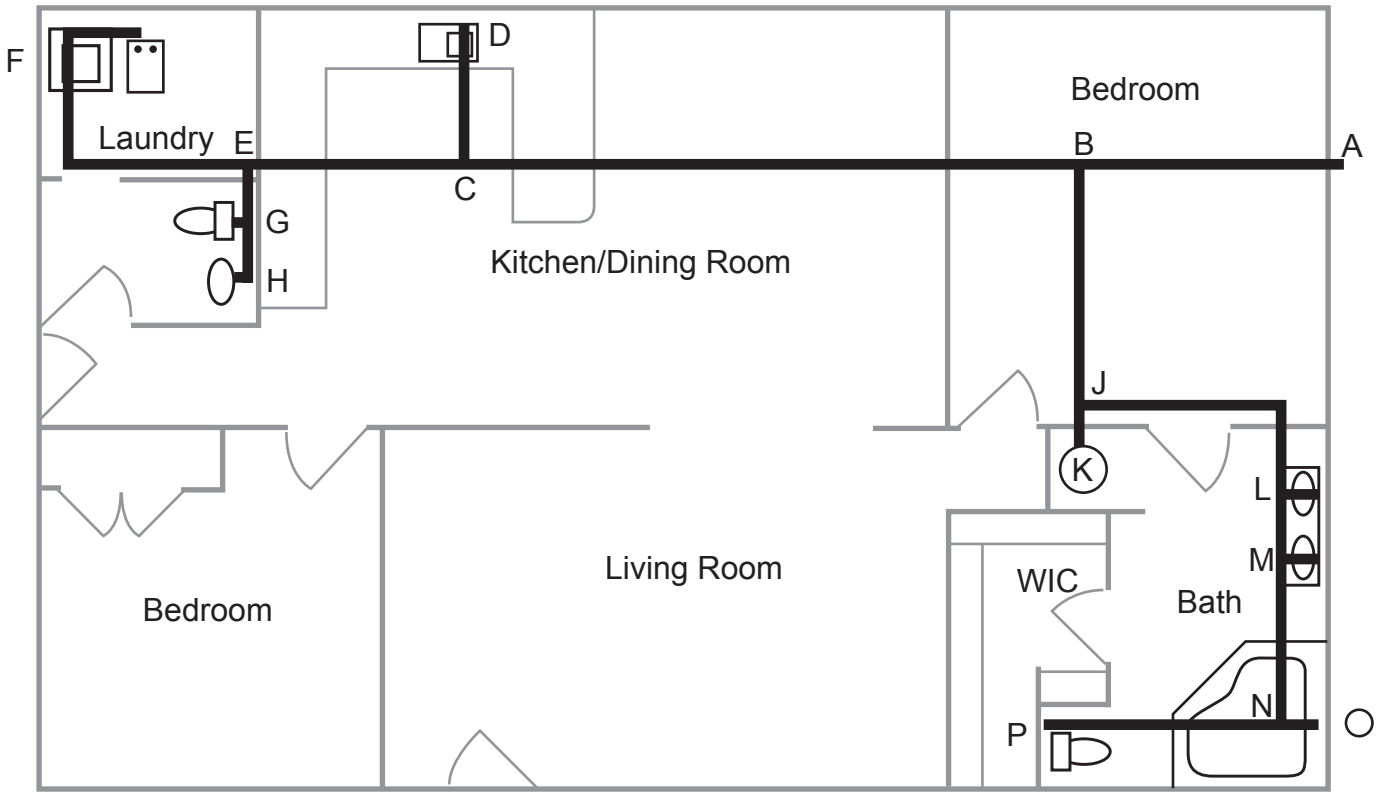
Using the procedure given in AS/NZS 3500 Part 1 Water services Appendix E, complete the tables below.

