

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

.....

No. 9196



Plumbers,
Gasfitters and
Drainlayers Board

CRAFTSMAN EXAMINATION, June 2008 GASFITTING

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 the blank pages at the back of this booklet. Clearly write the question number 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

The following are NOT permitted in the examination room:

Any publications, Acts, Regulations, Codes of Practice, or Standards

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

QUESTION 1

(a) A consumer gas piping installation is to be designed. State THREE factors that need to be considered in determining the maximum pressure that the pipework and components must be able to withstand.

- 1 _____

- 2 _____

- 3 _____

(3 marks)

(b) List the separation distance for a 50mm diameter gas pipe from each of the following:

- (i) any electrical wire or cable above ground

- (ii) any electrical earthing electrode above ground

- (iii) any underground gas pipe and an electrical earthing electrode not exceeding 1000 volts

- (iv) any underground gas pipe and a communication cable

- (v) any underground gas pipe and any other service other than electrical or communication

- (vi) any underground obstruction to protect the pipe from physical damage.

(3 marks)

Total 6 marks

QUESTION 2

- (a) State FIVE requirements, as specified in NZS 5261, that must be met when selecting the location for gas pipework within the confines of a building envelope.

1 _____

2 _____

3 _____

4 _____

5 _____

(5 marks)

- (b) An open-flued gas appliance is to be installed in a living room. State SIX factors to be considered when determining the size, position and type of ventilation required for the appliance.

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

(3 marks)

QUESTION 2 (cont'd)

(c) Where a gas appliance requires an electrical supply, state TWO requirements for the location of the electrical isolation switch.

1 _____

2 _____

(2 marks)

Total 10 marks

QUESTION 3

A continuous flow hot water system for a sports club is to be designed.

Specifications for the system are as follows:

Incoming water temperature: 5°C

Outlet water temperature: 65°C

Simultaneous hot water flow rates: 6 showers @ 0.05 litres/second

2 baths @ 0.15 litres/second

4 basins @ 0.05 litres/second.

Input rating of each continuous flow water heater: 55.3kW

- (a) Model B instantaneous water heaters are to be manifolded together to supply the hot water. Using Table 1 below, calculate the number of water heaters required. Show all working.

Table1: Manifolded continuous flow gas water heater outputs										
	2 units	2 units	3 units	3 units	4 units	4 units	5 units	5 units	6 units	6 units
Temp. rise	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B
°C	l/hr	l/hr	l/hr	l/hr	l/hr	l/hr	l/hr	l/hr	l/hr	l/hr
30	2380	3167	3570	4750	4760	6334	5950	7917	7140	9501
35	2034	2701	3051	4051	4068	5402	5085	6752	6102	8103
40	1777	2370	2665	3555	3554	4740	4442	5925	5331	7110
45	1578	2104	2367	3156	3156	4208	3945	5260	4734	6312
50	1418	1892	2127	2838	2836	3784	3545	4730	4254	5676
55	1287	1708	1930	2562	2574	3416	3217	4270	3861	5124
60	1198	1593	1797	2390	2396	3187	2995	3983	3595	4780

(6 marks)

- (b) Calculate the total gas input in MJ/h.

(1 mark)

QUESTION 3 (cont'd)

- (c) The manifolded water heaters are to be installed 30m from the LPG meter and at the end of a dedicated gas line. The gas pipe material is to be copper.

Using Figure E7 from NZS 5261 below, calculate the pressure drop and the diameter of the gas pipe to be installed.

