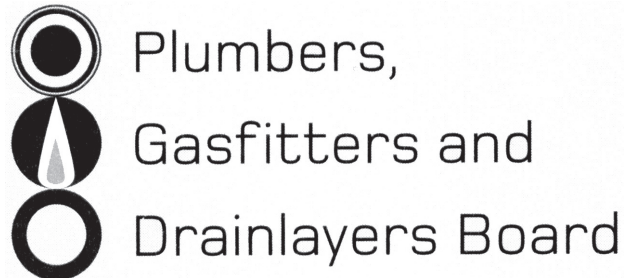


Affix label with Candidate Code  
Number here.  
If no label, enter candidate  
Number if known

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No. 9192



## REGISTRATION EXAMINATION, NOVEMBER 2016

# LICENSED 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 21–25 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 25 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**

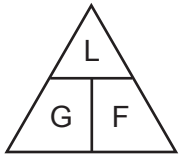
Candidates that sat this examination in November 2016 were provided with the following documents:

- New Zealand Building Code Clause G13 – Foul Water

## USEFUL FORMULAE

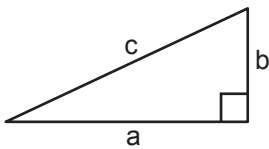
Circumference of circle =  $2 \times \pi \times R$  or Circumference of circle =  $\pi \times D$

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  $\times$  specific heat  $\times$  temp diff

Litres of hot water  $\times$  temp diff cold to hot = litres of mixed water  $\times$  temp diff cold to mixed

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

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

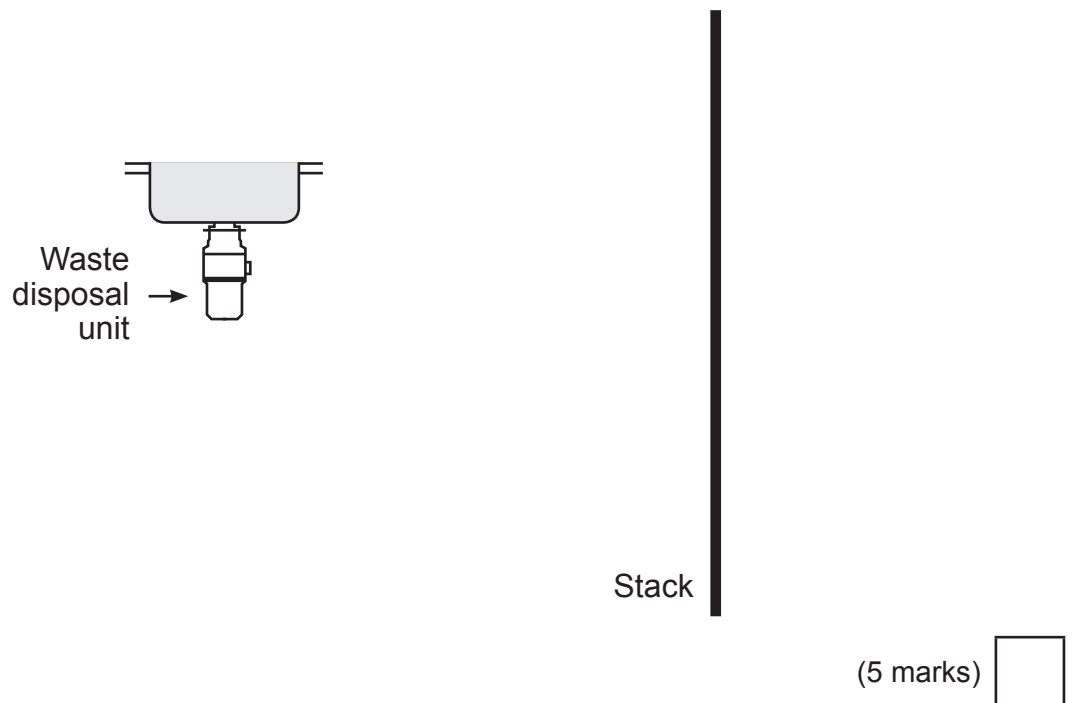
- (a) The starter drawing below shows a domestic kitchen sink with a waste disposal unit and a discharge stack.