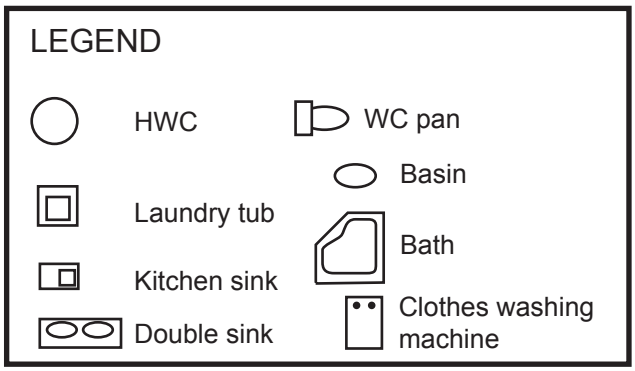
Index length	Pressure drop

Pipe section	Total loading units	Probable simultaneous flow rate (litres/s)	Pipe size (DN)
A - B			
B - C			
C - D			
C - E			
E - F			
E - G			
G - H			
B - J			
J - K			
J - L			
L - M			
M - N			
N - O			
N - P			

Total 19 marks

QUESTION 3 (cont'd)





QUESTION 4

(a) The Guide for Safety with Underground Services states that underground telecommunications ducts are commonly coloured green, purple or light blue.

List THREE other colours that telecommunications have used for ducting in the past and that may still be found underground.

1 _____

2 _____

3 _____

(3 marks) ☐

(b) List FIVE steps according to the Guide for Safety with Underground Services that should be taken before starting excavation work near underground services.

1 _____

2 _____

3 _____

4 _____

5 _____

(3 marks) ☐

(c) List FIVE trenchless or partial excavation techniques that may be used for the installation of mains or service pipes as stated in the Guide for Safety with Underground Services.

1 _____

2 _____

3 _____

4 _____

5 _____

(5 marks) ☐

QUESTION 4 (cont'd)

(d) A water main is to be installed below ground and adjacent to an overhead electric line support.

List the THREE conditions where consent is required from the power pole owner before any excavation can be carried out, as stated in Appendix 5 of the Guide for Safety with Underground Services.

1 _____

2 _____

3 _____

(3 marks)

Total 14 marks

QUESTION 5

The drawing opposite shows a range of sanitary fixtures connected to a single stack modified waste water system in a commercial building.

The WCs are cistern-flushed 'S' trap pans.

(a) Complete the drawing to show the ventilation requirements for a single stack modified system installed so that it complies with the minimum requirements of AS/NZS 3500 Part 2 Sanitary plumbing and drainage.

(3 marks)

(b) State the minimum allowable diameter for the vent pipework.

_____

(1 mark)

