

RED SEAL EXAM PREP

Gasfitter (Class A)

Free 50-Question Mock Exam

Practice for the Red Seal / Certificate of Qualification exam

Pass mark: 70% · Aligned to the published occupational standard topic weightings
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Mock Exam — answer all questions, then check the key

Q1. What are the primary components of natural gas as distributed in Canada?

- A) Equal parts hydrogen and methane
- B) Equal parts methane, propane, and butane
- C) Primarily propane with methane added for odour
- D) Primarily methane (CH₄), typically 90-95%

Q2. A Gasfitter Class A gas fitter calculates that the gas supply pressure at a building 300 m from the main drops to 4 in WC during peak demand. The appliances require minimum 5 in WC inlet. What is the solution?

- A) Increase the service pipe diameter to reduce pressure drop, or request higher supply pressure from the utility
- B) Install a booster regulator at the building to increase supply pressure — this is not a valid solution for low upstream pressure
- C) Increase the appliance orifice size to compensate for low pressure
- D) Accept 4 in WC — most appliances will operate at reduced pressure

Q3. What are the early symptoms of carbon monoxide (CO) poisoning?

- A) Difficulty breathing due to CO being heavier than oxygen
- B) Strong smell similar to rotten eggs and burning sensation in throat
- C) Flu-like headache, dizziness, nausea, and confusion
- D) Skin discolouration and high fever immediately upon exposure

Q4. When can PVC pipe be used for venting a gas appliance in Canada?

- A) PVC venting is prohibited in Canada under all circumstances
- B) For Category IV condensing appliances listed for PVC venting
- C) PVC can be used for any gas appliance venting as a cost-saving measure
- D) PVC is permitted for venting only in mild climates

Q5. What is second-stage regulation in a propane (LP gas) system?

- A) A backup regulator that activates if the primary fails
- B) The second regulator in a two-stage natural gas system at the meter
- C) The regulator reducing first-stage output to appliance pressure
- D) The second stage of pressure testing for LP systems

Q6. Approximately how many BTU of heat are in one cubic foot of natural gas?

- A) 5,000 BTU/ft³
- B) 500 BTU/ft³
- C) 1,000 BTU/ft³
- D) 2,500 BTU/ft³

Q7. A service regulator has an inlet pressure of 60 psig and is set for 7 in WC outlet. The lockup pressure measured at the test port is 14 in WC. Is this acceptable?

- A) Yes — if downstream piping is rated for that pressure
- B) No — lockup of 14 in WC indicates the regulator is over-pressuring the system
- C) Yes — 14 in WC lockup is within tolerance for this regulator type
- D) No — lockup pressure should never exceed the setpoint

Q8. What information must be recorded and provided to the building owner after commissioning a gas appliance?

- A) Gas pressures, combustion readings, and safety test results
- B) Only the date of installation is required
- C) The appliance model and serial number only
- D) No documentation is required for residential gas work

Q9. A direct-vent (sealed combustion) gas appliance draws combustion air from where?

- A) From the furnace room through a draft hood
- B) From the exterior through a dedicated sealed air pipe
- C) From the building interior through a grille on the appliance
- D) From a combination of interior and exterior air

Q10. A Gasfitter Class A gas fitter is installing a 120,000 BTU/h natural draft water heater in a confined utility room that draws combustion air from adjacent indoor spaces. Approximately what free opening area does CSA B149.1 require?

- A) The room only needs one window that opens to the exterior
- B) No combustion air required — water heaters use indoor air without restriction
- C) On the order of 1 in² of free area per 1,000 BTU/h — roughly 120 in² (~0.08 m²) total, split between a high and a low opening
- D) A single 300 mm × 300 mm louvre in the door is sufficient for any size of appliance

Q11. When installing gas piping underground, what protection is required for metallic pipe?

- A) Approved corrosion coating and/or cathodic protection
- B) Paint with zinc-based coating and install in concrete conduit
- C) Install in corrugated plastic sleeve only
- D) No protection needed for schedule 40 steel pipe

Q12. When must the gas supply be shut off and the building evacuated during a gas leak response?

- A) Immediately, whenever a leak is detected or suspected
- B) Only if the gas concentration exceeds 50% LEL on a detector
- C) Only if a gas smell persists for more than 10 minutes
- D) After checking appliances and attempting to find the leak with soapy water

Q13. A gas appliance rating plate states "Input: 100,000 BTU/h, AFUE: 80%". What is the useful heat output?