The distance between the sink outlet and the stack is 4.5 metres.

The sink is the highest fixture discharging into the stack.

Complete the drawing to show all the pipework required for the installation is to comply with the minimum requirements of New Zealand Building Code clause G13/AS1 Foul Water.

Include on the drawing the diameter and gradient of each section of pipework.



- (b) The fixture discharge pipe from a waste disposal unit is regularly blocking.

Give THREE possible causes of this.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_

(3 marks)

**Total 8 marks**

## QUESTION 2

- (a) Draw a cross sectional diagram of a gate valve, label the components and indicate the direction of flow.

(3 marks)

- (b) Draw a cross sectional diagram of a shower stop tap, label the components and indicate the direction of flow.

(3 marks)

**QUESTION 2 (cont'd)**

(c) Explain how a temperature and pressure relief valve operates.

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(4 marks)

**Total 10 marks**

### QUESTION 3

(a) A straight run of copper piping 25 metres long is to be installed.

The temperature at the time of installation is 15°C.

The pipework is being used for a hot water supply reaching a temperature of 59°C.

Using the information in the table below, calculate in millimetres how much space for expansion that would need to be allowed for the installation.

Formula:

Expansion = length × coeff. lin. exp. × temp. diff.

#### Coefficient of linear expansion

Material	Coefficient of linear expansion per degree K Note: One degree K = 1°C
Polyethylene— low density high density	0.00028 or $280 \times 10^{-6}$ 0.00011 to 0.00013 or $110 \times 10^{-6}$ to $130 \times 10^{-6}$
Polyvinyl chloride (uPVC)— normal impact high impact	0.00005 or $50 \times 10^{-6}$ 0.000081 or $81 \times 10^{-6}$
Acrylonitrile butadiene styrene (ABS)	0.000083 to 0.000095 or $83 \times 10^{-6}$ to $95 \times 10^{-6}$
Polypropylene Acrylics	0.00011 or $110 \times 10^{-6}$ 0.00005 to 0.00009 or $50 \times 10^{-6}$ to $90 \times 10^{-6}$
Nylon	0.00007 to 0.00001 or $70 \times 10^{-6}$ to $100 \times 10^{-6}$
Lead	0.000029 or $29 \times 10^{-6}$
Zinc	0.000035 or $35 \times 10^{-6}$
Aluminium	0.000025 or $25 \times 10^{-6}$
Brass	0.000018 or $18 \times 10^{-6}$
Copper	0.0000166 or $16.6 \times 10^{-6}$
Steel	0.0000133 or $13.3 \times 10^{-6}$
Cast iron	0.0000106 or $10.6 \times 10^{-6}$
Tin	0.000020 or $20 \times 10^{-6}$

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(4 marks)

**QUESTION 3 (cont'd)**

(b) Describe what can happen to copper products if they are exposed to continual vibration.

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(1 mark)

(c) (i) Name a material commonly used for clipping and supporting pipe that should not be allowed to make contact with copper pipe.

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(1 mark)

(ii) Explain what will occur if the material in (c)(i) is in contact with copper pipe.

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(1 mark)

**Total 7 marks**



**QUESTION 4**

(a) State the number of years each of the following items must last to comply with the New Zealand Building Code clause B2/AS1 Durability.

(i) Discharge pipework installed in a wall cavity.

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(1 mark)

(ii) Under-slab discharge pipework.

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(1 mark)

(iii) A trap installed in the cupboard under a sink or basin.

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(1 mark)

(iv) A rubber boot flashing installed on a vent pipe penetrating a roof.

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(1 mark)

(v) An external storage water heater installed on the outside of a dwelling.

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(1 mark)

**QUESTION 4 (cont'd)**

(b) Give THREE items of information that are required to determine the size of a soaker flashing that complies with New Zealand Building Code clause E2/AS1 External Moisture.