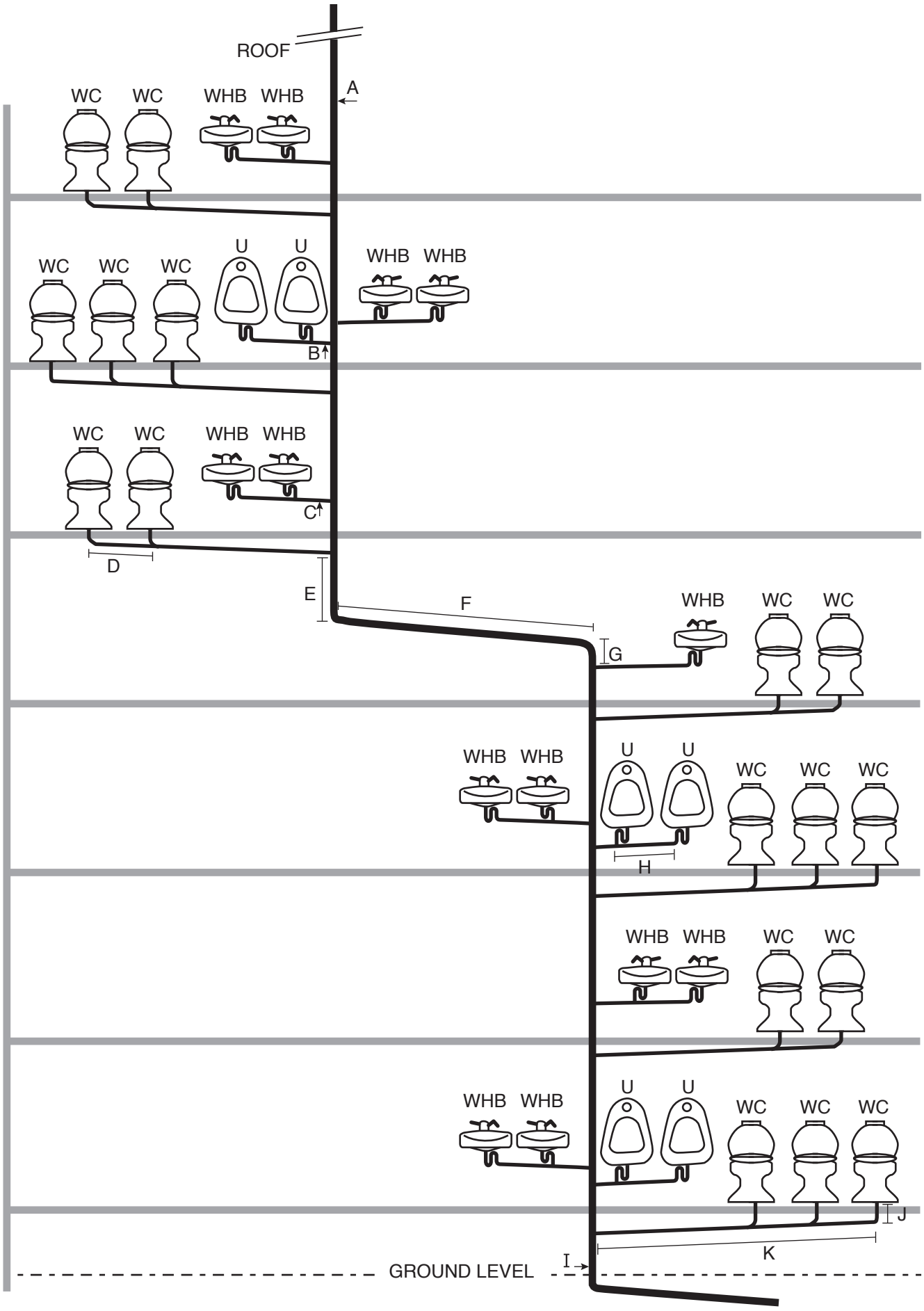
(c) Complete the table below by giving the measurements for each item listed with regard to the installation of the stack.

Total discharge loading for stack	
Minimum diameter of pipe at point A	
Maximum length of section B	
Maximum length of section C	
Maximum length of section D	
Minimum height of section E	
Minimum length of section F	
Minimum gradient of section F	
Minimum height of section G	
Maximum length of section H	
Minimum diameter of pipe at point I	
Maximum length of section J	
Maximum length of section K	

(13 marks)

Total 17 marks

QUESTION 5 (cont'd)



QUESTION 6

The diagram on the opposite page shows a schematic of polybutylene hot water supply pipework installed in the ceiling of a building, with droppers down to feed outlets.

The building specifications state the following:

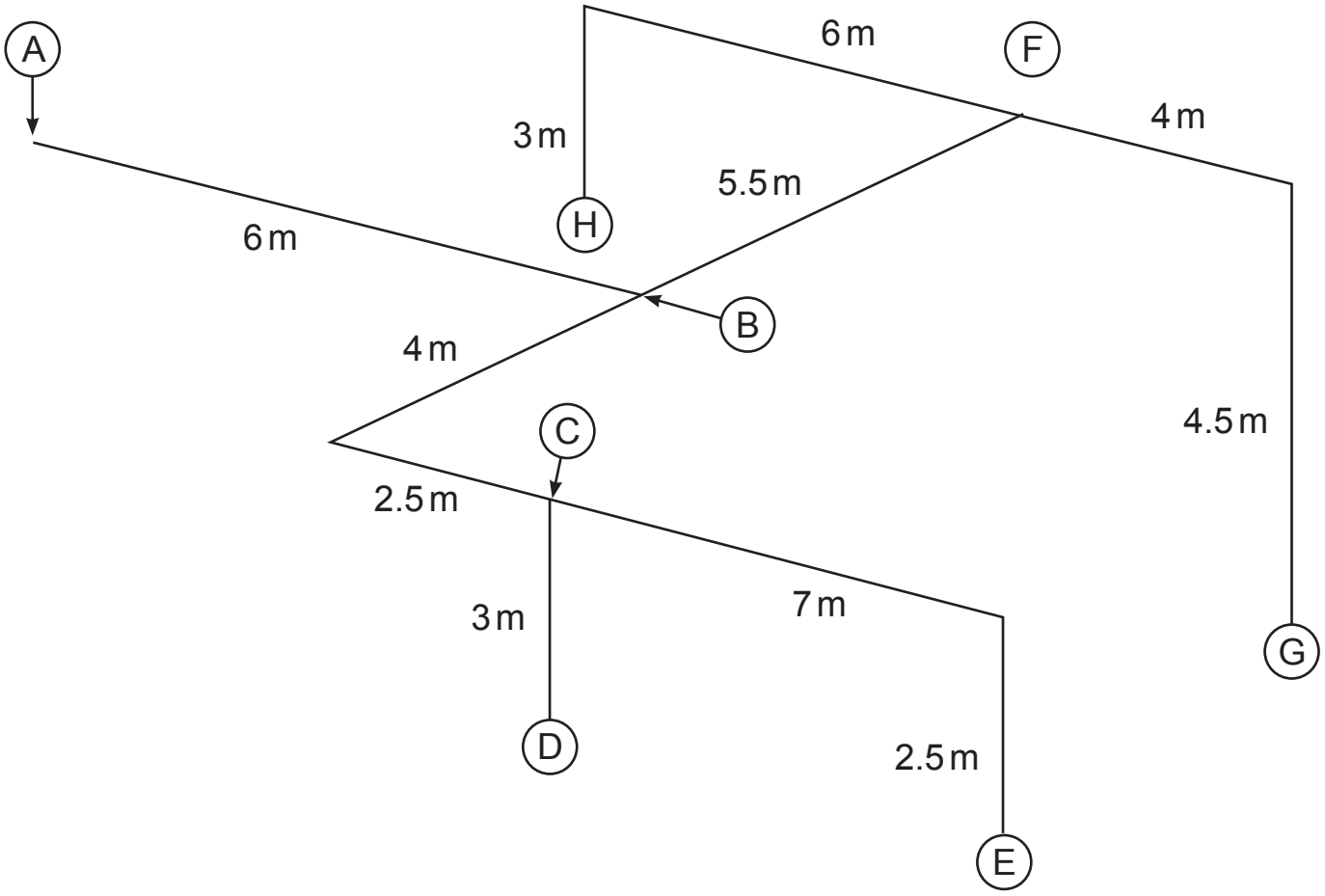
- Support is to be provided 100 mm from the end of each pipe.
- Three clips are to be included for each tee, each located 100 mm from the tee.
- Two clips are to be included for each bend, each located 100 mm from the bend.
- The straight lengths of pipework are to be supported to comply with the minimum requirements of AS/NZS 3500 Part 1 Water services.

Complete the table below to show the number of clips required for each listed section of the pipework. The diameter of the pipework in each section is as shown.

Pipe section	Number of clips
A – B (20 mm)	
B – C (20 mm)	
C – D (15 mm)	
C – E (15 mm)	
B – F (20 mm)	
F – G (15 mm)	
F – H (15 mm)	

Total 7 marks

QUESTION 6 (cont'd)



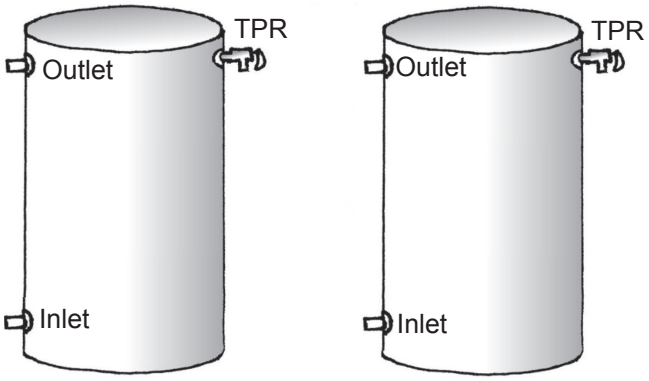
QUESTION 7

(a) The starter drawing below shows two hot water storage cylinders installed to provide hot water to 10 showers in a sports club ablution block.