- A) 100,000 BTU/h — all input is usable heat
- B) 120,000 BTU/h — efficiency multiplies the input
- C) 60,000 BTU/h — safety factor reduces output
- D) 80,000 BTU/h — 80% of input is converted to useful heat

Q14. What is the difference between an intermittent pilot (IPI) and a direct spark ignition (DSI) system?

- A) IPI is for high-efficiency furnaces only; DSI is for boilers only
- B) They are identical ignition systems with different names
- C) IPI sparks a pilot first; DSI sparks the main burner directly
- D) IPI uses a standing pilot; DSI uses a hot surface ignitor

Q15. A condensing boiler is installed with a return water temperature of 38°C (100°F). What is the implication of this return temperature?

- A) Low return temperature causes carbonic acid corrosion of the heat exchanger
- B) Return temperature is too low — the boiler will short-cycle
- C) The boiler is inefficient — return temperature must be above 60°C
- D) It enables condensing operation, achieving the highest efficiency

Q16. What are the four categories of gas appliance venting classification?

- A) Grades I-IV based on appliance efficiency
- B) Types A, B, C, D based on flue pipe material
- C) Categories I-IV, by vent pressure and flue temperature
- D) Classes 1-4 based on appliance BTU rating

Q17. During commissioning of a new gas furnace, the technician measures a CO reading of 200 ppm in the undiluted flue gas. What does this indicate?

- A) The furnace is operating normally in high-fire mode
- B) Normal — 200 ppm in flue gas is acceptable for residential furnaces
- C) Incomplete combustion — investigate before leaving it in service
- D) The CO detector is malfunctioning — CO should never be present in flue gas

Q18. A combustion analyzer shows O₂ = 10%, CO₂ = 7%, CO = 350 ppm in a gas furnace flue. What do these readings indicate and what action is required?

- A) Reduce gas pressure to lower the CO output
- B) Incomplete combustion — investigate before leaving in service
- C) The CO₂ reading confirms complete combustion — ignore the CO
- D) Normal readings — no corrective action is needed

Q19. What is the most common pipe material for above-ground natural gas distribution within buildings?

- A) Type L copper tubing
- B) Black steel pipe (Schedule 40)
- C) Schedule 40 PVC plastic pipe
- D) Galvanized steel pipe

Q20. What is the purpose of an inducer (induced draft) motor on a mid-efficiency or high-efficiency gas furnace?

- A) To induce a draft in the chimney by heating the flue pipe
- B) To pull combustion gases through the heat exchanger to the flue
- C) To circulate conditioned air through the building duct system
- D) To supply combustion air to the burner before ignition

Q21. What is a B-vent (Type B double-wall metal vent) designed for?

- A) Category I and II natural draft gas appliances
- B) Category IV positive-pressure condensing appliances
- C) Direct vent appliances requiring sealed combustion air
- D) Commercial high-pressure gas appliances only

Q22. What is the maximum spacing for supports on 1-inch (25 mm) black steel gas pipe run horizontally?

- A) 1 m (3 ft)
- B) 2.4 m (8 ft)
- C) 4.5 m (15 ft)
- D) No maximum spacing

Q23. Where should a combustible gas detector be positioned for a natural gas leak vs. a propane leak?

- A) Detector position does not matter — both gases disperse evenly
- B) Natural gas: near the ceiling; propane: near the floor
- C) Always at floor level for both natural gas and propane
- D) Always at breathing height (1.2 m) for both gases

Q24. What must a Gasfitter Class A gas fitter verify about vent termination height above a flat roof?

- A) Vent must extend to the highest point of the building
- B) A minimum height above the roof surface per CSA B149.1
- C) Vent can terminate at roof level — no height requirement
- D) 150 mm above the roof is sufficient for all appliances

Q25. A Category II gas appliance operates in non-positive pressure with flue gas below the dew point. What special vent considerations apply?

- A) The vent must drain and resist acidic condensate
- B) Category II uses standard B-vent — no special considerations
- C) Category II is rarely encountered and no standard exists
- D) Category II requires positive pressure metal vent only

Q26. A commercial kitchen requires 500,000 BTU/h of natural gas. The run from the meter is 20 m of 2" black steel pipe. The allowable pressure drop is 125 Pa (0.5 in WC). Using a pipe capacity table, what is the required pipe diameter?

