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

CRAFTSMAN EXAMINATION, NOVEMBER 2008

PLUMBING

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 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

QUESTION 1

(a) Under Schedule 1 of the Building Act, practitioners carrying out certain categories of sanitary plumbing work are exempt from the requirement to obtain a building consent. Give these TWO categories.

1 _____

_____

2 _____

_____

(2 marks)

(b) There is an exception to one of the categories of work in (a) relating to hot water storage heaters. State fully this exception.

_____

_____

_____

_____

_____

(3 marks)

(c) List FOUR functions of a Building Consent Authority under the Building Act.

1 _____

2 _____

3 _____

4 _____

(4 marks)

(d) State the period of time a building consent remains in force if the project for which it was issued has not been started.

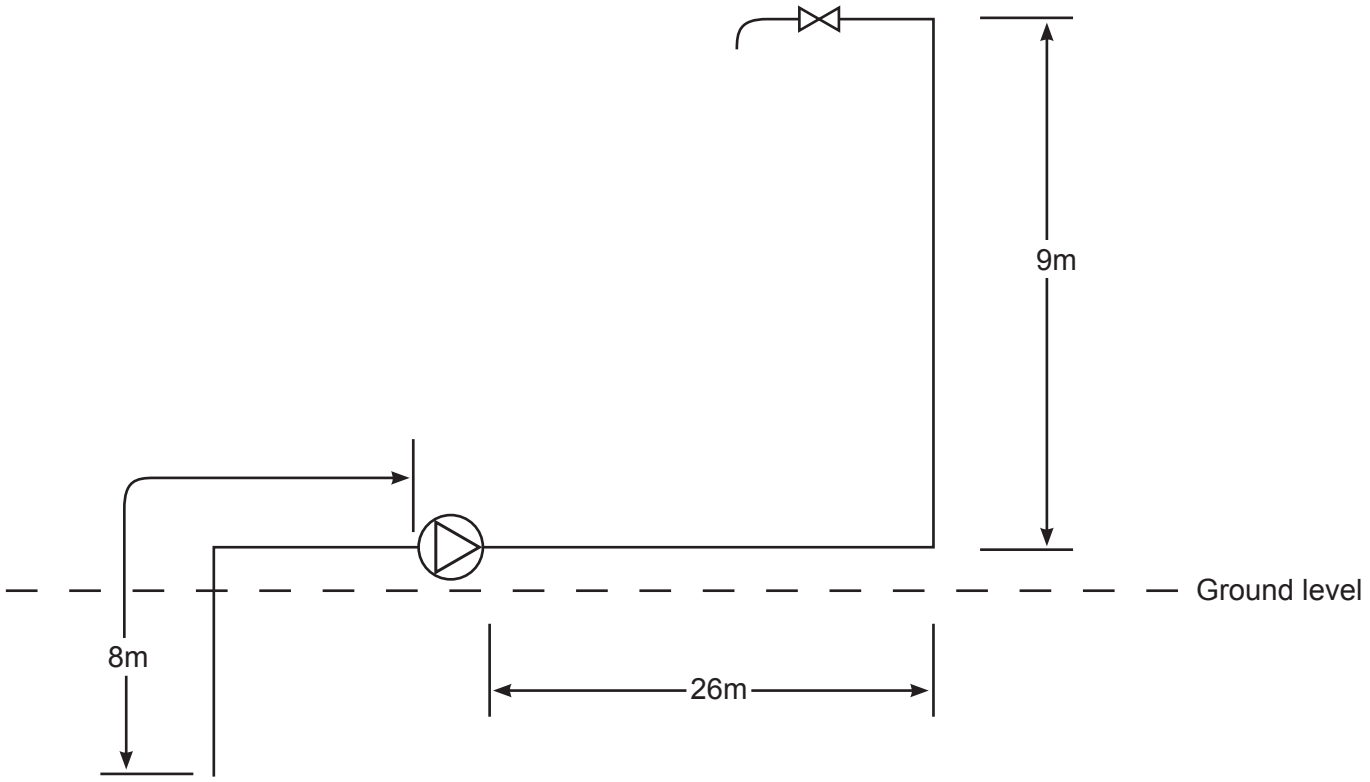
_____

(1 mark)

Total 10 marks

QUESTION 2

(a) The diagram below shows pipework associated with a pumping system.
The suction pipe is 40mm diameter polyethylene.
The delivery pipe is 32mm diameter PVC.
The discharge at the valved outlet is to be 5000 litres per hour at 175kPa.



The following table shows pipe friction loss (metres loss per 100 metres of pipe) for polyethylene and PVC pipes. Allowance has been included for pipe fittings.