A cold water supply fed directly from the network utility operator's water main is also shown.

The cylinders are to be connected in parallel.

(i) Complete the drawing to show the pipework and valves required for the installation of the cylinders.



Cold supply

(4 marks)

(ii) Give THREE advantages of installing the cylinders in parallel.

1 _____

2 _____

3 _____

(3 marks)

QUESTION 7 (cont'd)

(b) It is expected there will be one peak load period per day, where 80% of the showers will be in use.

The incoming cold water temperature is 16ºC.

The average shower temperature is expected to be 42 ºC.

The estimated average shower time is 10.5 minutes.

The thermostat on the cylinder is set to maintain a temperature of 70ºC.

The required flow rate at each shower is 0.1 litres per second.

Calculate the required capacity for each of the hot water cylinders.

Formula:

$$\text{Total storage required} = \frac{\text{Time (seconds)} \times \text{Flow rate (l/s)} \times \text{Number of showers} \times T_1}{T_2 \times \text{Peak load}}$$

where
T_1 = temperature increase from cold to average shower temperature
T_2 = temperature increase from cold to hot stored temperature

(5 marks)

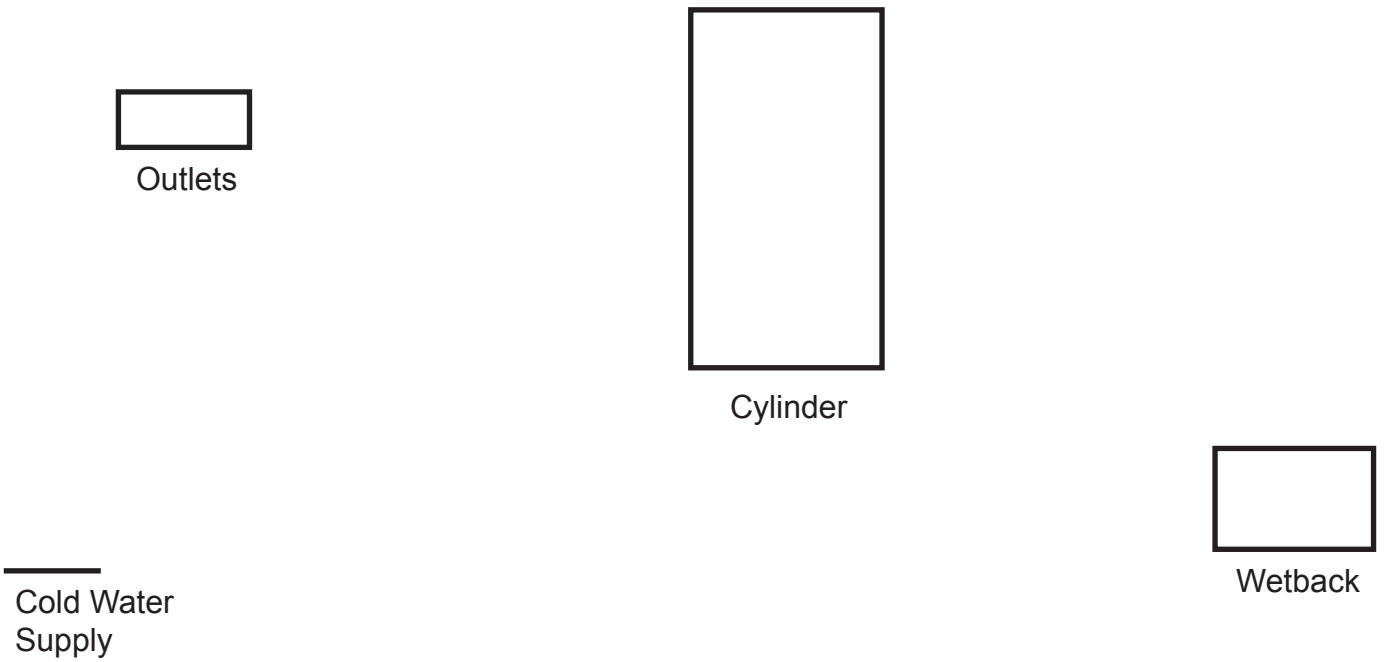
Total 12 marks

QUESTION 8

The starter drawing below shows a storage hot water cylinder, a wetback and hot water outlets.

Complete the drawing to show the pipework and valves required to connect the wetback, cylinder and the outlets.

The system is to be an indirect (closed loop), open vented system.



Total 6 marks

SECTION B

Answer the following multiple-choice questions by writing your answer (A, B, C, D or E) in the box provided after each one of the questions.

Each correct answer in this section of the examination is worth 1 mark.

Should your choice of answer be unclear no mark will be awarded.

1. Which of the following is the recommended minimum distance that a mechanical excavator should be used next to a cable or pipe, according to the Guide for Safety with Underground Services?

   A 500 mm.

   B 600 mm.

   C 800 mm.

   D 1000 mm.

   E 1200 mm.

   ☐

2. Which of the following is the recommended minimum distance between any live overhead electric line and any part of any mobile plant or load carried, according to the Guide for Safety with Underground Services?