- A) 1" pipe — pressure drop tables are not needed for short runs
- B) 1.5" pipe is sufficient for 500,000 BTU/h at 20m
- C) 2" pipe — verify with the CSA B149.1 capacity tables
- D) 3" pipe — always required for commercial loads above 200,000 BTU/h

Q27. A Gasfitter Class A gas fitter is commissioning a new gas boiler. What is the correct sequence for commissioning?

- A) Check combustion first, then adjust controls → verify gas supply
- B) Light appliance → check gas pressure → test safety controls → check combustion
- C) Verify supply → purge piping → light → verify controls → document
- D) Test safety controls → light appliance → purge piping → check pressure

Q28. What thread sealant must be used on gas pipe NPT connections?

- A) Standard white PTFE tape (plumber's tape)
- B) No sealant needed for tapered NPT threads — they self-seal
- C) Loctite thread sealant (any grade)
- D) Yellow PTFE tape or gas-rated pipe thread compound

Q29. What is the difference between a service regulator and an appliance regulator?

- A) Service reduces distribution pressure; appliance reduces it further
- B) Appliance regulators handle higher pressures than service regulators
- C) Service regulators are indoors; appliance regulators are outdoors
- D) They are interchangeable and perform the same function

Q30. What is the difference between a Class A and Class B Gas Fitter license?

- A) Class B has fewer restrictions than Class A
- B) Class A is the apprentice level; Class B is the journeyman level
- C) Class A is for natural gas only; Class B is for propane only
- D) Class A covers all gas systems and pressures; Class B is limited

Q31. What does the colour of a gas burner flame indicate about combustion quality?

- A) Blue = complete combustion; yellow = incomplete combustion
- B) Yellow is normal for natural gas; blue is normal for propane only
- C) Blue flame = too much air; yellow flame = correct mixture
- D) Flame colour is decorative and has no combustion significance

Q32. During a combustion analysis, the CO₂ reading in the flue gas of a natural gas furnace is 8.5%. What does this indicate?

- A) 8.5% CO₂ indicates perfect combustion efficiency
- B) 8.5% CO₂ is too high — CO₂ should never exceed 5% in flue gas
- C) Excess air is diluting the CO₂ below its stoichiometric maximum
- D) CO₂ has no relevance to combustion quality analysis

Q33. What is the key difference between CSST and rigid black steel pipe in terms of installation requirements?

- A) CSST can only be used outdoors in Canada
- B) CSST is flexible but requires bonding and physical protection
- C) CSST must be installed by a licensed electrician due to bonding requirements
- D) CSST is cheaper — no other differences

Q34. What is "lockup pressure" for a gas regulator and why is it important?

- A) The pressure at which the regulator lock-out valve activates
- B) The minimum inlet pressure for the regulator to open
- C) The maximum inlet pressure the regulator can handle
- D) The outlet pressure when gas flow is zero (no-flow)

Q35. What is the Lower Explosive Limit (LEL) of natural gas and what does it mean?

- A) 15% natural gas concentration — the maximum explosive level
- B) 0.5% — the threshold for immediate evacuation
- C) 1% natural gas concentration — below this level gas will not ignite
- D) 5% gas in air — the minimum concentration that can ignite

Q36. What happens to gas pressure in a pipe as flow rate increases and why does this matter for pipe sizing?

- A) Pressure is constant regardless of flow rate in a properly sized system
- B) Pressure drops from friction — pipes are sized to limit the drop
- C) Pressure increases then decreases — only the midpoint matters for sizing
- D) Pressure increases with flow — pipe must be sized to withstand higher pressure

Q37. What is the standard low-pressure natural gas outlet pressure from a service regulator to a residential building?

- A) 3.5 in WC (0.87 kPa)
- B) 7 in WC (1.75 kPa)
- C) 2 psig (13.8 kPa)
- D) 14 in WC (3.5 kPa)

Q38. What is the maximum horizontal run permitted for a power-vent (Category III) appliance vent?

- A) As specified by the appliance manufacturer
- B) Maximum 3 m regardless of appliance size
- C) No limit — power venting can run any distance horizontally
- D) 600 mm (2 ft) — power vents must be nearly vertical

Q39. A gas meter is rated for a maximum capacity of 250 ft³/h. The total connected load for the building is 400,000 BTU/h of natural gas appliances. Is the meter adequate?