Litres/ Min	POLYETHYLENE PIPE (diameter)						PVC PIPE (diameter)		
	15mm	20mm	25mm	32mm	40mm	50mm	32mm	40mm	50mm
11	25	3	1	--	--	--	--	--	--
23	90	12	3	1	0.5	--	0.4	--	--
45	--	40	10	4	1.5	--	0.3	1.2	0.5
68	--	80	20	8	3	0.7	2.1	0.6	0.2
90	--	--	30	13	5	1.3	3.2	1	0.4
114	--	--	50	20	8	2	4.2	1.6	0.6
136	--	--	60	25	10	3	6	2.1	0.8
159	--	--	--	30	14	4	8	2.8	1
182	--	--	--	40	18	5	10	3.8	1.2
227	--	--	--	60	27	7	20	5.2	1.7
273	--	--	--	--	38	9	22	7.4	2.5
318	--	--	--	--	50	12	25	9.5	3.3

QUESTION 2 (cont'd)

Use the diagram and the table to answer the following questions. Show all working.

(i) Calculate the total suction lift (suction lift + friction head in the suction pipe).

(3 marks)

(ii) Calculate the total delivery head (static delivery head + friction head in delivery pipe).

(2 marks)

(iii) Calculate the total working head.

(1 mark)

(b) Twelve residential units are to be constructed on a site with a single water supply. Using the following formula from AS/NZS 3500 Part 1: Water services, calculate the probable simultaneous demand on the water supply.

Formula: $Q = 0.03n + 0.4554\sqrt{n}$
where Q = flow rate in litres per second
n = number of dwellings.

Show all working.

(2 marks)

Total 8 marks

QUESTION 3

(a) Using your knowledge of the New Zealand Building Code Clause G12/AS1, explain the following terms in relation to backflow protection.

Containment: _____

_____

Zone protection: _____

_____

Individual protection: _____

_____

(3 marks)

(b) The New Zealand Building Code requires that water supply systems be installed so that cross connection cannot occur between systems. Give THREE situations in which cross connection can occur between systems.

1 _____

_____

2 _____

_____

3 _____

_____

(3 marks)

(c) State the outcome if the upstream check valve in a double check valve jams open under a static situation.

_____

_____

(1 mark)

QUESTION 3 (cont'd)

(d) Give TWO possible causes of back-siphonage occurring in a water main.

1 _____

_____

2 _____

_____

(2 marks)

Total 9 marks

QUESTION 4

(a) AS/NZS 3500 Part 1: Water services states that high pressure water services with rubber ring joints laid below ground must be restrained using thrust blocks. List FIVE locations where thrust blocks must be installed.

1 _____

2 _____

3 _____

4 _____

5 _____

(5 marks) ☐

(b) AS/NZS 3500 Part 1: Water services gives the requirements for the protection of water supplies in areas where the system could be damaged by freezing.

(i) For pipes and fittings located external to the building envelope, list TWO of the alternative methods of protection.

1 _____

2 _____

(2 marks) ☐

(ii) For pipes and fittings inside the building envelope, list THREE locations where pipes should not be run.

1 _____

2 _____

3 _____

(3 marks) ☐

Total 10 marks ☐

QUESTION 5

(a) A hydraulic ram pump is to be installed to fill a reservoir for a rural water supply. The water source can deliver 24 000 litres per day and is 32m above the ram. The ram has an efficiency factor of 66% and is 115m below the discharge outlet into the reservoir.

Using the following formula, calculate the amount of water pumped into the reservoir in a 24 hour period.

Formula: $D = (S \times F \times E) \div L$
where D = the quantity delivered in litres per 24 hours
S = the quantity of drive water in litres supplied to the ram in a 24 hour period
F = the head of the source of water above the ram in metres
E = the efficiency of the ram
L = the height of the reservoir above the ram in metres.

(2 marks)

(b) Using the following table, determine the minimum size of ram required for the duty in (a).

HYDRAULIC RAM CAPACITY

Size of hydraulic ram No			1	2	3	3.5	4	5X	6X	5Y	6Y
Volume of drive water	From	l/m	7	12	27	45	68	136	180	136	180
	To	l/m	16	25	55	96	137	270	410	270	410
Max. height ram will pump to	Metres		150	150	120	120	120	105	105	105	--

(2 marks)

Total 4 marks

QUESTION 6

A hot water supply system is to be designed for a sports club. A single electrically heated hot water storage tank is to be used to heat and contain the hot water.

The temperature in the tank must be raised from 8ºC (entering) to 70ºC (leaving).
The ablution block is to be fitted with seventeen shower heads and four wash hand basins that will be in continuous operation for two periods of thirty minutes each sports day afternoon.

The system is to be designed to include a 10% contingency volume of hot water for unforeseen overuse.

Each shower head will require 0.03 litres of non-tempered hot water per second.
Each wash hand basin will also require 0.03 litres of non-tempered hot water per second.

(a) Calculate the volume, in litres, of hot water that will need to be heated and stored for each sports day afternoon. Show all working.

(3 marks)

QUESTION 6 (cont'd))

(b) On sports days, the heating elements will operate between 10pm (the previous day) and 6.30am for economic reasons.

Calculate the number of kilowatt hours required on average each hour that the heating element operates to heat the contents of the tank from cold to hot. Show all working.

The specific heat of water is 4.2 kJ/°C
Heating efficiency is 95%.