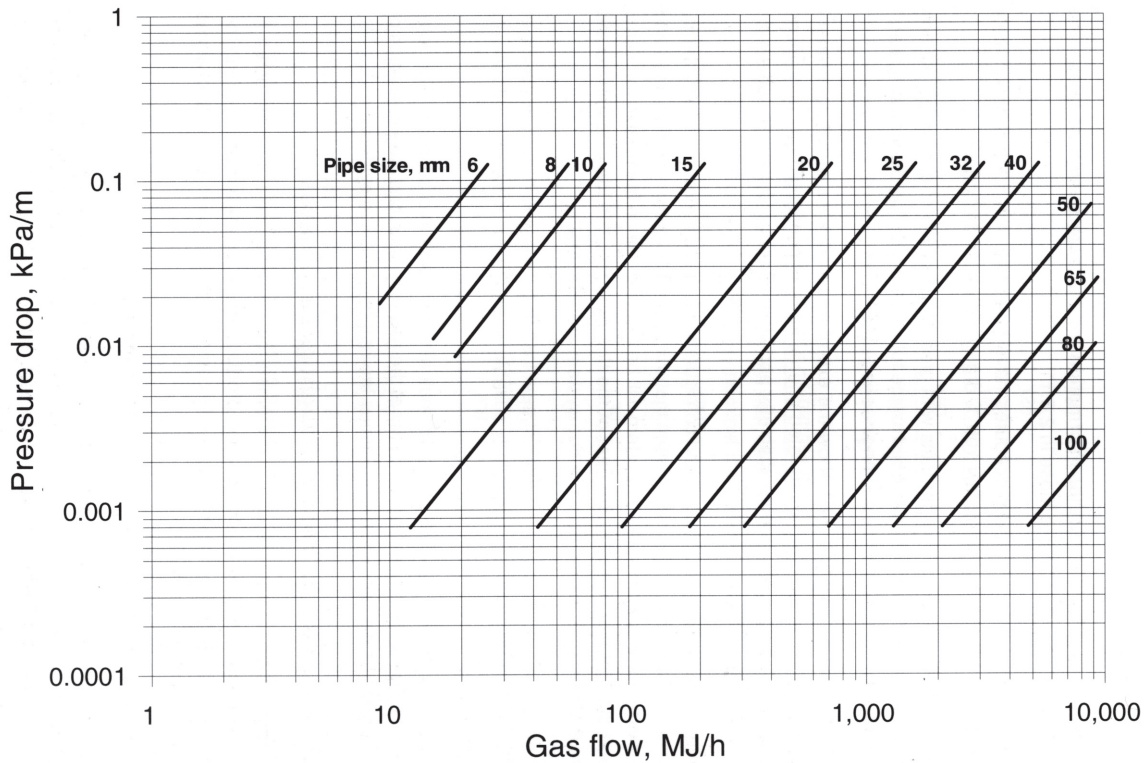


Figure E7 – Pipe sizing for LPG (propane) in copper pipe

(2 marks)

- (d) State whether or not a temperature limiting valve will be required on the outlet side of the water heaters. Give a reason for your answer.

(1 mark)

Total 10 marks

QUESTION 4

The diagram opposite shows a gas system installation for a motel block.

The pressure from the outlet of the first stage regulator is 20 kPa.

The pipe materials are steel for the first stage and cross-linked polyethylene (PE) for the second stage.

The gas is LPG.

- (a) Using Figure E6 from NZS 5261 below, size the pipework from the first stage regulator to the second stage regulator.