- A) Cannot determine without knowing the number of appliances
- B) Yes — 250 ft³/h is always sufficient for residential use
- C) Yes — connected load does not equal actual demand
- D) No — the required 400 ft³/h exceeds the meter capacity

Q40. At what flue gas temperature will condensation occur in a natural gas appliance vent, and why does this matter?

- A) About 55-60°C (130-140°F) — below this, acidic condensate forms
- B) Condensation only occurs in propane appliances — natural gas flue gas does not condense
- C) Condensation occurs at 100°C (212°F) — the boiling point of water
- D) There is no specific dew point — condensation depends only on ambient temperature

Q41. What is the correct procedure for purging a new gas piping system before lighting appliances?

- A) Purge using nitrogen, then switch to gas
- B) Open all appliance valves and let gas flow for 60 seconds to purge the system
- C) Light the pilot repeatedly — purging happens automatically during ignition attempts
- D) Slowly displace air with gas, venting to a safe outdoor location

Q42. What is stoichiometric combustion?

- A) Combustion with insufficient air, producing maximum heat output
- B) Combustion with excess air — the safest type for gas appliances
- C) Combustion with exactly the theoretical air required
- D) Combustion at the highest possible flame temperature

Q43. A high-efficiency condensing furnace produces liquid condensate that drains from the heat exchanger. What is special about this condensate?

- A) It is slightly acidic and may require a neutralizer
- B) It is pure water that can be discharged anywhere
- C) It contains natural gas byproducts and is considered hazardous waste
- D) It is alkaline and must be diluted before discharge

Q44. What is a hot surface ignitor (HSI) and how does it work in a modern gas furnace?

- A) A pilot burner that remains lit continuously between heating cycles
- B) An element that glows red-hot to ignite the gas burner on contact
- C) A UV flame sensor that monitors the main burner flame
- D) A spark ignitor that creates a high-voltage arc to light the burner

Q45. What is the purpose of a drip leg (sediment trap) installed before a gas appliance?

- A) To serve as an emergency shutoff in case of fire
- B) To reduce gas pressure to the appliance
- C) To allow pressure testing of the appliance separately
- D) To trap condensate, debris, and scale from the gas supply

Q46. What is a lockout/tagout (LOTO) procedure for gas systems and when is it required?

- A) Locking and tagging the closed gas valve before maintenance
- B) LOTO for gas means attaching a warning label to the appliance
- C) LOTO is for electrical systems only — gas systems use manual shutoff valves
- D) Only required for high-pressure industrial gas systems

Q47. When two gas appliances share a common vent, what must be considered?

- A) The larger appliance vents normally; the smaller one must use a separate vent
- B) The common vent must be sized for the combined flue gas volume
- C) Common venting always reduces vent size requirements
- D) Only matching appliance types (e.g., two furnaces) may share a common vent

Q48. What defines a "direct vent" (sealed combustion) gas appliance?

- A) An appliance that vents directly through the roof without a chimney
- B) An appliance with a direct connection to the gas main
- C) An appliance that vents directly into the return air plenum
- D) One that draws outdoor combustion air and vents through sealed pipes

Q49. What is flame rectification (flame sensing) and how does it work in modern gas furnaces?

- A) The flame conducts DC current, proving the burner is lit
- B) A safety circuit where a thermocouple generates DC voltage to prove pilot flame
- C) A method to correct the shape of an abnormal flame using air baffles
- D) A sensor that detects the blue colour of a normal gas flame

Q50. A gas dryer venting system must terminate where?

- A) Into a laundry room if it has a window
- B) Into an approved lint trap inside the building
- C) Into the attic space to reduce moisture in the house
- D) To the exterior of the building only

Answer Key & Explanations

Q1. Answer: D

Pipeline natural gas is primarily methane (CH₄), typically 90-95%, with minor amounts of ethane (C₂H₆), propane (C₃H₈), and butane (C₄H₁₀), plus inert gases (N₂, CO₂). The exact composition varies by source and region. This composition determines energy content (~1,000 BTU/ft³) and combustion characteristics.