1 \_\_\_\_\_

2 \_\_\_\_\_

3 \_\_\_\_\_

(3 marks)

**Total 8 marks**

## QUESTION 5

A low pressure hot water cylinder is to be replaced by a continuous-flow water heater.

Give FOUR considerations relating to the plumbing system that should be taken into account before deciding to go ahead.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_

**Total 4 marks**

## QUESTION 6

(a) Sketch a Venturi.

(1 mark)

(b) Describe how a Venturi works.

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(2 marks)

(c) Give an example of where a Venturi is used in a plumbing system.

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(1 mark)

**Total 4 marks**






## QUESTION 7

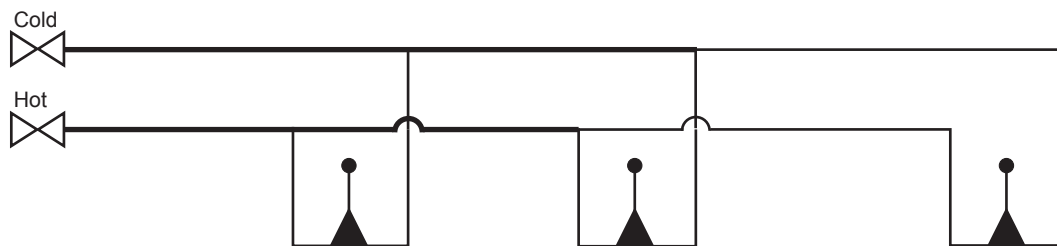
The diagram below is a schematic showing the pipework required for three showers.

The pipework is to be made of copper.

The diagram is drawn to a scale of 1:50

### Legend

-  Existing female isolating valve
-  Female shower mixer
-  Bracket elbow/wingback
-  20 mm pipe
-  15 mm pipe



- (a) Complete the table to list the plumbing materials (excluding sundries) required to carry out the pre-line pipework installation.

Material	Quantity	Material	Quantity
15 mm Cu pipe		20 × 15 × 15 Cu tee	
20 mm Cu pipe		15 mm Cu tee	
20 mm crox nut		Shower mixers	
15 mm crox nut		15 mm hex nipples	
Bracket elbows		20 mm hex nipples	

(6 marks)

**QUESTION 7 (cont'd)**

- (b) State how and when the water supply piping in (a) should be tested to meet the requirements of the New Zealand Building Code clause G12/AS1 Water Supplies.

Include in your answer the minimum test pressures and test time.

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(4 marks)

**Total 10 marks**

**QUESTION 8**

(a) State the purpose of an access point on a sanitary plumbing discharge pipe system.

\_\_\_\_\_

(1 mark)

(b) Give FOUR areas where access points must be included in a sanitary plumbing discharge pipe system to comply with the New Zealand Building Code clause G13/AS1 Foul Water.

1 \_\_\_\_\_

2 \_\_\_\_\_

3 \_\_\_\_\_

4 \_\_\_\_\_

(4 marks)

(c) Give FOUR restrictions that apply to the location of the terminal of a discharge system vent pipe as specified in the New Zealand Building Code clause G13/AS1 Foul Water.

1 \_\_\_\_\_

2 \_\_\_\_\_

3 \_\_\_\_\_

4 \_\_\_\_\_

(4 marks)

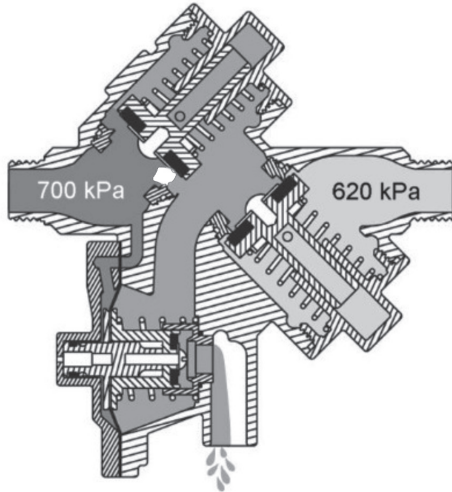
**Total 9 marks**

### QUESTION 9

The diagrams below show some of the stages in the operation of a reduced pressure zone back flow prevention assembly.

