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

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No. 9193

Plumbers, Gasfitters and Drainlayers Board

REGISTRATION EXAMINATION, NOVEMBER 2016

LICENSED GASFITTER

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 17–21 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

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

- AS/NZS 5601 Part 1: General installations
- AS/NZS 5601 Part 2: LP Gas installations in caravans and boats for non-propulsive purposes

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 = $0.7854 \times D^2$

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

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

$$\text{Correction factor} = \frac{\text{atmospheric pressure + supply pressure}}{\text{atmospheric pressure}}$$

$$\text{Gas rate (m}^3\text{/h)} = \frac{\text{volume (m}^3\text{)} \times 3600}{\text{time (seconds)}}$$

SECTION A

QUESTION 1

(a) Describe the effect on a thermo-electric flame failure device in each of the following situations.

(i) Pilot flame is too small.

_____

(1 mark) ☐

(ii) Pilot flame is too large.

_____

(1 mark) ☐

(b) Describe the operation of a thermo-electric flame failure device on a gas storage water heater.

_____

_____

_____

_____

_____

_____

(4 marks) ☐

Total 6 marks ☐

QUESTION 2

Describe the operation of each of the following thermostat types used in gas appliances.

(a) Thermistor.

(3 marks)

(b) Vapour expansion thermostat.

(3 marks)

(c) Rod and tube thermostat.

(3 marks)

Total 9 marks

QUESTION 3

Carbon monoxide (CO) is a by-product of incomplete combustion.

List FOUR circumstances in relation to gas appliances that can lead to the production of carbon monoxide.

1 _____

2 _____

3 _____

4 _____

Total 4 marks

QUESTION 4

Answer the following questions regarding cross-linked polyethylene pipework.

(a) (i) Give TWO reasons why unprotected cross-linked polyethylene pipework should not be installed above ground.

1 _____

2 _____

(2 marks)

(ii) Give TWO methods of protecting cross-linked polyethylene pipework when installed above ground.

1 _____

2 _____

(2 marks)

(b) Give THREE advantages of using polyethylene pipework when compared with steel pipework for underground gas service lines.

1 _____

2 _____

3 _____

(3 marks)

Total 7 marks

QUESTION 5

(a) A gasfitter is to install additional appliances in an existing gas installation.

List SIX checks that the gasfitter should carry out before commencing work.

1 _____

2 _____

3 _____

4 _____

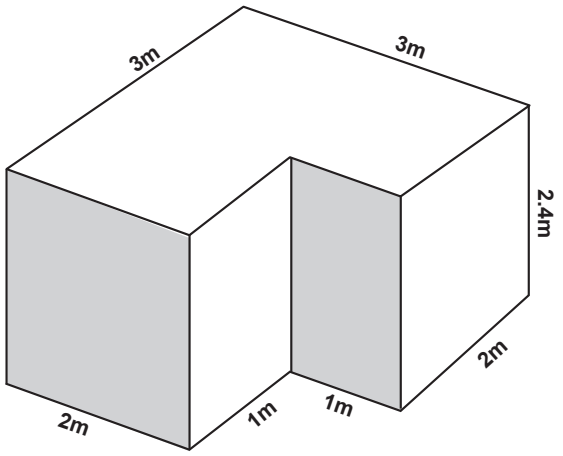
5 _____

6 _____

(6 marks)

(b) An open flued decorative fire is to be installed into the living room shown below.

Calculate the maximum heat input rating in MJ/h that the fire is permitted to have to be installed in the room without the need for additional ventilation.



_____

_____

_____

_____

_____

(4 marks)

Total 10 marks

QUESTION 6

(a) A gas-fired ducted central heating furnace is fitted with a thermo-electric flame failure system.

The aeration port on the pilot of the furnace has become blocked with lint.

Describe THREE possible outcomes of this situation.

1 _____

2 _____

3 _____

(3 marks)

(b) The baffle on a gas-fired storage water heater has collapsed into the combustion chamber of the water heater and blocked the flue.

The appliance is in operation.

Describe THREE possible outcomes of this situation.

1 _____

2 _____

3 _____

(3 marks)

Total 6 marks

QUESTION 7

(a) A natural gas water heater, hob and decorative fire have been installed.

The customer believes that the fire is using too much gas.

List FIVE steps that should be taken to perform a gas rating of the appliance.

1 _____

2 _____

3 _____

4 _____

5 _____

(5 marks)

(b) Give FOUR reasons why gas appliances should always be commissioned.

1 _____

2 _____

3 _____

4 _____

(4 marks)

(c) State TWO effects an incorrectly sized injector fitted in a gas burner may have.