Q2. Answer: A

The correct solution for inadequate supply pressure is reducing pressure drop in the supply pipe (increase pipe diameter) or requesting higher supply pressure from the utility. A booster regulator cannot boost pressure beyond what is supplied. Oversizing orifices is dangerous and code-violating. Appliances must receive minimum pressure specified by the manufacturer.

Q3. Answer: C

CO (carbon monoxide) is odourless and colourless. Early symptoms: headache, dizziness, nausea, weakness, and confusion — often mistaken for the flu. Key distinguishing feature: symptoms improve when leaving the building (away from CO source) and worsen upon return. Severe exposure causes unconsciousness and death.

Q4. Answer: B

PVC Schedule 40 vent pipe is permitted for Category IV condensing appliances when the flue gas temperature stays within PVC's temperature limits throughout the vent (typically <65°C/150°F at the pipe). The appliance must be listed for PVC venting and the manufacturer's instructions must specifically permit it. Not all condensing appliances are listed for PVC.

Q5. Answer: C

LP gas systems typically use two-stage regulation: First stage at the tank reduces vapor pressure (which varies with temperature) to a constant ~10 psig (69 kPa). Second stage at or near the building reduces 10 psig to appliance operating pressure (~11 in WC / 2.74 kPa). This provides stable pressure regardless of tank level or temperature.

Q6. Answer: C

Natural gas has an energy content of approximately 1,000 BTU per cubic foot (higher heating value). This is a fundamental value for pipe sizing, appliance sizing, and combustion calculations. Propane contains approximately 2,500 BTU per cubic foot (as gas).

Q7. Answer: A

Lockup pressure of 14 in WC = 2× the 7 in WC setpoint, which can be normal and acceptable as long as it does not exceed the maximum allowable pressure of downstream piping and appliances. For residential low-pressure service, the maximum allowable downstream pressure is typically 14 in WC per CSA B149.1. If the spec is 125% = 8.75 in WC, further investigation is needed. Verify against appliance and piping ratings.

Q8. Answer: A

Professional commissioning documentation provides proof of safe installation and a baseline for future service. Records should include: gas supply (inlet) pressure, manifold/burner pressure, combustion analysis readings (CO₂, O₂, CO, flue temp, efficiency), safety control verification results, vent check, and any deficiencies noted or corrected. Some jurisdictions require documentation submission to the authority.

Q9. Answer: B

Direct-vent (sealed combustion) appliances use a two-pipe system: one pipe draws combustion air from outside, and the other exhausts flue gases to outside. The combustion process is completely isolated from the building interior, making them ideal for tight buildings and eliminating combustion air requirements.

Q10. Answer: C

CSA B149.1 sizes combustion-air openings from the appliance input. For a confined space taking air from other indoor spaces the rule of thumb is on the order of 1 in² of free area per 1,000 BTU/h of input, provided through two openings — one within 300 mm of the ceiling and one within 300 mm of the floor. 120,000 BTU/h → on the order of 120 in² (~0.08 m²) of free area total, i.e. a fraction of a square metre, not several square metres. Confirm the exact area for the air source (indoor vs. outdoor) and duct configuration against the current CSA B149.1 tables, and remember louvre free area is only ~60–75% of gross.

Q11. Answer: A

Underground metallic gas pipe must be protected against soil corrosion per CSA B149.1. Methods include factory polyethylene coating or wrap, field-applied tape wrapping, or fusion-bonded epoxy coating; cathodic protection is also required for many installations. Mechanical joints (unions, threaded fittings) are not permitted below grade — use welded or properly coated fittings.

Q12. Answer: A

Gas leak response: DO NOT operate any electrical switches (can spark ignition), DO NOT use phone inside, shut off gas at the exterior meter shutoff, leave the building immediately, and call the gas utility from outside. Even a small ignition source can ignite gas-air mixture at concentrations between 5-15% (LEL-UEL for natural gas).

Q13. Answer: D

AFUE of 80% means 80% of fuel energy is converted to heat delivered to the space. Output = Input × AFUE = 100,000 × 0.80 = 80,000 BTU/h. The remaining 20,000 BTU/h (20%) is lost through the flue.

Q14. Answer: C

IPI (Intermittent Pilot Ignition): a spark creates a pilot flame at the start of each heat cycle; the flame sensor confirms pilot is lit, then the main gas valve opens and the pilot ignites the main burner. DSI (Direct Spark Ignition): the spark fires directly at the main burner without a pilot. DSI is faster but requires the spark to be at the burner.