Describe what is occurring in each diagram.

(a)



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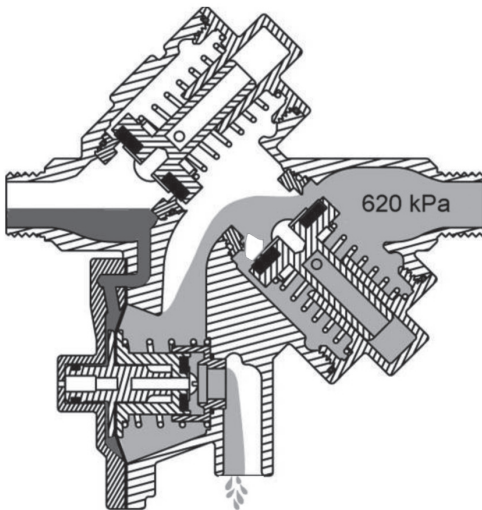
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(2 marks)

(b)



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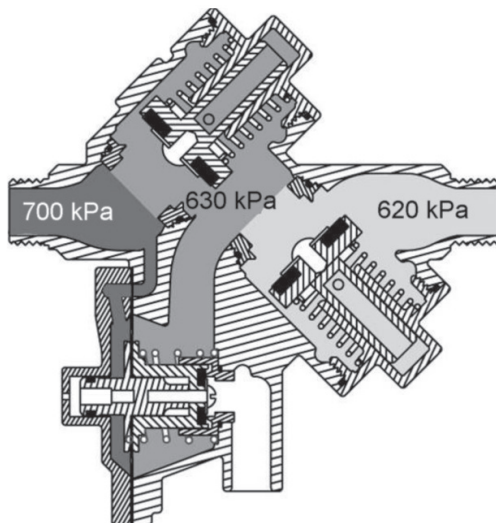
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(2 marks)

(c)



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(2 marks)

**Total 6 marks**



**QUESTION 10**

(a) Explain the purpose of a floor waste gully.

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(1 mark)

(b) Name THREE different sanitary fixtures that are NOT permitted to discharge to a floor waste gully.

1 

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2 

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3 

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(3 marks)

(c) Name TWO fixtures that must have a fixture trap fitted when discharging to a floor waste gully.

1 

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2 

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(2 marks)

(d) Name TWO fixtures that are permitted to discharge to a floor waste gully without a fixture trap.

1 

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2 

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(2 marks)

(e) Name an outlet that is permitted to discharge to a floor waste gully installed in an adjacent room.

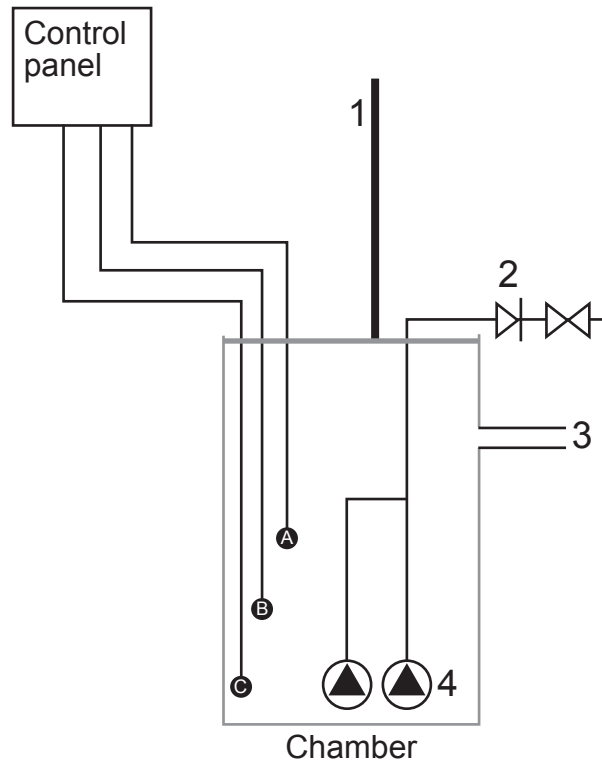
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(1 mark)

**Total 9 marks**

**QUESTION 11**

The diagram below shows a wet well installation in the basement of the building to pump sanitary discharge to a suitable height.