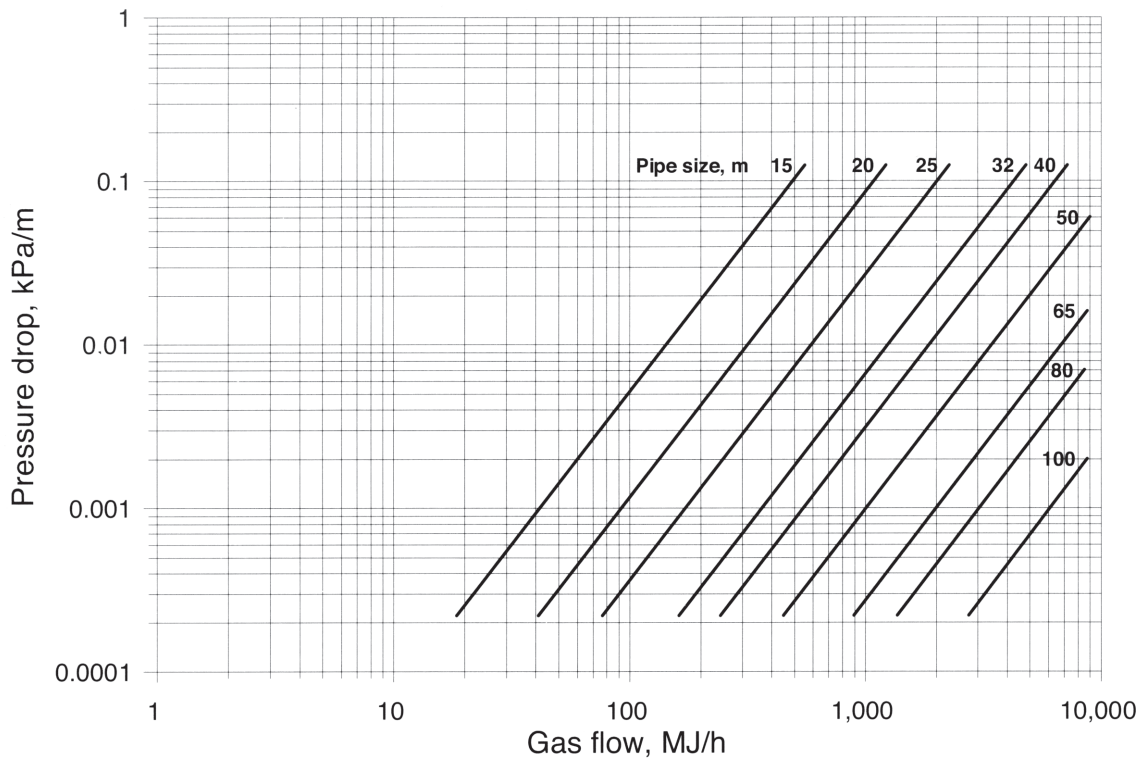
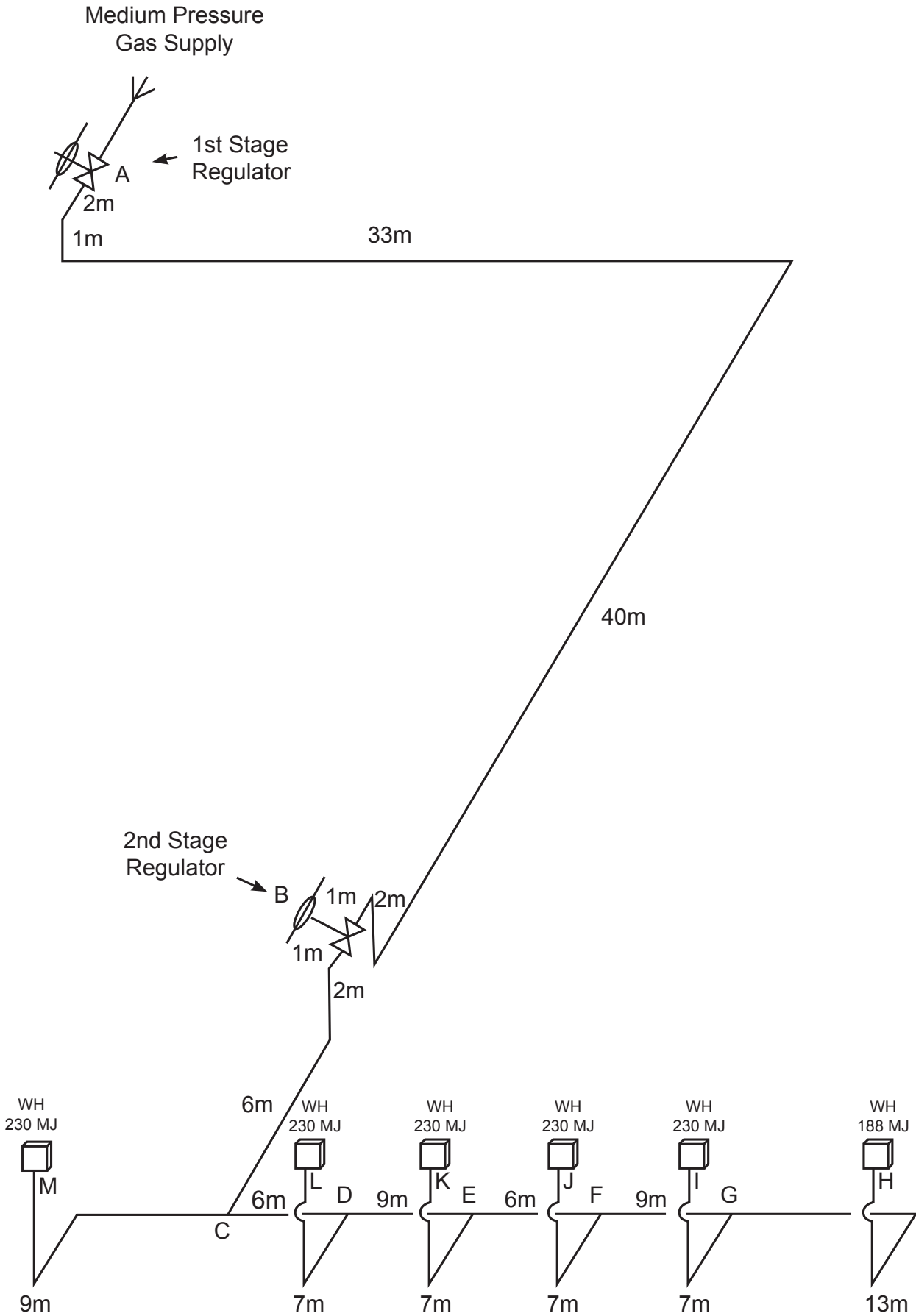


Figure E6 – Pipe sizing for LPG (propane) in steel pipe

(3 marks)

QUESTION 4 (cont'd)



QUESTION 4 (cont'd)

(b) The following chart is for sizing LPG pipework when using cross-linked polyethylene (PE) composite pipe with crimped fittings.