Q15. Answer: D

Condensing boilers are designed to operate at low return water temperatures (below 55°C/130°F). At low temperatures, the flue gases cool below their dew point and condense, releasing latent heat. This is the condensing effect — extracting extra energy from the fuel, achieving the highest efficiency (90%+ AFUE). High return temps prevent condensing and reduce efficiency to non-condensing levels.

Q16. Answer: C

Appliances are classed Categories I-IV based on vent static pressure (positive or non-positive) and flue gas temperature relative to dew point. Per CSA B149.1: Cat I = non-positive pressure, above dew point (80% furnace). Cat II = non-positive pressure, below dew point (condensing, low temp). Cat III = positive pressure, above dew point (some direct vent). Cat IV = positive pressure, below dew point (condensing, high efficiency). Venting material requirements differ for each.

Q17. Answer: C

For residential gas furnaces, acceptable CO in undiluted flue gas is typically below 100 ppm (some standards allow up to 400 ppm, but best practice targets <100 ppm). A reading of 200 ppm indicates incomplete combustion caused by insufficient combustion air, incorrect gas pressure, or heat exchanger restriction. Investigate before leaving the appliance running.

Q18. Answer: B

Analysis: 10% O₂ = high excess air (~90% theoretical air excess). High excess air with significant CO (350 ppm, above the recommended >100 ppm limit) is unusual — normally excess air helps complete combustion. This combination indicates incomplete combustion likely from burner contamination (blocking primary air), heat exchanger restriction causing recirculation, or poor primary air. Investigate and correct before leaving the appliance in service.

Q19. Answer: B

Black steel pipe (ASTM A53 or equivalent, Schedule 40) with malleable iron or black steel fittings is the standard for above-ground interior gas piping. Galvanized pipe is not approved inside buildings (zinc flakes can clog appliance components). PVC is not approved for gas.

Q20. Answer: B

The inducer fan draws combustion gases through the heat exchanger and forces them out the vent pipe. It creates negative pressure in the heat exchanger, ensuring complete flue gas evacuation and allowing use of smaller-diameter vent pipes. A pressure switch verifies inducer is running before allowing ignition.

Q21. Answer: A

Type B double-wall metal vent (B-vent) consists of an inner aluminum liner and outer galvanized steel shell with air space insulation. The insulated design keeps the inner wall warm, maintaining flue gas temperature to prevent condensation inside the vent and preserve draft. Used for natural draft Category I gas appliances.

Q22. Answer: B

CSA B149.1 requires support spacing for gas pipe. For 1" rigid steel pipe, maximum support spacing is typically 2.4 m (8 ft) horizontally — check CSA B149.1 or manufacturer specs for the exact requirement. Smaller pipe requires closer spacing: 3/4" = 1.8 m, 1/2" = 1.5 m. Check current code as values may vary by jurisdiction.

Q23. Answer: B

Gas detector placement follows gas behaviour: Natural gas (SG=0.55, lighter than air) rises to the ceiling when leaked — detector within 300mm of ceiling. Propane (SG=1.52, heavier than air) settles to the floor and in low areas — detector within 300mm of floor. Wrong placement means the detector may not alarm until dangerous concentrations exist.

Q24. Answer: B

CSA B149.1 requires vent terminals to extend a minimum height above the roof surface (typically 600 mm above a flat roof within 600 mm of the terminal) to prevent flue gas re-entrainment during wind conditions. For flat roofs, the terminal must extend above the roof line with clearances from any adjacent wall that would cause downwash. Minimum heights are specified based on roof type and distance from roof edge or adjacent walls.

Q25. Answer: A

Category II appliances (non-positive pressure, condensing conditions) are uncommon but do exist. The vent must resist acidic condensate even though it operates at negative (or zero) pressure, so corrosion-resistant materials (AL29-4C stainless steel or listed plastic) are required. Condensate drainage from the vent back to the appliance or to a floor drain is necessary.

Q26. Answer: C

Gas pipe sizing requires using CSA B149.1 Appendix tables. For natural gas at standard conditions with 125 Pa (0.5 in WC) allowable pressure drop, 2" pipe at 20m typically carries 400,000-600,000 BTU/h — sufficient for this load. Always use the official tables for the exact supply pressure, pipe length, and allowable drop in your jurisdiction.

