Answer **ALL** questions.

**QUESTION 1**

(a) Using NZS 3604, state THREE conditions that determine the position and size of a hole to be drilled through a wooden floor joist for a gas pipe.

(1) _____

(2) _____

(3) _____

(3 marks)

(b) State SIX conditions that must be complied with for a gas pipe embedded directly within a concrete floor slab.

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(6) _____

(6 marks)

(c) State THREE requirements for an underground gas pipe passing through the outer wall of a building.

(1) _____

(2) _____

(3) _____

(3 marks)

(d) List FOUR types of fittings that are unsuitable for joining gas installation pipes.

(1) _____

(2) _____

(3) _____

(4) _____

(2 marks)

(e) Why must the gas velocity be restricted in gas pipework?

_____

_____

(1 mark)

(Total 15 marks)

**QUESTION 2**

(a) With the aid of a line diagram, identify all the requirements, including depths, for a polyethylene (MDPE) gas pipe operating at 100 kPa laid under a lawn within private property.

(3 marks)

(b) State THREE advantages of using polyethylene (MDPE) compared with using steel for underground gas service lines.

(1) _____

(2) _____

(3) _____

(3 marks)

(c) List FOUR items of equipment that would normally be provided by the gas supplier as part of the metering set for a domestic dwelling.

(1) _____

(2) _____

(3) _____

(4) _____

(4 marks)

(Total 10 marks)

**QUESTION 3**

(a) Why is it important to ventilate a confined space when there has been a gas leak?

(2 marks)

(b) How is the efficiency of a gas appliance calculated?

(2 marks)

(c) Describe the appearance of a gas flame when the primary air is closed off.

(2 marks)

(d) Why is it necessary to apply a pressure factor in order to correct domestic gas meter readings at an altitude of 300 m above sea level?

(2 marks)

(e) What are the flammability limits for natural gas?

(2 marks)

(f) Explain the significance, when dealing with an LPG leak, of LPG having a density greater than air.

(2 marks)

(g) Define the term **vitiation** and state what it causes in relation to a gas appliance.

(3 marks)

(Total 15 marks)

**QUESTION 4**

(a) Calculate the gas rate for a space heater based on the information set out below.

Use the formula: $\frac{\text{room size} \times \text{flow input} \div \text{efficiency}}{\text{heat value}}$

Room size = 80 $m^3$
Heat input to room = 0.36 $MJ/m^3/h$
Appliance efficiency = 70%
Heating value of gas = 95 $MJ/m^3$

(3 marks)

(b) Using a figure of 0.36 $MJ/h/m^3$ as the heat input rate for a domestic living room, calculate the heat input rate required for a gas space heater to provide comfortable living conditions for a room 4.8 m × 3.5 m with a stud height of 2.7 m.

(3 marks)

(c) Calculate the rating of a heater required for a room with the following dimensions:

4.0 m × 3.8 m × 2.7 m high

Assume a heat rate input requirement of 0.36 $MJ/h/m^3$
Note: Show all workings

(2 marks)

(Total 8 marks)

**(Turn over**

**QUESTION 5**

State the type and purpose of each of the following controls when fitted to a domestic **gas-fired storage water heater.**

| Control | Type | Purpose |
|---|---|---|
| Flame failure device | | |
| Thermostat | | |
| Pilot adjustor | | |
| Energy cut-off device | | |

(Total 4 marks)

**QUESTION 6**

(a) A low pressure gas-fired, open-flued storage water heater is to be installed in a cupboard to replace an existing electric heater. Name FOUR modifications that are necessary to comply with the Gas Installation Standard requirements.

(1) _____

(2) _____

(3) _____

(4) _____

(4 marks)

(b) A small area at one end of a warehouse requires heating for short periods to a temperature suitable for staff working at a workbench in the area. Name the type and location of gas-fired heaters most suitable for this application and give your reasons.

_____

_____

_____

(3 marks)

(c) Complete the following table for an automatic gas burner fitted with a separate pilot system and a programmable control unit.

The equipment in operation during each period must be chosen from the following:

- fan
- igniter
- flame monitoring system

| Period | Equipment in operation during period | Pilot gas valve: open or shut? | Main gas valve: open or shut? |
|---|---|---|---|
| Pre-purge | | | |
| Start flame ignition | | | |
| Start flame proving | | | |
| Main flame establishment | | | |

(6 marks)

[The table must be totally correct – no part marks will be awarded.]

(Total 13 marks)

**(Turn over**

**QUESTION 7**

(a) Identify TWO purposes for EACH of the following on a gas-fired gas package burner fitted to an industrial boiler.

(i) air proving system

(1) _____

(2) _____

(ii) two safety shut-off valves

(1) _____

(2) _____

(iii) separate main burner and pilot burner regulators

(1) _____

(2) _____

(6 marks)

(b) List FOUR functions of a **programmable control unit** (PCU) on a package burner.

(1) _____

(2) _____

(3) _____

(4) _____

(4 marks)

(Total 10 marks)

**QUESTION 8**

(a) State THREE reasons for fitting a down-draught diverter.

(1) _____

_____

(2) _____

_____

(3) _____

_____

(3 marks)

(b) What is the **secondary flue pipe**?

_____

_____

_____

_____

(2 marks)

(Total 5 marks)

**QUESTION 9**

(a) List SIX steps required to carry out a gas **pipework test** on a new domestic dwelling.

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(6) _____

(6 marks)

(b) State which valves are open or closed when a **gas installation test** is carried out on a new domestic gas installation.

_____

_____

_____

(3 marks)

(c) State the minimum test pressures, in kPa, for each of the following for a domestic installation that has a working pressure of 1.5 kPa:

(i) a pipework test

_____

_____

(ii) an installation test

_____

_____

(iii) a leakage test

_____

_____

(3 marks)

(Total 12 marks)

**QUESTION 10**

(a) Explain why there is a limit placed on the size of a flueless space heater that can be fitted in a living room?

_____

_____

_____

(2 marks)

(b) What is the minimum distance permitted from a 100 mm diameter flue without a flue liner to any combustible material?

_____

_____

(1 mark)

(c) (i) What is required to be fitted to the top of a flue pipe?

_____

_____

(1 mark)

(ii) List TWO reasons for this fitting.

(1) _____

(2) _____

(2 marks)

(Total 6 marks)

**QUESTION 11**

What fixing considerations are required by the New Zealand Building Code for a free-standing gas-fired or solid-fuel space heater installation?

(Total 2 marks)