OD (mm)	4 (m)	6 (m)	8 (m)	10 (m)	12 (m)	14 (m)	16 (m)	18 (m)
16	179	143	122	107	97	89	83	77
20	363	290	247	218	197	181	168	157
26	782	624	532	470	425	390	362	339
32	1574	1256	1071	946	855	785	729	682
40	2972	2373	2022	1786	1614	1482	1376	1289
50	5654	4513	3847	3398	3071	2819	2617	2452
63	11051	8822	7519	6642	6002	5510	5116	4792

Using the chart, complete the following table to size the pipework from the second stage regulator to the water heaters.

Allow a length correction factor of 1m for each fitting.

Pipe section	Straight pipe length (m)	Number of fittings	Corrected length (m)	Gas input in MJ/h	Pipe diameter
B-C		3			
C-D		2			
D-E		3			
E-F		2			
F-G		4			
G-H		4			
G-I		3			
F-J		5			
E-K		4			
D-L		3			
C-M		6			

(11 marks)

Total 14 marks

QUESTION 5

A second hand domestic gas cooker is to be installed. State EIGHT features of the appliance that should be checked prior to installation to ensure safe operation of the appliance.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____
- 7 _____
- 8 _____

Total 4 marks

QUESTION 6

- (a) A gas fired domestic storage hot water heater installation with an open flue is to be installed in a garage that is attached to a house.

State FOUR specific factors to be taken into account in the design of the installation.

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

(4 marks)

- (b) Describe SIX steps to be carried out in the soundness test for gas pipework supplying a gas fired water heater installation.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____

(3 marks)

QUESTION 6 (cont'd)

(c) List FIVE checks, in addition to the soundness testing, that must be carried out before the water heater installation in (a) can be certified.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____

(5 marks)

(d) A domestic gas fired water heating installation is being designed. State SIX factors that need to be considered when selecting the capacity of the heater.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____

(3 marks)

Total 15 marks

QUESTION 7

A gas boiler is installed in a plant room, and has an energy input of 1050kW. The ventilation is directly to outside.

Table 13 following relates to ventilation.

Table 13 – Ventilation

Gas appliance location	Source of ventilation	Factor F
Gas appliance in a room or enclosure, other than a plant room	Directly to outside	300
	Via an adjacent room	600
Gas appliance in a plant room	Directly to outside	150
	Via an adjacent room	300

(a) Using Table 13 above, calculate the natural free ventilation area required.

Formula: $A = F \times T$

where A = the minimum free ventilation area in mm^2

F = the factor from Table 13

T = the total gas consumption rate of all appliances in MJ/h.

(2 marks)

(b) A hot water heater rated at 510MJ/h is installed in the plant room in addition to the boiler. Using Table 13 above, calculate the natural free ventilation area required.

(3 marks)

QUESTION 7 (cont'd)

(c) In relation to the total installation in (b):

(i) state how many openings are required

(ii) state where the openings must be positioned

(iii) state how much free area each opening should have.

(3 marks)

Total 8 marks

QUESTION 8

(a) State why a zero pressure gas regulator is used in a commercial gas installation.

(2 marks)

(b) Give TWO situations when a pilot-operated regulator should be used.

1

2

(2 marks)

(c) A monitor regulator and an active regulator are installed on a gas supply line. Draw a line diagram to show the layout of the regulator installation. Include the impulse lines and the direction of the gas flow.

(3 marks)

QUESTION 8 (cont'd)

(d) Give TWO reasons why it may be necessary to fit a vent pipe to the service regulator or the relief valve on a domestic gas supply.

1 _____

2 _____

(2 marks)

Total 9 marks

QUESTION 9

(a) A gas appliance with a natural draught flue has an energy input of 58kW.

Fig 1 from NZS 5261 below relates to flue design.