Q27. Answer: C

Proper commissioning sequence: 1) Verify supply gas pressure, 2) Inspect and purge new piping, 3) Light appliance per manufacturer instructions, 4) Verify manifold/burner pressure, 5) Verify all safety controls (high limit, pressure switches), 6) Conduct combustion analysis (CO₂, O₂, CO, flue temp), 7) Document all readings. Always follow manufacturer commissioning checklist.

Q28. Answer: D

Standard white PTFE tape is NOT rated for gas service. Gas connections require yellow PTFE tape or pipe thread compound specifically rated and listed for gas service (e.g., Rector Seal T+2, Gas-Tite). Using non-rated sealants can result in leaks that develop over time. CSA B149.1 requires listed sealants.

Q29. Answer: A

Service regulators (at the meter set) reduce gas utility distribution pressure to standard service pressure (~7 in WC / 1.75 kPa for NG). Appliance regulators (built into appliances or installed on the supply) further reduce service pressure to the appliance inlet pressure specified by the manufacturer (~3.5 in WC for natural gas burners).

Q30. Answer: D

Class A Gas Fitter (Gasfitter Class A Red Seal) is licensed for all types and pressures of gas systems — residential, commercial, and industrial including high-pressure industrial installations and supply infrastructure. Class B Gas Fitter (403B) is restricted to residential and light commercial appliance installation and service at standard (low) operating pressures.

Q31. Answer: A

A steady blue flame indicates complete combustion with the correct air-fuel mixture. Blue comes from excited CH radicals. Yellow/orange flames indicate insufficient air or incorrect mixture (incomplete combustion) — carbon particles glow yellow before they can fully oxidize, producing soot and CO. A few yellow tips at the top of flame is acceptable; fully yellow flame is not.

Q32. Answer: C

Maximum theoretical CO₂ for natural gas (stoichiometric) is approximately 11.7-12.5%. In practice, residential furnaces read 8-10% CO₂ due to excess air, which dilutes the CO₂ concentration and increases flue gas volume and heat loss. A reading of 8.5% indicates significant excess air (approximately 35-40% excess). Higher excess air = more heat wasted heating unused air. Target: 8.5-10% CO₂ for natural gas furnaces.

Q33. Answer: B

CSST advantages: flexibility to route around obstacles, faster installation, fewer fittings, can be fished through walls. CSST requirements: electrical bonding/grounding (lightning protection), steel protection plates at framing penetrations, and specific end fittings — while rigid steel uses threaded or welded connections. Always follow the manufacturer installation guide.

Q34. Answer: D

Lockup pressure is the outlet pressure of a regulator when downstream demand is zero (all appliances off, valves closed). CSA B149.1 requires lockup pressure not to exceed the maximum allowable (design working) pressure for the downstream piping and appliances. Typical lockup: 125% of setpoint.

Q35. Answer: D

Natural gas explosive range: LEL = 5% (minimum concentration at which gas will ignite if an ignition source is present) to UEL = 15% (maximum ignition concentration). Below 5% = too lean to ignite. Above 15% = too rich to ignite (but becomes explosive as it disperses). Gas detectors typically alarm at 10-25% of LEL (~0.5-1.25% actual concentration) to provide warning well before reaching the explosive range.

Q36. Answer: B

As gas flows through a pipe, friction causes pressure to drop, and the greater the flow rate, the greater the pressure drop per unit length. Pipe sizing ensures that pressure drop from the supply (meter) to the most distant appliance stays within allowable limits (125 Pa for residential NG), maintaining adequate appliance inlet pressure for proper combustion.

Q37. Answer: B

The standard residential natural gas service pressure (low pressure) is approximately 7 inches of water column (7 in WC or 1.75 kPa). This is the outlet pressure from the service regulator at the meter set. Most residential appliances operate at this pressure, then further reduced by an appliance regulator if needed.

Q38. Answer: A

Power-vent (Category III) appliances use a blower to push flue gases through the vent. Maximum horizontal run depends on the appliance manufacturer's specifications and the vent system's static pressure capacity — typically up to 15-25 m depending on the number of elbows and pipe size. Each elbow reduces equivalent straight-pipe capacity. Exceeding maximum run reduces flue gas velocity and can cause condensate accumulation.