   A 2 m.

   B 4 m.

   C 5 m.

   D 6 m.

   E 10 m.

   ☐

3. How many litres of water per person must be stored for use when the water supply to a community care building is interrupted?

   A 50

   B 75

   C 100

   D 125

   E 150

   ☐

4. What is the minimum allowable diameter for the overflow pipe fitted to a safe tray under a water supply tank?

A 25 mm.

B 32 mm.

C 40 mm.

D 50 mm.

E 65 mm.

☐

5. What is the maximum allowable temperature for the hot water outlets feeding basins at a home for the elderly?

A 32°C.

B 36°C.

C 45°C.

D 50°C.

E 55°C.

☐

6. Within which distance from the top and bottom of a hot water storage cylinder must a seismic restraint be fitted?

A 50 mm.

B 75 mm.

C 100 mm.

D 150 mm.

E 200 mm.

☐

7. A third seismic restraint is required to be fitted to a hot water storage cylinder exceeding what capacity?

A 150 litres.

B 200 litres.

C 250 litres.

D 300 litres.

E 350 litres.

☐

8. What is the minimum permitted capacity for a storage hot water cylinder for a solar water heating system with 7 m^2 of solar panels?

A 180 litres.

B 200 litres.

C 250 litres.

D 300 litres.

E 350 litres.

☐

9. Why must a minimum capacity be provided for hot water storage in a solar water heating system?

A To prevent the system from overheating.

B To provide the water at an adequate temperature.

C To prevent the growth of legionella bacteria.

D To ensure there is enough water to meet the demand.

E To give an equal volume of water in the cylinder and panels.

☐

10. Which of the following will NOT protect a solar panel when the temperature drops below freezing?

A A frost valve.

B A circulating pump activated by a thermostat.

C An indirect system with glycol added.

D A drain-back system.

E A temperature/pressure relief valve.

☐

11. A pipe 8 m long has been installed at a gradient of 1:80 (1.25%).

What is the pipe fall?

A 8 mm.

B 10 mm.

C 80 mm.

D 100 mm.

E 1000 mm.

☐

12. A pipe is to be laid at a gradient of 2.5%. The fall is 1350 mm.

What is the length of the pipe?

A 5.4 m

B 11.4 m

C 14 m

D 54 m

E 140 m

☐

Total 12 marks ☐

For Examiner's use only

Question number	Marks	Marks
1		
2		
3		
4		
5		
6		
7		
8		
Section B		
Total		