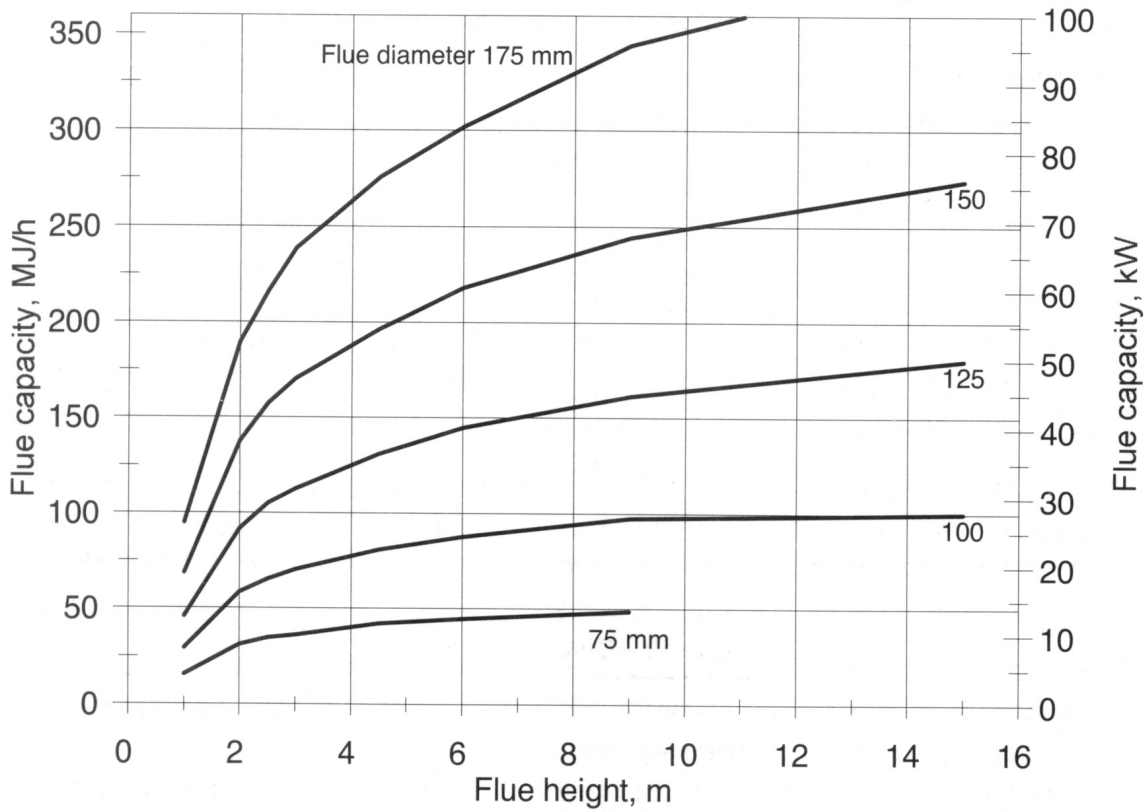


Fig 1: Flue design chart

Using Fig 1, determine the diameter and the height required for the flue. Give TWO alternatives.

1 _____

2 _____

(4 marks)

QUESTION 9 (cont'd)

(b) (i) A gas appliance has a natural draught flue.

State the restrictions on the length of any lateral run in relation to the total length of the flue.

(2 marks)

(ii) State the minimum allowable diameter for a circular natural draught flue.

(1 mark)

(c) State TWO effects of excessive heat loss on the operation of a natural draught flue.

1

2

(2 marks)

Total 9 marks

QUESTION 10

(a) (i) State the type of gas heater that is used to provide an air curtain.

(ii) State where a gas fired heater needs to be positioned to provide an air curtain.

(iii) Describe how a gas fired air curtain operates.

(4 marks)

(b) A floor-mounted indirect fired flued air heater is to be used for commercial space heating. Explain how the heater operates.

(4 marks)

(c) A direct fired heater is installed in a commercial premises. Two tests related to the combustion of the heater should be carried out each year. State what these should test for to ensure the safety of the occupants.

1

2

(2 marks)

Total 10 marks

QUESTION 11

The table below lists stages in the operation of a burner. Complete the table for a 300kW burner having a separate pilot.

Stage	Purpose of Stage
Pre-purge	<hr/> <hr/>
Start gas flame ignition	<hr/> <hr/>
Start gas flame proving	<hr/> <hr/>
Main burner run	<hr/> <hr/>
Lockout	<hr/> <hr/>

Total 5 marks

For Examiner's use only

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