Q39. Answer: D

To check meter adequacy: convert BTU/h to ft³/h by dividing by 1,000 (BTU/ft³). $400,000 \text{ BTU/h} \div 1,000 = 400 \text{ ft}^3/\text{h}$, which exceeds the meter capacity of 250 ft³/h — the meter is insufficient. A larger meter (e.g., 400 ft³/h or larger) is required. Note: diversity factor may apply for large installations.

Q40. Answer: A

Natural gas combustion produces CO₂ and H₂O. The dew point of natural gas flue gases is approximately 55-60°C (130-140°F); below this temperature, water vapour condenses into liquid in the vent. The condensate absorbs CO₂ forming carbonic acid (H₂CO₃) and sulfurous acid, producing an acidic liquid (pH 3-4). This is why ordinary metal vents corrode when serving Category IV condensing appliances.

Q41. Answer: D

Purging replaces air in new gas piping with gas by allowing gas to slowly displace air at a low-pressure vent point or appliance connection. CSA B149.1 requires purging using a controlled vent to an unconfined outdoor location — never into an enclosed space (explosion risk). Monitor with a combustible gas detector until gas composition is confirmed. The first gas/air mixture vented may be in the flammable range — keep ignition sources away.

Q42. Answer: C

Stoichiometric combustion uses exactly the theoretical air-fuel ratio to completely combust all fuel — no excess air and no incomplete combustion: all fuel molecules react with exactly enough oxygen molecules, producing only CO₂ and H₂O with no excess O₂ remaining. In practice, gas appliances operate with some excess air (5-15%) to ensure complete combustion, as perfect stoichiometry is difficult to achieve in real conditions.

Q43. Answer: A

Condensing furnaces extract so much heat that flue gases cool below the dew point, producing liquid condensate. The condensate contains carbonic acid ($\text{CO}_2 + \text{H}_2\text{O}$) and sulfurous acid, making it acidic (pH 3-4). Many municipalities require a condensate neutralizer before discharging to certain drains, such as copper or cast iron drain systems.

Q44. Answer: B

HSI (hot surface ignitor) is made of silicon carbide or silicon nitride. The control board energizes it for a warm-up period (15-30 seconds) until it glows red-hot, then opens the gas valve. The glowing element ignites the gas. HSI replaced standing pilots in mid-efficiency and high-efficiency furnaces.

Q45. Answer: D

A drip leg is a short vertical pipe extension below the horizontal run, capped at the bottom, installed as the last fitting before connecting to the appliance. Condensate, pipe scale, and debris fall into the drip leg before they can enter the appliance regulator and gas valve, preventing blockage and damage.

Q46. Answer: A

LOTO for gas systems prevents accidental re-energization of the gas supply while work is in progress: 1) Close the supply valve, 2) Lock the valve in the closed position with a lockout device, 3) Attach a danger tag with worker's name and warning, 4) Verify zero energy (test downstream for gas flow/pressure). This prevents another worker from inadvertently opening the gas supply during maintenance.

Q47. Answer: B

Common venting of two Category I appliances is permitted under specific conditions. The common vent segment must be sized using CSA B149.1 common vent sizing tables for the combined total BTU input, considering: height of the vertical common vent, individual connector lengths, and both appliance types. Improper sizing causes spillage at one appliance.

Q48. Answer: D

Direct vent (sealed combustion) appliances draw all combustion air from outside and vent all flue gases to outside through a sealed concentric or twin-pipe system — one pipe supplies fresh outdoor combustion air, the other exhausts flue gases. The combustion process is completely isolated from the building interior. No interior combustion air is required, making them ideal for tight, well-insulated buildings.

Q49. Answer: A

Flame rectification uses the ionizing property of combustion gases. An AC voltage is applied between the flame rod (sensor) and the burner ground. The flame acts as a diode — it rectifies AC to DC, so DC current flows only when flame is present, proving burner ignition. The control board detects the DC current (microamps); if flame fails, DC stops, and the board shuts the gas valve within 1-2 seconds.

Q50. Answer: D

Gas dryer exhaust contains moisture, heat, lint, and combustion gases (CO). CSA B149.1 and building codes require all gas dryer venting to terminate at the exterior of the building — never into an attic, crawlspace, or wall cavity. Venting into enclosed spaces creates fire hazard (lint), moisture damage, and CO poisoning risk.

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