(2 marks)

(a) Name each of the components labelled 1 – 4.

- |   |       |   |       |
|---|-------|---|-------|
| 1 | _____ | 3 | _____ |
| 2 | _____ | 4 | _____ |

(b) Explain what should occur as the water level reaches each of the sensors (labelled A, B and C).

(i) Sensor A

\_\_\_\_\_

(1 mark)

(ii) Sensor B

\_\_\_\_\_

(1 mark)

(iii) Sensor C

\_\_\_\_\_

(1 mark)

**Total 5 marks**

## QUESTION 12

(a) Draw a cross-sectional diagram of a needle valve.

(2 marks)

(b) Give an example of where a needle valve is used in a plumbing system.

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(1 mark)

**Total 3 marks**

**QUESTION 13**

- (a) The water supplied at the shower head from a low pressure hot water cylinder is insufficient for the customer's requirements.

Give FOUR solutions, other than changing the cylinder, that could be implemented to remedy this.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_

(4 marks)

- (b) State THREE specific requirements that must be met when hot water pipework is installed under a concrete slab.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_

(3 marks)

**Total 7 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. What is the recommended ratio horizontal distance to vertical distance for adjusting a ladder to a safe angle?

A 1:3

B 1:4

C 1:5

D 2:5

E 2:7

2. When using a ladder to access a roof, what is the minimum distance the ladder should extend above the roof edge?

A 0.300 m.

B 0.500 m.

C 1.000 m.

D 1.250 m.

E 1.500 m.

3. Which of the following is a manipulative joint used on copper pipe?

A Crox fitting.

B Brazing socket.

C Olive/ferrule fitting.

D Female to male threaded fitting.

E Tapered thread fitting.

4. Which of the following pipe materials can be joined by electro-fusion?

- A Copper.
- B Polybutylene.
- C Polyethylene.
- D Polyvinyl chloride.
- E Steel.

5. Which of the following is an acceptable method for joining uPVC?

- A Solvent cement welding.
- B Electro-fusion.
- C Crimp fittings.
- D Self threading fittings.
- E Hose tail and clamp.

6. Which of the following describes the effect increasing the pressure has on water?

- A Decreases the volume.
- B Increases the volume.
- C Lowers the boiling point.
- D Raises the boiling point.
- E Increases the pH level (hard water).

7. Which statement best describes a forced hot water central heating system?

- A A system that must be vented through a temperature/pressure relief (TPR) valve.
- B A system where the water is circulated by a pump.
- C A system that uses thermosiphon currents to circulate the water.
- D A system where the water is heated by a high pressure gas burner.
- E A system that uses a high output fan to blow air over a heat exchanger filled with hot water.

8. Which of the following is an indirect heating system?
- A A wetback that heats water that is piped to hot outlets.
  - B A central heating system.
  - C A heat transfer system to move warm air from one room to another.
  - D A solid fuel fire with a flue that extends through a second storey room to heat that area.
  - E A closed loop solar water heater system.

9. What is the maximum allowable temperature at which hot water in a childcare centre can be supplied to a sanitary fixture used for personal hygiene?

- A 35°C.
- B 40°C.
- C 45°C.
- D 50°C.
- E 55°C.

10. Which of the following describes trap seal loss due to oscillation?

- A The ambient temperature within the room causes the trap seal to be lost into the atmosphere.
- B The discharge from an adjacent fixture on a branch discharge pipe runs full bore, and pressure differences causes the water to drain out of another fixture.
- C The waste pipe from the fixture outlet drops vertically for some distance before the trap, and insufficient water is left in the trap to form a seal.
- D Air movement over the vent terminal causes the water seal to spill over the trap weir.
- E A fixture waste pipe runs full bore and negative pressure causes the trap seal to be drawn into the waste pipe.

**Total 10 marks**

For Examiner's use only

Question number	Marks	Marks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
Section B		
Total		