1 _____

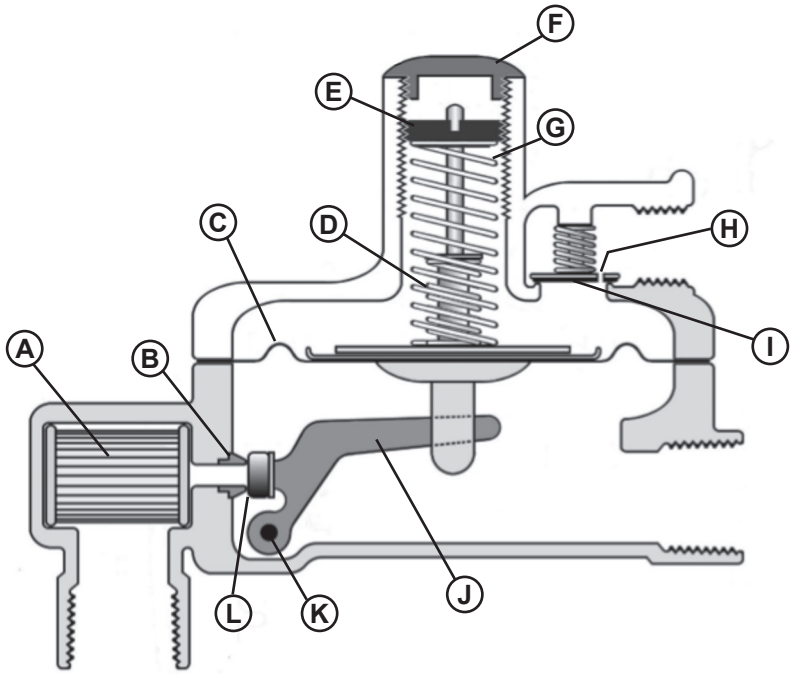
2 _____

(2 marks)

Total 11 marks

QUESTION 8

The diagram below shows a cross-sectional view of a gas service regulator.



Complete the table below identifying the listed components.

Fulcrum		Regulator loading spring	
Orifice		Pressure relief spring	
Filter		Breather	
Diaphragm		Regulator adjustment screw	
Excess relief valve		Regulator valve	

Total 5 marks

QUESTION 9

Complete the table below by explaining how air for combustion is supplied to each type of burner listed.

Atmospheric burner	
Forced draught burner	
Induced draught burner	

Total 3 marks

QUESTION 10

(a) Gas soundness testing is required for an installation.

Using AS/NZS 5601 Parts 1 and 2, complete each table below by naming the test used in each situation, and giving the pressure, time allowances for the test and permitted pressure loss.

(i) An existing installation at a house with a pipework volume of 25 litres is to be tested before work begins.

Name of test	
Pressure of test	
Time allowances for test	
Permitted pressure loss	

(3 marks)

(ii) A caravan has had a cook top and associated pipework with a volume of 5 litres installed.

Name of test	
Pressure of test	
Time allowances for test	
Permitted pressure loss	

(3 marks)

(iii) New piping with a volume of 15 litres has been installed in the timber frame of a house prior to lining.

Name of test	
Pressure of test	
Time allowances for test	
Permitted pressure loss	

(3 marks)

QUESTION 10 (cont'd)

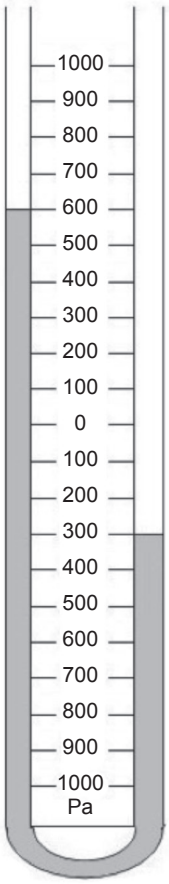
(b) Each diagram below shows an indirect water-filled manometer.

Give, in kPa, the pressure readings shown on each of the manometers.

I indicates which side of each manometer is connected to the gas installation.

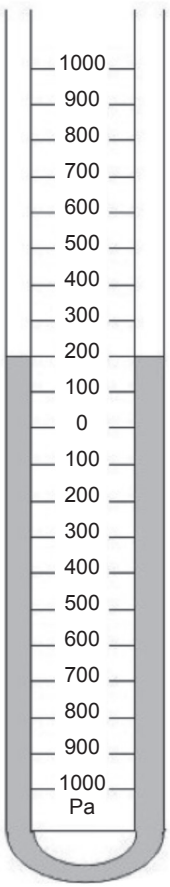
A indicates which side of each manometer is open to the atmosphere.