Formula:

$$\text{Energy input (kW)} = \frac{\text{mass of water (kg) x specific heat of water x temperature difference}}{\text{1000 x 3.6 x time (h)}}$$

(3 marks)

(c) Calculate the volume of cold water that will need to be mixed with the total volume of hot water to provide a safe delivery temperature of 42ºC. Show all working.

Formula:
Litres hot water x temp. rise cold to hot = litres mixed water x temp. rise cold to mixed

(3 marks)

Total 9 marks

QUESTION 7

The New Zealand Building Code G12/AS1 gives requirements that must be met when installing expansion control and relief valve drainpipes from valve-vented hot water storage tanks.

(a) List FIVE of the requirements that must be met in all cases.

1 _____

_____

2 _____

_____

3 _____

_____

4 _____

_____

5 _____

_____

(5 marks)

(b) List THREE of the requirements that must be met where freezing is likely to occur.

1 _____

_____

2 _____

_____

3 _____

_____

(3 marks)

QUESTION 7 (cont'd))

(c) List TWO of the requirements that must be met for combined relief valve drains.

1 _____

_____

2 _____

_____

(2 marks)

Total 10 marks

QUESTION 8

(a) A pressure type vacuum breaker backflow prevention device is to be installed. Using your knowledge of the New Zealand Building Code Clause G12/AS1, state the THREE specific requirements that must be met relating to the installation.

1 _____

_____

2 _____

_____

3 _____

_____

(3 marks)

(b) State the spring pressure for the No. 1 check valve of a reduced pressure zone device for backflow prevention.

_____

(1 mark)

(c) Name TWO ways that cross-contamination of a water supply can be prevented in bidet installations.

1 _____

_____

2 _____

_____

(2 marks)

Total 6 marks

QUESTION 9

(a) An open vented hot water storage vessel is to be installed in a commercial premises. The pressure reducing valve setting is to be 112kPa.

Calculate the minimum height of the top of the vent pipe above the pressure reducing valve, including the allowance for expansion above the standing water level, for the installation to comply with the New Zealand Building Code. Show all working.

(2 marks)

(b) Calculate, in kPa, the pressure that will be exerted on the base of the hot water cylinder if the pressure reducing valve is 400mm below the hot water cylinder. Show all working.

(2 marks)

Total 4 marks

QUESTION 10

(a) Give TWO reasons why a relief vent is fitted to a soil or waste stack.

1 _____

_____

2 _____

_____

(2 marks)

(b) Sketch a relief vent connected to a soil stack, and show the restricted zone on the soil stack. Label all parts.

(3 marks)

QUESTION 10 (cont'd)

(c) When designing a foul water and drainage system, certain venting requirements must be met for the system to comply with AS/NZS 3500 Part 2: Sanitary plumbing.

(i) State the minimum gradient of a vent required to ensure that any condensation or liquids will drain back into the sanitary plumbing and drainage system.

(1 mark)

(ii) State the minimum level requirement for interconnecting ventilation pipes.

(2 marks)

(iii) Some ventilation pipes must be vented to the open air and must not be interconnected to any other system ventilation pipe. List THREE of these.

1

2

3

(3 marks)

Total 11 marks

QUESTION 11

(a) Describe fully how a grease converter fitted to a commercial kitchen washing sink discharge pipe operates.

(4 marks)

(b) Explain how the size of a grease converter is determined.

(2 marks)

QUESTION 11 (cont'd)

(c) A restaurant kitchen contains a grease converter. Calculate the capacity of the converter from the information contained in the following table.

Type of fixture	Fixture volume (litres)	Quantity	Total volume
Wash hand basin	12	4	
Domestic sink	32	-	
Dom. Double sink	64	-	
Commercial sink	81	2	
Com. Double sink	162	1	
Com. Pot-wash sink	144	1	
Tilting kettle	150	-	
Small dishwasher	185	-	
Med. dishwasher	235	1	
Large dishwasher	350	-	
Other fixtures		-	
		Total	

(3 marks)

Total 9 marks

QUESTION 12

(a) A building owner has asked a plumber to prepare a specification for a metal roof extension to an existing metal roof. State FOUR factors that should be considered when preparing the specification.

1 _____

_____

2 _____

_____

3 _____

_____

4 _____

_____

(4 marks)

QUESTION 12 (cont'd)

(b) Stormwater from the roof of a large warehouse discharges into an iron internal gutter.

The total length of the gutter is 96 metres. The gutter has been broken into eight equal sections to prevent damage by linear expansion.

The gutter is subject to temperatures that range from 4ºC to 30ºC.

Calculate the allowance that must be made to each section for the change in length that will occur. Give your answer in mm. Show all working.

The co-efficient of expansion of iron is 0.000012 per °C.

(2 marks)

Total 6 marks

QUESTION 13

An above ground non-pressure PVC waste and soil pipe installation is to be tested using a water test.

Describe, in the correct order, the steps required for the test to comply with the New Zealand Building Code G13/AS1. Your answer must include the minimum and maximum test pressures.

Total 4 marks

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Question number	Marks	Marks
1		
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