(i) A I



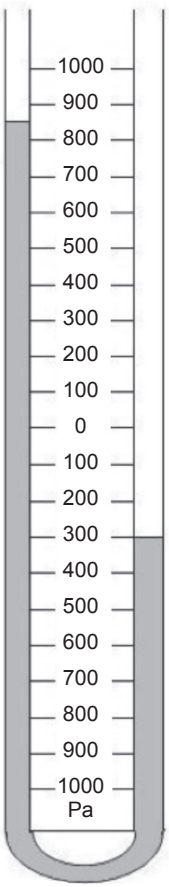
_____ kPa

(ii) I A



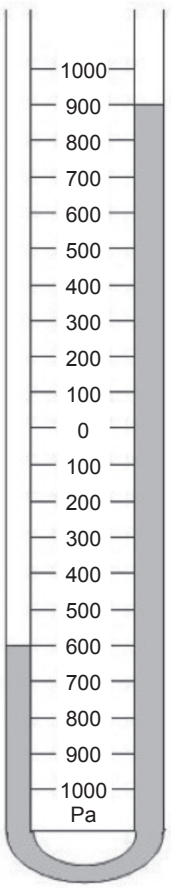
_____ kPa

(iii) A I



_____ kPa

(iv) I A



_____ kPa

(4 marks) ☐

Total 13 marks ☐

QUESTION 11

(a) State the atmospheric pressure at standard reference conditions.

_____

(1 mark) ☐

(b) Give the TWO standard reference conditions used when establishing atmospheric pressure.

1 _____

2 _____

(2 marks) ☐

(c) Describe what the term atmospheric pressure refers to.

_____

_____

(2 marks) ☐

(d) Give TWO factors that can affect atmospheric pressure.

1 _____

2 _____

(2 marks) ☐

(e) State what the term absolute pressure refers to.

_____

(1 mark) ☐

Total 8 marks ☐

QUESTION 12

(a) When natural gas and LPG disperse from a gas leak, they behave differently.

Describe the behaviour of each gas when a leak occurs and give the reason for that behaviour.

Natural gas

_____

LPG

_____

Reason

_____

(2 marks)

(b) Select either natural gas or LPG.

Complete the table below for the type of gas selected.

Type of gas	
Main constituent(s)	
Relative density	
Heating (calorific) value (MJ/m^3)	
Volume of air required for combustion of 1 cubic metre of gas	
Lower explosive limit (% gas in air)	
Upper explosive limit (% gas in air)	

(6 marks)

Total 8 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. The efficiency of a gas appliance can be found using which calculation?

   A Appliance heat input ÷ heat output.

   B Appliance MJ/h × heating value of the gas.

   C Appliance heat output ÷ heat input.

   D Appliance MJ/m^3 ÷ heating value of the gas.

   E Appliance heat input × heat output.

   ☐

2. A gas hob has been commissioned and is working correctly.

   When a wok is used on the gas hob, the bottom of the wok turns black with soot.

   Which of the following is the most likely cause of this?

   A The calorific value of the gas has altered.

   B The bottom of the wok is impinging on the burner flame.

   C The wok is getting too hot and should be used on a smaller burner.

   D The wok is positioned beyond the outer cone of the burner flame.

   E The wok has a copper base which heats too quickly.

   ☐

3. Which of the following safety devices will shut off gas supply in the event of mechanical ventilation failing to operate?

   A Flame rectification.

   B Fire damper.

   C Carbon monoxide detector.

   D Oxygen depletion device.

   E Fan interlock.

   ☐

4. Natural gas is part of which family of gases?

A 1st family.

B 2nd family.

C 3rd family.

D 4th family.

E 5th family.

☐

5. Which of the following appliance types is most susceptible to adverse effects of air movement caused by the operation of mechanical ventilation systems?

A Balanced flued appliances.

B Power flued appliances.

C Fan forced appliances.

D Natural draught appliances.

E Room sealed appliances.

☐

6. Biogas mostly consists of methane and which other gas?

A Propane.

B Butane.

C Pentane.

D Carbon dioxide.

E Nitrogen.

☐

7. Which of the following can be confirmed by gas rating an appliance?

A The burner injector size is correct.

B The appliance efficiency.

C Correct air to gas ratio.

D The operation of the appliance safety devices.

E Correct operation of the appliance flue.

☐

8. According to AS/NZS 5601 Part 1, what is the minimum permissible clearance above an 8 MJ/h overhead radiant heater that is installed indoors to a combustible surface?

A 400 mm.

B 600 mm.

C 800 mm.

D 900 mm.

E 1100 mm.

☐

9. According to AS/NZS 5601 Part 1, what colour must natural gas pipes be painted for identification purposes?

A BS07G38 (yellow).

B AS08H44 (green).

C BS08C35 (buff).

D NZ34A35 (bright yellow).

E BS09Y07 (grey).

☐

10. According to AS/NZS 5601 Part 2, what is the minimum possible clearance between the highest part of a gas hob and a range hood constructed of non-combustible materials?

A 350 mm.

B 450 mm.

C 500 mm.

D 550 mm.

E 600 mm.

☐

Total 10 marks ☐

For Examiner's use only

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